e-Front runners

MICREX-SX series

SPH

USER'S MANUAL

High-speed Multirange 4ch Analog Input Module	**Type: NP1AXH4-MR**
Standard Multirange 4ch Analog Input Module	**Type: NP1AX04-MR**
Standard Multirange 8ch Analog Input Module	**Type: NP1AX08-MR**
High-speed Multirange 2ch Analog Output Module	**Type: NP1AYH2-MR**
Standard Multirange 2ch Analog Output Module	**Type: NP1AY02-MR**

FEH207b

Preface

This User's Manual explains the system configuration, the specifications and operations of the multi-range analog input module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR) and the multi-range analog output module (NP1AYH2-MR, NP1AY02-MR) of the MICREX-SX series SPH. Read this manual carefully to ensure correct operation. When using modules or peripheral devices, be sure to read the corresponding user's manuals listed below.

Title	Manual No.	Contents
User's Manual Instructions, MICREX-SX series SPH	FEH200	Explains the memory, language and system definitions of the MICREX-SX series.
User's Manual Hardware, MICREX-SX series SPH	FEH201	Explains the system configuration, the specifications and operations of modules in the MICREX-SX series.
User's Manual Multi-range 8ch Analog I/O Module, MICREX-SX series SPH	FEH206	Explains the specifications and operations of the Multi-channel Analog Module.
User's Manual D300win <Reference>, MICREX-SX series	FEH254	Explains the menu and icon of D300winV2 and all of the operations of D300winV2.

In addition to the above manuals, the following Fuji Electric FA Components & Systems Co., Ltd. site offers various manuals and technical documents associated with MICREX-SX.
URL http://www.fujielectric.co.jp/fcs/eng/

Notes

1. This manual may not be reproduced in whole or part in any form without prior written approval by the manufacturer.
2. The contents of this manual (including specifications) are subject to change without prior notice.
3. If you find any ambiguous or incorrect descriptions in this manual, please write them down (along with the manual No. shown on the cover) and contact FUJI.

Safety Precautions

Be sure to read the “Safety Precautions” thoroughly before using the module.
Here, the safety precaution items are classified into “Warning” and “Caution.”

Warning : Incorrect handling of the device may result in death or serious injury.

Caution : Incorrect handling of the device may result in minor injury or physical damage.

Even some items indicated by “Caution” may also result in a serious accident.
Both safety instruction categories provide important information. Be sure to strictly observe these instructions.

Warning
◊ Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to theoperator. ◊ Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur. ◊ Place the emergency stop circuit, interlock circuit or the like for safety outside the PLC. A failure of PLC might break or cause problems to the machine. ◊ Do not connect in reverse polarity, charge (except rechargeable ones), disassemble, heat, throw in fire or short-circuit the batteries, otherwise, they might burst or take fire. ◊ If batteries have any deformation, spilled fluids, or other abnormality, do not use them. The use of such batteries might cause explosion or firing. ◊ Do not open the FG terminal with the LG-FG short circuited. (It must be grounded, otherwise it might cause electric shock.)

Safety Precautions

⚠ Caution

◊ Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
◊ Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
◊ Follow the directions of the operating instructions when mounting the product. If mounting is improper, the product might drop or develop problems or erratic operations.
◊ Use the rated voltage and current mentioned in the operating instructions and manual. Use beyond the rated values might cause fire, erratic operation or failure.
◊ Operate (keep) in the environment specified in the operating instructions and manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure.
◊ Select a wire size to suit the applied voltage and carrying current. Tighten the wire terminals to the specified torque. Inappropriate wiring or tightening might cause fire, malfunction, failure, or might cause the product to drop from its mounting.
◊ Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, erratic operation or failure might occur.
◊ Remove the dust-cover seals of modules after wiring, otherwise, fire, accidents, failure or fault might occur.
◊ Connect the ground terminal to the ground, otherwise, an erratic operation might occur.
◊ Periodically make sure the terminal screws and mounting screws are securely tightened.
Operation at a loosened status might cause fire or erratic operation.
◊ Put the furnished connector covers on unused connectors, otherwise, failure or erratic operation might occur.
◊ Install the furnished terminal cover on the terminal block, otherwise, electric shock or fire might occur.
◊ Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run.
The wrong operation might break or cause machine problems.
◊ Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.
◊ Before touching the PLC, discharge any static electricity that may have been collected on your body. To discharge it, touch a grounded metallic object. Static electricity might cause erratic operation or failure of the module.
◊ Be sure to install the electrical wiring correctly and securely, observing the operating instructions and manual. Wrong or loose wiring might cause fire, accidents, or failure.
◊ When disengaging the plug from the outlet, do not pull the cord, otherwiase, break of cable might cause fire or failure.
◊ Do not attempt to change system configurations (such as installing or removing I/O modules) while the power is ON, otherwise, failure or erratic operation might occur.
◊ Do not attemp to repair the module by yourself contact your Fuji Electric agent. When replacing the batteries, correctly and securely connect the battery connectors, otherwise, fire, accidents or failure might occure.
◊ To clean the module, turn power off and wipe the module with a cloth moistened with warm water. Do not use thinner or other organic solvents, as the module surface might become deformed or discolored.
◊ Do not remodel or disassemble the product, otherwise, a failure might occur.
◊ Follow the regulations of industrial wastes when the device is to be discarded.
◊ The modules covered in these operating instructions have not been designed or manufactured for use in equipment or systems which, in the event of failure, can lead to loss of human life.
◊ If you intend to use the modules covered in these operating instructions for special applications, such as for nuclear energy control, aerospace, medical, or transportation, please consult your Fuji Electric agent.
◊ Be sure to provide protective measures when using the module covered in these operating instructions in equipment which, in the event of failure, may lead to loss of human life or other grave results.
◊ External power supply (such as 24V DC power supply) which is connected to DC I/O should be strongly isolated from AC power supply.

Revision

***Manual No. is shown on the cover.**

Printed on	*Manual No.	Revision contents
Sep. 1998	FEH207	First edition
Sep. 2001	FEH207a	Standard analog input module NP1AX04-MR, Standard analog output module NP1AY02-MR, and 8 channels standard analog input module NP1AX08-MR specifications added.
Mar. 2004	FEH207b	• The broken wire detection value was added to the explanation of the broken wire detection function. • Note 4 was added to the Section "5-4 Wiring of Analog Output Module."

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Section 1 General

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Section 1 General
1-1 General

The MICREX-SX series SPH Multi-range Analog Input/Output Modules are used mounted on the SPH base board.

1-1-1 Analog input module

This module converts an analog signal (voltage or current input) which is input from outside the PC to a digital value of INT type (integer). It is possible to set voltage input or current input and an input range for each channel of the module.

High-speed analog input module: NP1AXH4-MR (4 channels)
Standard analog input module: NP1AX04-MR (4 channels)
Standard analog input module: NP1AX08-MR (8 channels)

1-1-2 Analog output module

This module converts integer (INT) type data (input value) set from the CPU module into an analog voltage signal or analog current signal and outputs them to an external device. It is possible to set a voltage output or current output and an output range for each channel of the module.

High-speed analog output module: NP1AYH2-MR (2 channels)
Standard analog output module: NP1AY02-MR (2 channels)

Note: NP1AX08-MR of 8-channel input specification cannot be mounted on the baseboard for remote I/O, such as those for T-link.

Section 2 Specifications

Page

Section 2 Specifications

2-1 General Specifications

Item		Specification
Physical environmental conditions	Operating ambient temperature	0 to 55° C
	Storage temperature	-25 to +70° C
	Relative humidity	20% to 95% RH; no condensation
	Pollution degree	2
	Corrosion immunity	Free from corrosive gases. Not stained with organic solvents.
	Operating altitude	2,000m or less above sea level (Transport condition: 70kPa or higher)
Mechanical service conditions	Vibration	Half amplitude: 0.15mm, constant acceleration: 19.6m/s^2 Two hours for each of three mutually perpendicular axes, total six hours.
	Shock	Acceleration peak: 147m/s^2 Three times for each of three mutually perpendicular axes.
Electrical service conditions	Noise immunity	1.5kV, rise time 1ns, pulse width 1μs (noise simulator)
	Electrostatic discharge	Contact discharge: ± 8kV, aerial discharge: ± 15kV
	Radioelectromagnetic field	10V/m (80MHz to 1000MHz)
Construction		Panel-mounted type (IP30)
Cooling		Air cooling
Insulation method		Photocoupler (no insulation between channels)
Dielectric strength		500V AC, one minute (between I/O terminals and frame ground)
Insulation resistance		10MΩ or more with 500V DC megger(between I/O terminals and frame ground)
Internal current consumption at 24V DC		NP1AXH4-MR : 120mA or less (high speed analog input) NP1AX04-MR : 120mA or less (standard analog input) NP1AX08-MR : 120mA or less (standard analog input 8 channels) NP1AYH2-MR : 120mA or less (high speed analog output) NP1AY02-MR : 120mA or less (standard analog output)
Mass		NP1AXH4-MR : Approx. 200g (high speed analog input) NP1AX04-MR : Approx. 200g (standard analog input) NP1AX08-MR : Approx. 200g (standard analog input 8 channels) NP1AYH2-MR : Approx. 200g (high speed analog output) NP1AY02-MR : Approx. 200g (standard analog output)
Dimensions		Refer to Section 2-9.

2-2 Performance/Function Specifications

2-2-1 Analog input module

(1) High-speed analog input (NP1AXH4-MR)

Item		Specification
Type		NP1AXH4-MR
No. of input channels		4 channels
Input impedance		Voltage input: 1MΩ or more, Current input: 250Ω or less
Input tolerance		Voltage input: ± 15V (one minute), Current input: ± 30mA (one minute)
Conversion characteristics (Note 1)		<table><tr><td>Input</td><td>Analog input range</td><td>Digital output value</td></tr><tr><td>Voltage (V)</td><td>-10 to 10, -5 to 5, 1 to 5, 0 to 5, 0 to 10</td><td rowspan="2">-8000 to 8000 or 0 to 16000</td></tr><tr><td>Current (mA)</td><td>0 to 20, 4 to 20, -20 to 20</td></tr></table>
Resolution		14 bits
Overall accuracy (for full scale)		± 0.1% or lower (at 25° C), ± 1.0% or lower (at 0° C to 55° C)
Digital output format		INT type (integer)
Sampling time		1ms/4 channels
Input filtering time		47μs
Input delay time		1ms + Takt cycle
Wire connections	External wiring connections	Detachable screw terminal block (M3) 20 poles
	Applicable wire size	AWG #22 to 18 (Note 2)
	Treatment of terminals not used	Short-circuited (between V, I and COM)
Status indication		ONL: indicates normal condition (green LED), ERR: indicates abnormal condition (red LED), SETTING: remains on or blinks during setting operation (green LED).
Gain/offset adjustment		By switch or program (Note 3)
Voltage/current selection		By changing the terminal block connection (for each channel)
Other functions		• A/D conversion enable/disable (by application program) • Conversion data averaging (by application program) • Pre-alarming (by application program) • Scaling (by application program)
Occupied slot		1 slot
Occupied words		10 words (input: 8 words, output: 2 words)

Note: 1) Use an application program to set the desired analog input range. For details, refer to “Section 4 Software Interface.” (The analog input range factory setting is ± 10V.)
2) The applicable wire size depends on the crimp terminal used. For details, refer to “5-1 Wiring Precautions.”
3) For the method of gain/offset adjustment, refer to “Section 6 Gain/Offset Adjustment.”

2-2 Performance/Function Specifications

(2) Standard analog input (NP1AX04-MR, NP1AX08-MR)

<table>
<tr><th colspan="2">Item</th><th colspan="2">Specification</th></tr>
<tr><td colspan="2">Type</td><td>NP1AX04-MR</td><td>NP1AX08-MR</td></tr>
<tr><td colspan="2">No. of input channels</td><td>4 channels</td><td>8 channels</td></tr>
<tr><td colspan="2">Input impedance</td><td colspan="2">Voltage input: 2MΩ , Current input: 250Ω</td></tr>
<tr><td colspan="2">Input tolerance</td><td colspan="2">Voltage input: ± 15V (one minute), Current input: ± 30mA (one minute)</td></tr>
<tr><td colspan="2">Conversion characteristics (Note 1)</td><td colspan="2"><table><tr><td>Input</td><td>Analog input range</td><td>Digital output value</td></tr><tr><td>Voltage (V)</td><td>-10 to 10, -5 to 5, 1 to 5, 0 to 5, 0 to 10</td><td rowspan="2">-500 to 500
or 0 to 1000</td></tr><tr><td>Current (mA)</td><td>0 to 20, 4 to 20, -20 to 20</td></tr></table></td></tr>
<tr><td colspan="2">Resolution</td><td colspan="2">10 bits</td></tr>
<tr><td colspan="2">Overall accuracy (for full scale)</td><td colspan="2">± 0.5% or lower (at 25° C), ± 1.0% or lower (at 0° C to 55° C)</td></tr>
<tr><td colspan="2">Digital output format</td><td colspan="2">INT type (integer)</td></tr>
<tr><td colspan="2">Sampling time</td><td>4ms/4 channels</td><td>1ms + 0.5ms x No. of conversion enabl channels</td></tr>
<tr><td colspan="2">Input filtering time</td><td colspan="2">47μs (hardware)</td></tr>
<tr><td colspan="2">Input delay time</td><td>4ms + Takt time</td><td>Sampling cycle + Takt time</td></tr>
<tr><td rowspan="3">Wire connections</td><td>External wiring connections</td><td colspan="2">Detachable screw terminal block (M3) 20 poles</td></tr>
<tr><td>Applicable wire size</td><td colspan="2">AWG #22 to 18 (Note 2)</td></tr>
<tr><td>Treatment of terminals not used</td><td colspan="2">Short-circuited (between V, I and COM)</td></tr>
<tr><td colspan="2">Status indication</td><td colspan="2">ONL: indicates normal condition (green LED),
ERR: indicates abnormal condition (red LED),
SETTING: remains on or blinks during setting operation (green LED).</td></tr>
<tr><td colspan="2">Gain/offset adjustment</td><td colspan="2">By switch or program (Note 3)</td></tr>
<tr><td colspan="2">Voltage/current selection</td><td colspan="2">By changing the terminal block connection (for each channel)</td></tr>
<tr><td colspan="2">Other functions</td><td colspan="2">• A/D conversion enable/disable (by application program)
• Conversion data averaging (by application program)
• Pre-alarming (by application program)</td></tr>
<tr><td colspan="2">Occupied slot</td><td colspan="2">1 slot</td></tr>
<tr><td colspan="2">Occupied words</td><td>10 words
(input: 8 words, output: 2 words)</td><td>18 words
(input: 16 words, output: 2 words)</td></tr>
</table>

Note: 1) Use an application program to set the desired analog input range. For details, refer to “Section 4 Software Interface.” (The analog input range factory setting is ± 10V.)
2) The applicable wire size depends on the crimp terminal used. For details, refer to “5-1 Wiring Precautions.”
3) For the method of gain/offset adjustment, refer to “Section 6 Gain/Offset Adjustment.”

2-2-2 Analog output module

(1) High-speed analog output (NP1AYH2-MR)

Item		Specification
Type		NP1AYH2-MR
No. of output channels		2 channels
External load resistance		Voltage output: 1kΩ or more, Current output: 600Ω or less
Conversion characteristics (Note 1)		<table><tr><td>Output</td><td>Digital input value</td><td>Analog output range</td></tr><tr><td>Voltage (V)</td><td rowspan="2">-8000 to 8000 or 0 to 16000</td><td>-10 to 10, -5 to 5, 1 to 5, 0 to 5, 0 to 10</td></tr><tr><td>Current (mA)</td><td>0 to 20, 4 to 20</td></tr></table>
Resolution		14 bits
Overall accuracy (for full scale)		± 0.1% or lower (at 25° C), ±1.0% or lower (at 0° C to 55° C)
Digital input type		INT (integer)
Output delay time		1ms + Takt time
Wire connections	External wire connections	Detachable screw terminal block (M3) 20 poles
	Applicable wire size	AWG #22 to 18 (Note 2)
	Treatment of output terminals not used	Open
Status indication		ONL: indicates normal condition (green LED), ERR: indicates abnormal condition (red LED), SETTING: remains on or blinks during setting operation (green LED).
Gain/offset adjustment		By switch or program (Note 3)
Voltage/current selection		By changing the terminal block connection (for each channel)
Other functions		• Analog output enable/disable (by application program) • Negative value output enable/disable (by application program) • Test output (by application program) • Scaling (by application program)
Occupied slot		1 slot
Occupied words		6 words (input: 2 words, output: 4 words)

Note: 1) Use an application program to set the desired analog output range. For details, refer to “Section 4 Software Interface.” (The analog output range factory setting is 1 to 5V.)
2) The applicable wire size depends on the crimp terminal used. For details, refer to “5-1 Wiring Precautions.”
3) For the method of gain/offset adjustment, refer to “Section 6 Gain/Offset Adjustment.”

2-2 Performance/Function Specifications

(2) Standard analog output (NP1AY02-MR)

Item		Specification
Type		NP1AY02-MR
No. of output channels		2 channels
External load resistance		Voltage output: 1kΩ or more, Current output: 600Ω or less
Conversion characteristics (Note 1)		<table><tr><td>Output</td><td>Digital input value</td><td>Analog output range</td></tr><tr><td>Voltage (V)</td><td rowspan="2">-500 to 500 or 0 to 1000</td><td>-10 to 10, -5 to 5, 1 to 5, 0 to 5, 0 to 10</td></tr><tr><td>Current (mA)</td><td>0 to 20, 4 to 20</td></tr></table>
Resolution		10 bits
Overall accuracy (for full scale)		± 0.5% or lower (at 25° C), ±1.0% or lower (at 0° C to 55° C)
Digital input type		INT (integer)
Output delay time		2ms
Wire connections	External wire connections	Detachable screw terminal block (M3) 20 poles
	Applicable wire size	AWG #22 to 18 (Note 2)
	Treatment of output terminals not used	Open
Status indication		ONL: indicates normal condition (green LED), ERR: indicates abnormal condition (red LED), SETTING: remains on or blinks during setting operation (green LED).
Gain/offset adjustment		By switch or program (Note 3)
Voltage/current selection		By changing the terminal block connection (for each channel)
Other functions		• Analog output enable/disable (by application program) • Negative value output enable/disable (by application program) • Test output (by application program)
Occupied slot		1 slot
Occupied words		6 words (input: 2 words, output: 4 words)

Note: 1) Use an application program to set the desired analog output range. For details, refer to “Section 4 Software Interface.” (The analog output range factory setting is 1 to 5V.)
2) The applicable wire size depends on the crimp terminal used. For details, refer to “5-1 Wiring Precautions.”
3) For the method of gain/offset adjustment, refer to “Section 6 Gain/Offset Adjustment.”

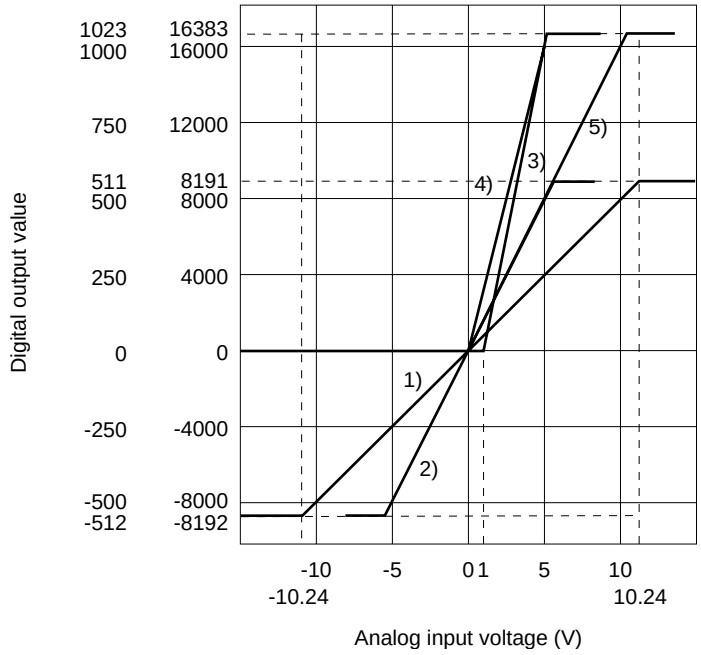
2-3 I/O Characteristics of Analog Input Module

With NP1AXH4-MR, NP1AX04-MR or NP1AX08-MR, it is possible to select voltage/current input for each channel. (Refer to section 5-2 to 5-4)

2-3-1 Voltage input characteristics

Analog input voltage range	Offset	Gain	Output value NP1AXH4-MR	Output value NP1AX04-MR NP1AX08-MR	I/O characteristics
-10 to 10V	0V	10V	± 8000	± 500	Analog input voltage characteristic 1)
-5 to 5V	0V	5V	± 8000	± 500	Analog input voltage characteristic 2)
1 to 5V	1V	5V	0 to 16000	0 to 1000	Analog input voltage characteristic 3)
0 to 5V	0V	5V	0 to 16000	0 to 1000	Analog input voltage characteristic 4)
0 to 10V	0V	10V	0 to 16000	0 to 1000	Analog input voltage characteristic 5)

Analog input voltage characteristics



Notes:

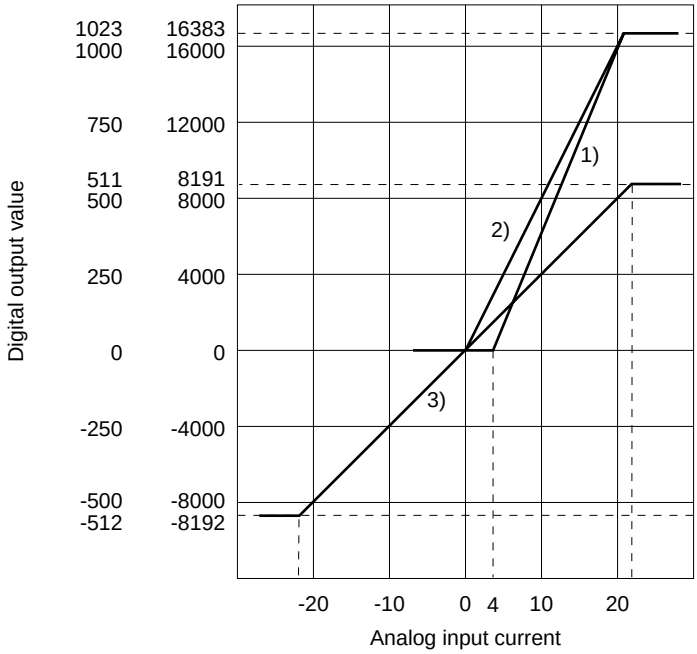
- If the input voltage is such that the output value of NP1AXH4-MR becomes out of the range from –8192 to +8191 or 16383 or that the output value of NP1AX04-MR or NP1AX08-MR becomes out of the range from –512 to +511 or 1023, the digital output value is fixed to –8192, +8191 or 16383 for NP1AXH4-MR, or fixed to –512, +511 or 1023 for NP1AX04-MR/NP1AX08-MR.
- If the input voltage is higher than 10.24V or lower than -10.24V, the accuracy of the digital output value is not guaranteed.
- Do not input a voltage which is outside ± 15V. It can destroy elements inside the module.

2-3 I/O Characteristics of Analog Input Module

2-3-2 Current input characteristics

Analog input current range	Offset	Gain	Output value NP1AXH4-MR	Output value NP1AX04-MR NP1AX08-MR	I/O characteristics
4 to 20mA	4V	20mA	0 to 16000	0 to 1000	Analog input current characteristic 1)
0 to 20mA	0V	20mA	0 to 16000	0 to 1000	Analog input current characteristic 2)
-20 to 20mA	0V	20mA	± 8000	± 500	Analog input current characteristic 3)

Analog input current characteristics



Notes:

- If the input current is such that the output of the NP1AXH4-MR is outside -8192 to +8191 or greater than 16383, or if the input current is such that the output of the NP1AX04-MR/NP1AX08-MR are outside -512 to +511 or greater than 1023, when the NP1AXH4-MR, the digital output value is fixed to -8192, and +8191 or 16383, when the NP1AX04-MR/NP1AX08-MR, the digital output value are fixed to -512, and +511 or 1023.
- During factory shipment, the module is adjusted using a specific voltage range. Because of this, when current input is used, the digital output value is subject to slight deviation.
  When current input is used, therefore, it is advisable to adjust the gain and offset.
- Do not input a voltage which is outside ± 30mA. It can destroy elements inside the module.

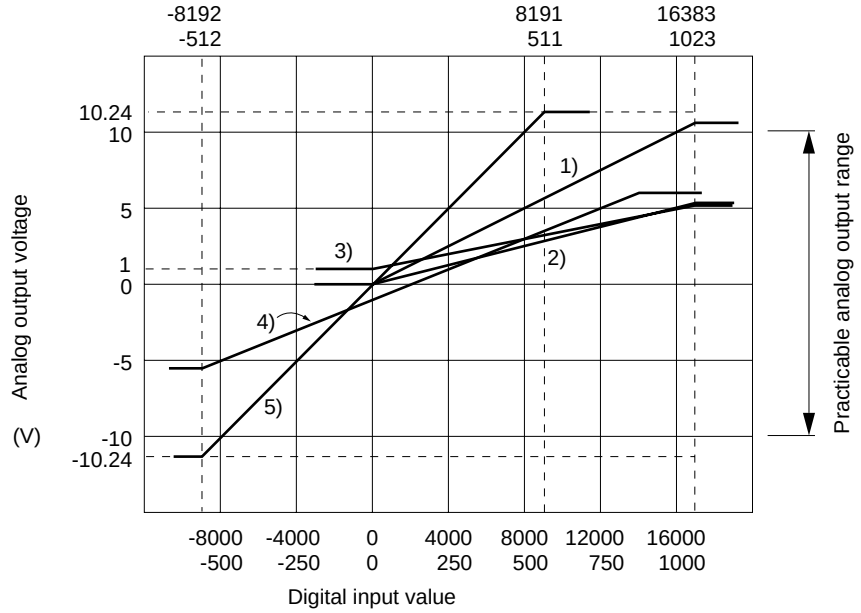
2-4 I/O Characteristics of Analog Output Module

With the NP1AYH2-MR and NP1AY02-MR, there are possible to select either voltage output or current output for each channel by appropriate wiring to the terminal block.

2-4-1 Voltage output characteristics

Analog output voltage range	Offset	Gain	Input value NP1AYH2-MR	Input value NP1AY02-MR	I/O characteristics
0 to 10V	0V	10V	0 to 16000	0 to 1000	Analog output voltage characteristic 1)
0 to 5V	0V	5V	0 to 16000	0 to 1000	Analog output voltage characteristic 2)
1 to 5V	1V	5V	0 to 16000	0 to 1000	Analog output voltage characteristic 3)
± 5V	0V	5V	± 8000	± 500	Analog output voltage characteristic 4)
± 10V	0V	10V	± 8000	± 500	Analog output voltage characteristic 5)

Analog output voltage characteristics



Notes:

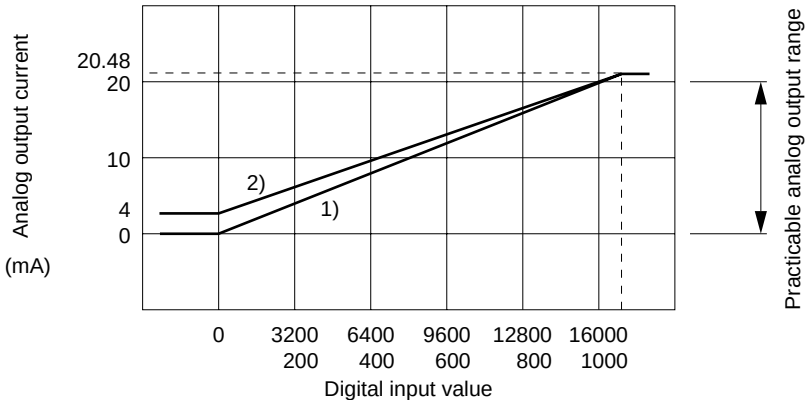
- When the input value of the NP1AYH2-MR is outside -8192 to +8191 or greater than 16383, or when the input value of the NP1AY02-MR is outside -512 to +511 or greater than 1023, the output value is fixed to 10.24V or -10.24V.

2-4 I/O Characteristics of Analog Output Module

2-4-2 Current output characteristics

Analog output current range	Offset	Gain	Input value NP1AYH2-MR	Input value NP1AY02-MR	I/O characteristics
0 to 20mA	0mA	20mA	0 to 16000	0 to 1000	Analog output current characteristic 1)
4 to 20mA	4mA	20mA	0 to 16000	0 to 1000	Analog output current characteristic 2)

Analog output current characteristics



Notes:

- Even if a digital input value greater than 1023 or 16383 is set, it is fixed to 20.48mA.
- The NP1AYH2-MR is adjusted using the factory setting output voltage range of 1V to 5V. When using current output, therefore, adjust the gain and offset.

2-5 Overall Accuracy

2-5-1 Overall accuracy of analog input module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

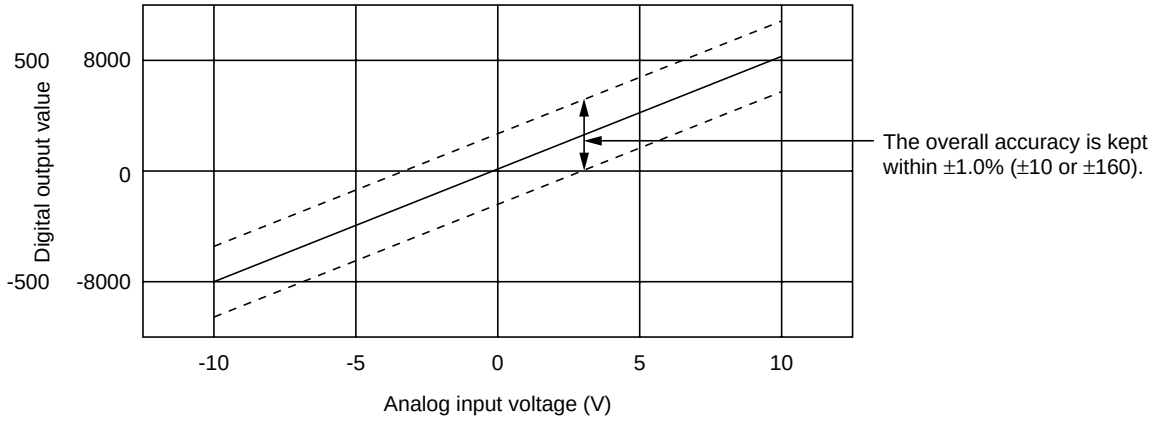
The overall accuracy of A/D conversion is as follows.

- NP1AXH4-MR ... ± 0.1% (at 25°C), ± 1.0% (full scale)
- NP1AX04-MR, NP1AX08-MR ... ± 0.5% (at 25°C), ± 1.0% (full scale)

Note: The above overall accuracy is guaranteed when the input is within the practicable input range.

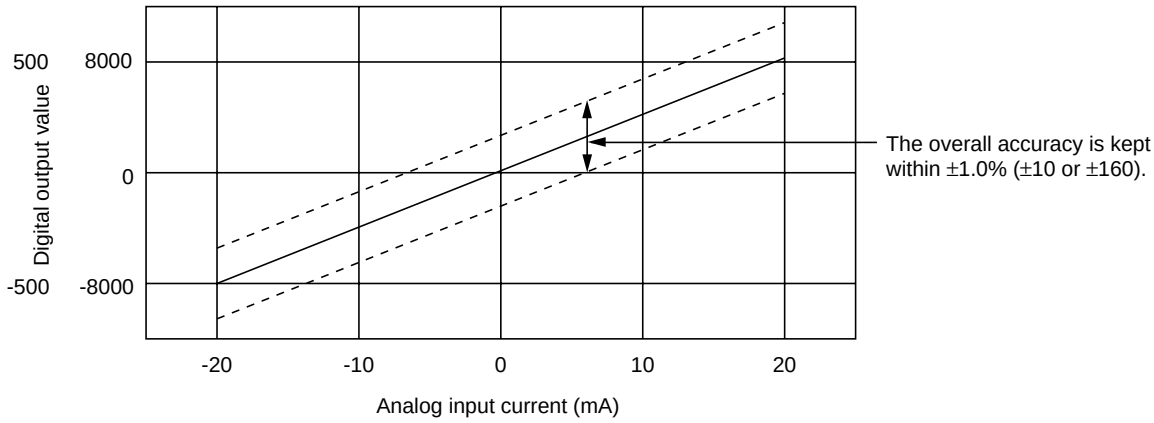
Example 1)
When the input characteristic is set to voltage input (-10V to 10V)

Overall accuracy (when voltage input is used)



Example 2)
When the input characteristic is set to current input (-20A to 20A)

Overall accuracy (when current input is used)



Notes:

(1) Digital output value
NP1AXH4-MR: ± 8000
NP1AX04-MR, NP1AX08-MR: ± 500
(2) The overall accuracy for full scale is calculated as follows.
1) {500 - (-500)} x 0.01 = 10, 2) {8000 - (-8000)} x 0.01 = 160
Thus, the variance in digital output are within, 1) ± 10, and 2) ± 160.

2-5-2 Overall accuracy of analog output module (NP1AYH2-MR, NP1AY02-MR)

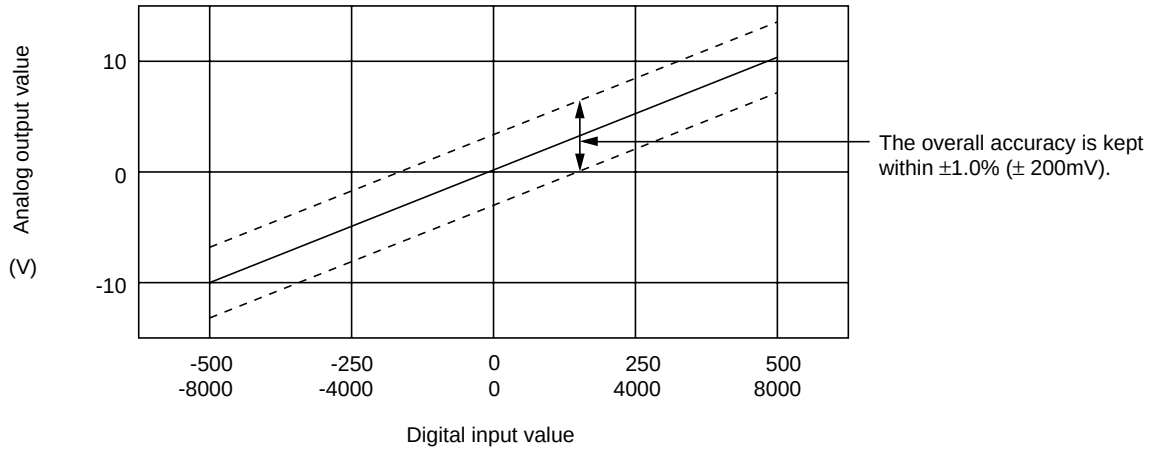
The overall accuracy of D/A conversion is as follows.

- NP1AYH2-MR ... ± 0.1% (at 25°C), ± 1.0% (full scale)
- NP1AY02-MR ... ± 0.5% (at 25°C), ± 1.0% (full scale)

Note: The above overall accuracy is guaranteed when the input is within the practicable input range.

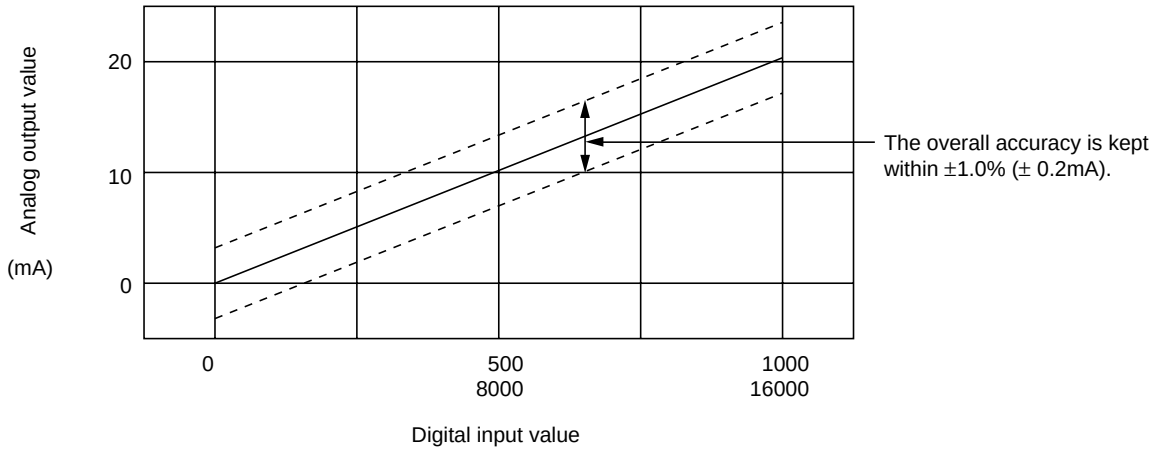
Example 1)
When the output characteristic is set to voltage output (-10 to 10V)

Overall accuracy (when voltage output is used)



Example 2)
When the output characteristic is set to current output (0 to 20mA)

Overall accuracy (when current output is used)



Notes:

(1) Digital input value
NP1AYH2-MR: ± 8000
NP1AY02-MR: ± 500
(2) The overall accuracy for full scale is calculated as follows.
{10 - (-10)} x 0.01 = 0.2 (V) = 200mV····voltage output
{20 - (0)} x 0.01 = 0.2 (mA).·····current output
Thus, the variance is ± 0.2 (V) for voltage output and ± 0.2 (mA) for current output.

2-6 Resolution

2-6-1 Analog input module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

The resolution can be freely changed by gain/offset adjustment.
The relationship between gain/offset adjustment and digital output value is as follows.
Fine adjustment is not available with NP1AX08-MR. (This module is already adjusted at shipment and therefore can be used only by range setting.)

(1) Resolution

Resolution is obtained by the following expression.

$$\text{Resolution} = \frac{\text{(Gain) - (Offset)}}{\text{Digital output value range}} \quad \text{(mV or } \mu\text{A)}$$

(2) Relationship between maximum resolution and digital output value

For example, because maximum resolution of 0.5V range is 0.3125 mV in voltage and 1μA in current for the analog input module (NP1AXH4-MR), and 5 mV in voltage and 20 μA in current for NP1AX04-MR, respectively, digital output value may not always increase or decrease by ones if the following relation is met.

$$\frac{\text{(Gain) - (Offset)}}{\text{Digital output value range}} < \text{Max. resolution}$$

Example

$$\frac{\text{(Gain = 5V) - (Offset = 1V)}}{\text{Digital output value range = 16000}} = 0.25\text{mV} < \text{Max. resolution } 0.3125\text{mV}$$

The digital output value increases (decreases) by 1 as the input voltage is increased (decreased) by 0.3125mV. When the change in input voltage is 0.25mV, the digital output value does not change by 1.

2-6-2 Resolution of analog output module (NP1AYH2-MR, NP1AY02-MR)

(1) Analog output value

The resolution can be freely changed by gain/offset adjustment.
The relationship between gain/offset adjustment and analog output value is as follows.

$$\text{Analog output value} = \frac{\text{(Gain) - (Offset)}}{\text{Digital value resolution}} \times \text{Digital input value} + \text{Offset}$$

(2) Relationship between maximum resolution and analog output value

For example, because maximum resolution of the analog output module (NP1AYH2-MR) is 0.3125mV for voltage output and 1μA for current output. Therefore, if the gain/offset settings make the following expression hold true, the change of analog output value when the digital input value is changed by 1 may be different from the one calculated by the above expression.

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

Example

$$\frac{\text{(Gain = 5V) - (Offset = 1V)}}{\text{(Digital value resolution = 1000)}} = 4\text{mV} < \text{(Max. resolution } 5\text{mV)}$$

2-7 Conversion Method

2-7-1 Conversion method of analog input module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

With the analog input module, the digital output value is
determined by the settings of input/output characteristics and A/D conversion method.

(1) Input/output characteristics
- Offset
- Gain

The set values of offset and gain determine the digital output value for an analog input (voltage/current) value.

Offset ...
The input voltage/current value that makes the digital output value 0.
Gain .....
The input voltage/current value that makes the digital output value 8000 or 16000 (NP1AXH4-MR).
The input voltage/current value that makes the digital output value 500 or 1000 (NP1AX08-MR, NP1AX04-MR).

(2) A/D conversion method
- Sampling process
- Averaging process

Set either sampling process or averaging process for each channel.

1) Sampling process

In this process, digital output values which are obtained by A/D conversion of analog input values sequentially are stored in the area for digital output values.

2) Averaging process

In this process, A/D conversion is performed a set number of times for a channel specified by the CPU and the average of A/D-converted values, excluding the maximum and minimum values, is calculated and stored in the area for digital output values.
It should be noted that when the set number of times of A/D conversion is 2 or less, a sampling process, not an averaging process, is performed.

Number of times of A/D conversion that can be set for averaging process ...
1 to 128 (NP1AXH4-MR, NP1AX04-MR), 1 to 64 (NP1AX08-MR)

Notes:

- Setting a number outside the range shown above results in an error. In this case, the contents of the buffer memory remain unchanged and the A/D conversion for the averaging process before the setting error has occurred is performed.

2-7-2 Conversion method of analog output module (NP1AYH2-MR, NP1AY02-MR)

With the analog output module, the analog output (voltage or current) value is determined by the settings of input/output characteristics.

(1) Input/output characteristics
- Offset
- Gain

The set values of gain and offset determine the analog output (voltage/current) value for a digital input value.

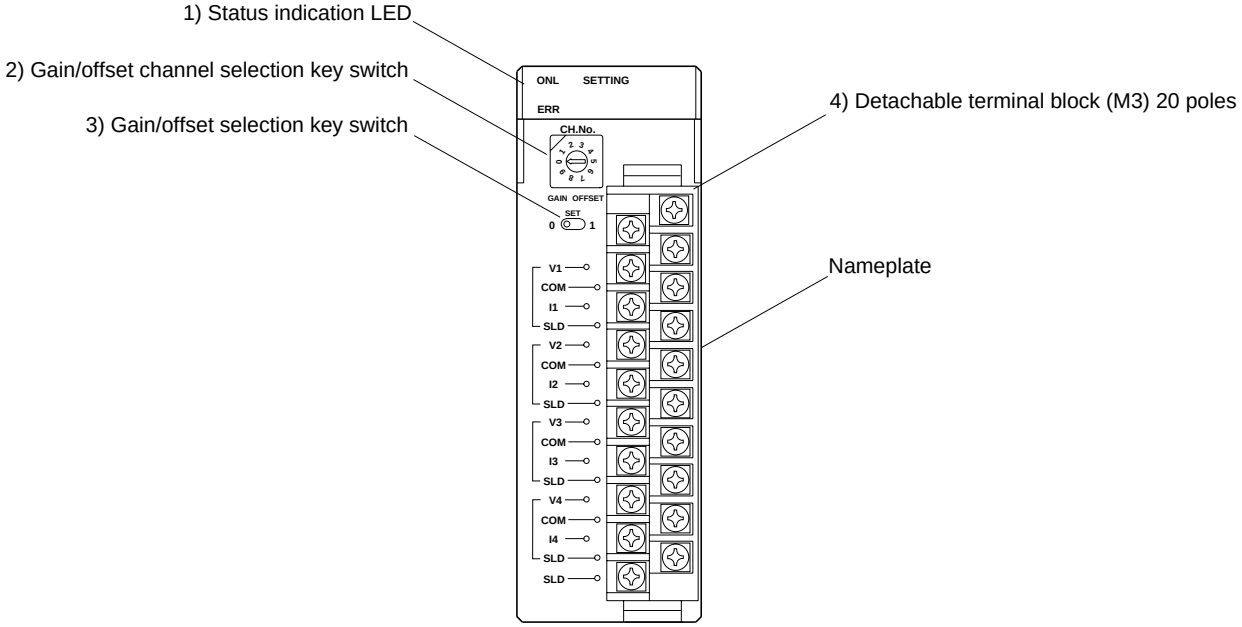
Offset ...
The analog output voltage/current value when the value to be D/A-converted is 0.
Gain .....
The analog output voltage/current value when the value to be D/A-converted is 8000 or 16000 (NP1AYH2-MR).
The analog output voltage/current value when the value to be D/A-converted is 500 or 1000 (NP1AY02-MR).

2-8 Names and Functions

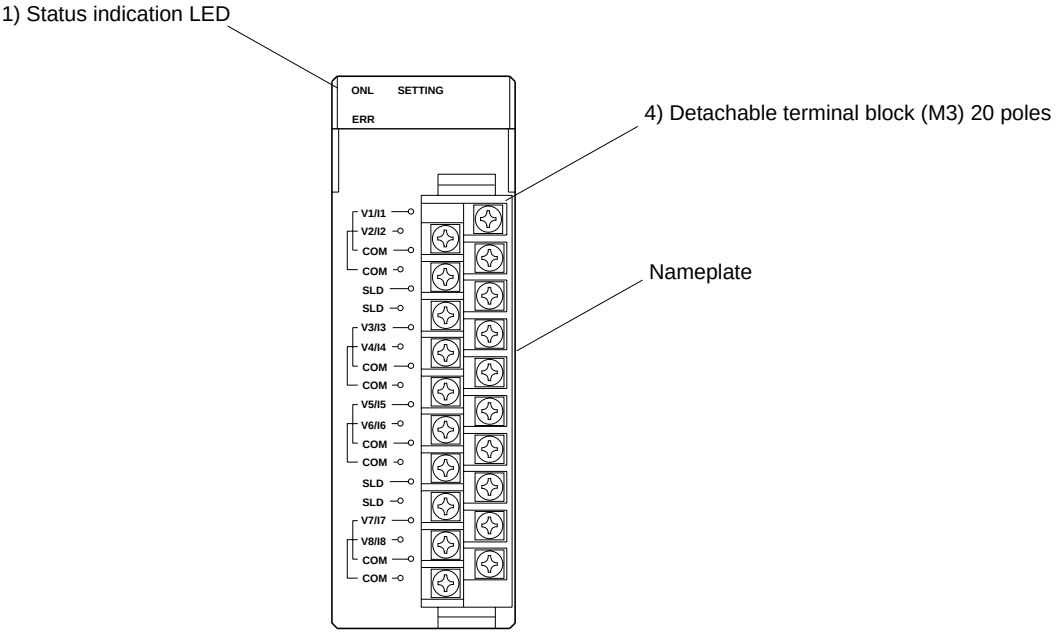
2-8-1 Analog input module (NP1AXH4-MR/NP1AX04-MR/NP1AX08-MR)

(1) Names

<NP1AXH4-MR/NP1AX04-MR>



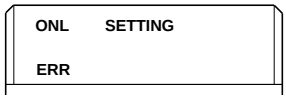
<NP1AX08-MR>



(2) Functions

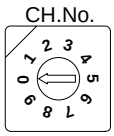
1) Status indication LED

Indicates the condition of the analog input module.



Symbol	Color	Status Description
ONL	Green	Lights on when local module is operating normally; blinks while connecting to SX bus.
ERR	Red	Lights on when local module is abnormal.
SETTING	Green	Setting condition during gain/offset adjustment Normally : LED is off. During setting : LED blinks every 1 second. Setting completed : LED blinks for 3 seconds. Setting error : LED blinks every 0.5 seconds

2) Gain/offset channel selection key switch (For NP1AXH4-MR/NP1AX04-MR only)



0: Should be set for running.
1, 2, 3, 4: Channel numbers selected for gain/offset adjustment.
5 to 9: Not used.

3) Gain/offset selection key switch (For NP1AXH4-MR/NP1AX04-MR only)

(Left) GAIN: Gain adjustment mode.
(Center) SET: Gain/offset adjustment completion mode.
(Right) OFFSET: Offset adjustment mode.

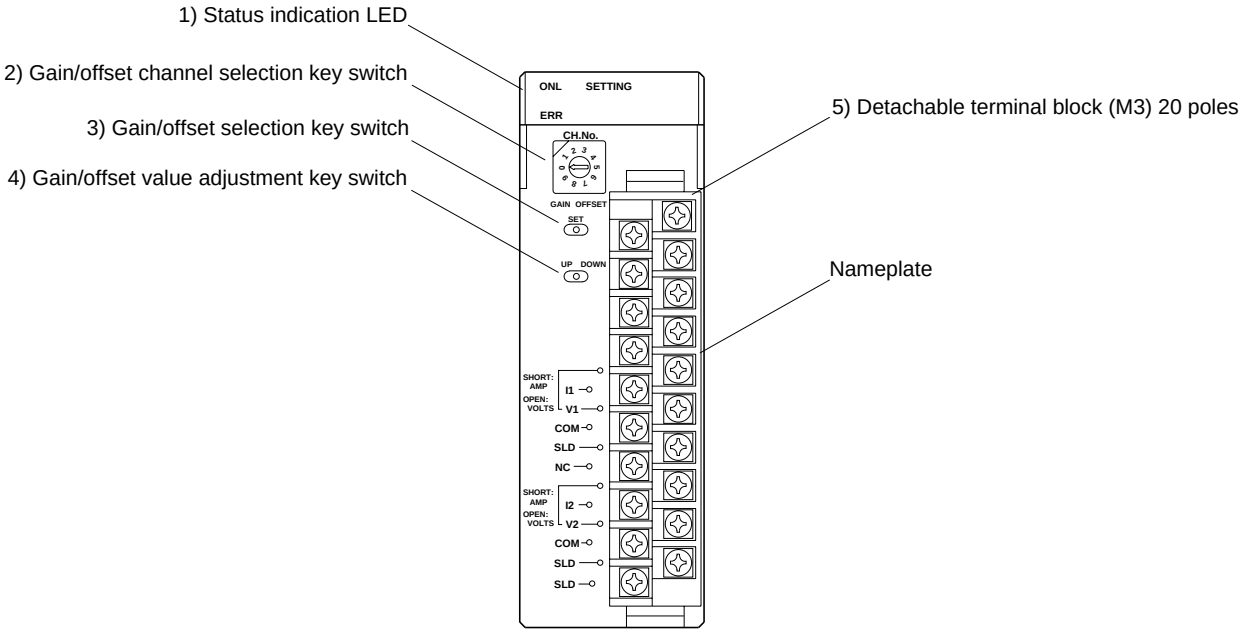
4) Detachable terminal block

This is a 20-pole (M3) detachable terminal block. For the terminal arrangement, refer to “5-2 Wiring of Analog Input Module.”

2-8 Names and Functions

2-8-2 Analog output module (NP1AYH2-MR, NP1AY02-MR)

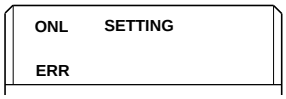
(1) Names



(2) Functions

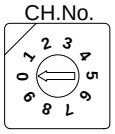
1) Status indication LED

Indicates the status of the analog output module.



Symbol	Color	Status Description
ONL	Green	Lights on when local module is operating normally; blinks while connecting to SX bus.
ERR	Red	Lights on when local module is abnormal.
SETTING	Green	Setting condition during gain/offset adjustment Normally : LED is off. During setting : LED blinks every 1 second. Setting completed : LED blinks for 3 seconds. Setting error : LED blinks every 0.5 seconds

2) Gain/offset channel selection key switch



0: Should be set for running.
1, 2: Channel numbers selected for gain/offset adjustment.
3 to 9: Not used.

3) Gain/offset selection key switch

(Left) GAIN: Gain adjustment mode.
(Center) SET: Gain/offset adjustment completion mode.
(Right) OFFSET: Offset adjustment mode.

4) Gain/offset value adjustment key switch

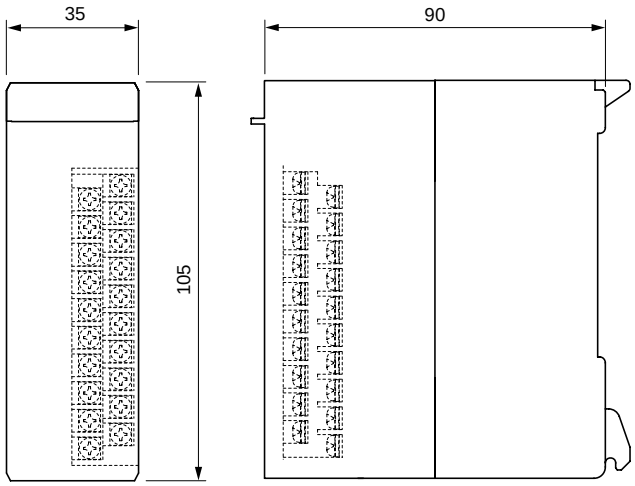
Used to adjust gain/offset values.

(Left) UP, (Right) DOWN

5) Detachable terminal block

This is a 20-pole (M3) detachable terminal block. For the terminal arrangement, refer to “5-3 Wiring of Analog Output Module.”

High-speed analog input module: NP1AXH4-MR
Standard analog input module: NP1AX04-MR
Standard analog input module: NP1AX08-MR
High-speed analog output module: NP1AYH2-MR
Standard analog output module: NP1AY02-MR



Section 3 System Configuration

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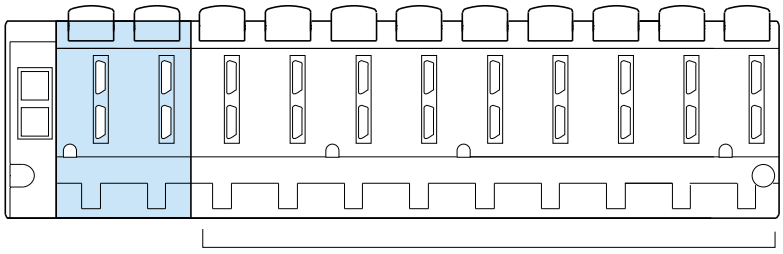
Section 3 System Configuration
3-1 Mounting on Base Board

3-1-1 Mounting position

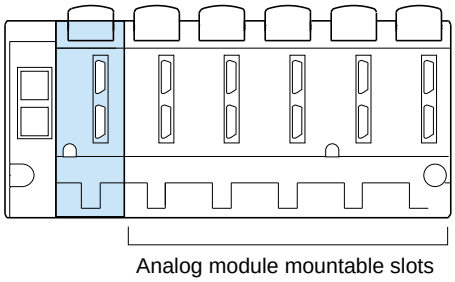
The analog input/output modules are connected to the MICREX-SX Series SPH SX bus and I/O master module link. The mounting position of the modules on the base board is shown below.

<Base board without 6-slot base board>

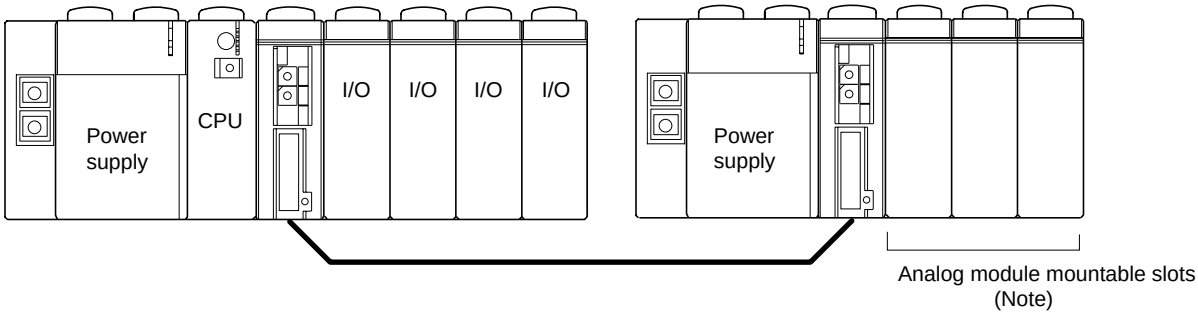


The modules can be mounted in any of the slots in the base board, except the two leftmost slots which are for the power module.

<6-slot base board>



Note: NP1AX08-MR of analog 8-channel specification cannot be mounted on the baseboard for remote I/O of the T-link.



3-1-2 Number of mountable modules

It is possible to connect a maximum of 238 modules to the SX bus (a maximum of 254 modules in one configuration including the link of the I/O master) (due to hardware limitation).
It should be noted, however, that the maximum number of analog input/output modules that can actually be connected is limited by the number of words they occupy in the input/output areas (I/Q areas).

For analog input module (4 channels) $\frac{512 \text{ words}}{10 \text{ words}} \approx 51.2 \quad \approx 51$ modules

For analog input module (8 channels) $\frac{512 \text{ words}}{18 \text{ words}} \approx 28.4 \quad \approx 28$ modules

For analog output module $\frac{512 \text{ words}}{6 \text{ words}} \approx 85.3 \quad \approx 85$ modules

Section 4 Software Interface

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Section 4 Software Interface

4-1 Analog Input Module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

For the analog input module, the following operations can be specified by an application program.

- Setting of analog input range (The analog input range is factory set to -10V to 10V. When any other range is used, be sure to set that range.)
- Conversion enable/disable
- Averaging process/sampling process
- Pre-alarming
- Scaling (For NP1AXH4-MR only)

4-1-1 Memory assignment

The analog input module (NP1AXH4-MR, NP1AX04-MR) occupies 10 words (8 words for input and 2 words for output) in the input/output areas.

Offset addresses		b15 ... b0	
	+0	Channel 1 digital output value	AI module to CPU (8 words)
	+1	Channel 2 digital output value	
	+2	Channel 3 digital output value	
	+3	Channel 4 digital output value	
	+4	Channel 1 status (setting information, detection of broken wire, conversion status, etc.)	
	+5	Channel 2 status (setting information, detection of broken wire, conversion status, etc.)	
	+6	Channel 3 status (setting information, detection of broken wire, conversion status, etc.)	
	+7	Channel 4 status (setting information, detection of broken wire, conversion status, etc.)	
	+8	Operation	CPU to AI module (2 words)
	+9	Set value	

The analog input module (NP1AX08-MR) occupies 18 words (16 words for input and 2 words for output) in the input/output areas.

Offset addresses		b15 ... b0	
	+0	Channel 1 digital output value	AI module to CPU (16 words)
	+1	Channel 2 digital output value	
	+2	Channel 3 digital output value	
	+3	Channel 4 digital output value	
	+4	Channel 5 digital output value	
	+5	Channel 6 digital output value	
	+6	Channel 7 digital output value	
	+7	Channel 8 digital output value	
	+8	Channel 1 status (setting information, detection of broken wire, conversion status, etc.)	
	+9	Channel 2 status (setting information, detection of broken wire, conversion status, etc.)	
	+10	Channel 3 status (setting information, detection of broken wire, conversion status, etc.)	
	+11	Channel 4 status (setting information, detection of broken wire, conversion status, etc.)	
	+12	Channel 5 status (setting information, detection of broken wire, conversion status, etc.)	
	+13	Channel 6 status (setting information, detection of broken wire, conversion status, etc.)	
	+14	Channel 7 status (setting information, detection of broken wire, conversion status, etc.)	
	+15	Channel 8 status (setting information, detection of broken wire, conversion status, etc.)	
	+16	Operation	CPU to AI module (2 words)
	+17	Set value	

4-1 Analog Input Module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

(1) Digital output value

The area in which to store an analog value converted to a digital value.

<NP1AXH4-MR, NP1AX04-MR>

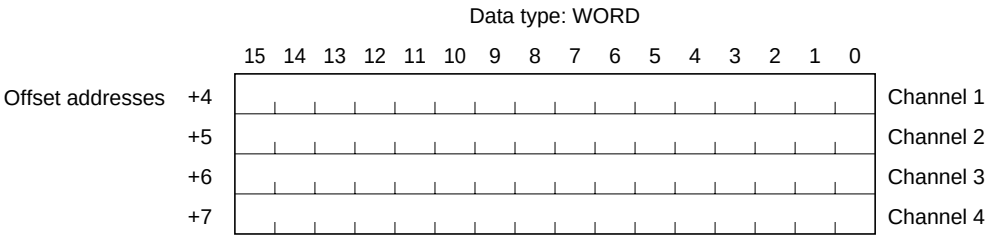
Offset addresses	+0	Channel 1 output value (INT type)
	+1	Channel 2 output value (INT type)
	+2	Channel 3 output value (INT type)
	+3	Channel 4 output value (INT type)

<NP1AX08-MR>

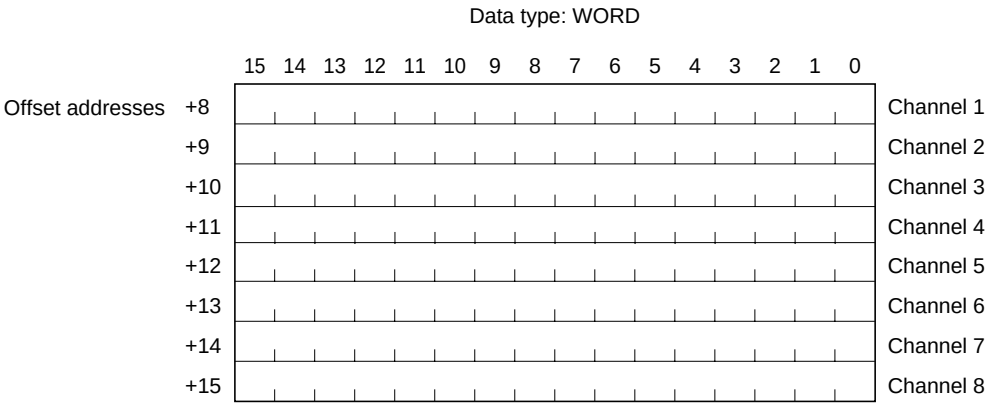
Offset addresses	+0	Channel 1 output value (INT type)
	+1	Channel 2 output value (INT type)
	+2	Channel 3 output value (INT type)
	+3	Channel 4 output value (INT type)
	+4	Channel 5 output value (INT type)
	+5	Channel 6 output value (INT type)
	+6	Channel 7 output value (INT type)
	+7	Channel 8 output value (INT type)

(2) Status
Indicates detection of broken wire, gain/offset adjustment status, and detection of pre-alarm points.

<NP1AXH4-MR, NP1AX04-MR>



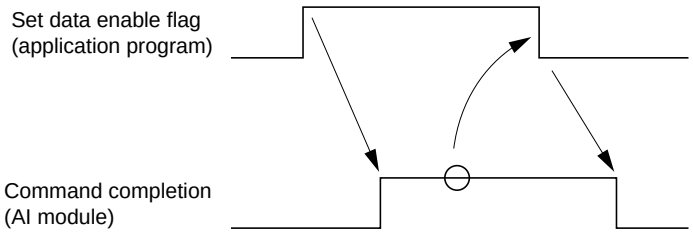
<NP1AX08-MR>



Bit	Status	Contents
0	Detection of broken wire	0: No broken wire detected, 1: Broken wire detected
1	Gain/offset adjustment status	0: Adjustment completed, 1: Adjusting (Unavailable for NP1AX08-MR)
2	Gain/offset adjustment error	0: No adjustment error, 1: Adjustment error (Unavailable for NP1AX08-MR)
3	Command completion	0: No command issued or command not completed, 1: Command completed
4	Over-range error	0: No error, 1: Error
5	Scaling data error	0: No error, 1: Error (Unused for NP1AX04-MR or NP1AX08-MR)
6		
7	Pre-alarm value	Point I
8	Pre-alarm value	Point H
9	Pre-alarm value	Point G
10	Pre-alarm value	Point F
11	Pre-alarm value	Point E
12	Pre-alarm value	Point D
13	Pre-alarm value	Point C
14	Pre-alarm value	Point B
15	Pre-alarm value	Point A

<Detection of broken wire: bit 0>
A broken wire of the input signal line can be detected only when the analog input range are 4 to 20mA or 1 to 5V.
It is judged as wire breakage having occurred if analog input value drops to 3.68mA when used in the analog input range of 4 to 20mA or if analog input value drops to 0.92V when used in the analog input range of 1 to 5V.

<Command completion: bit 3>
Each set data item is input to the AI module when the enable flag (bit 15 of offset address +8) is set. Upon completion of the input, the AI module sets the command completion flag. After confirming the command completion flag, the application program resets the enable flag.



<Over-range error: bit 4>
This bit is set to “1” if an external voltage (current) input value exceeds the selected input range.

Example:
If 6V is input when the selected input range is 0 to 5V.

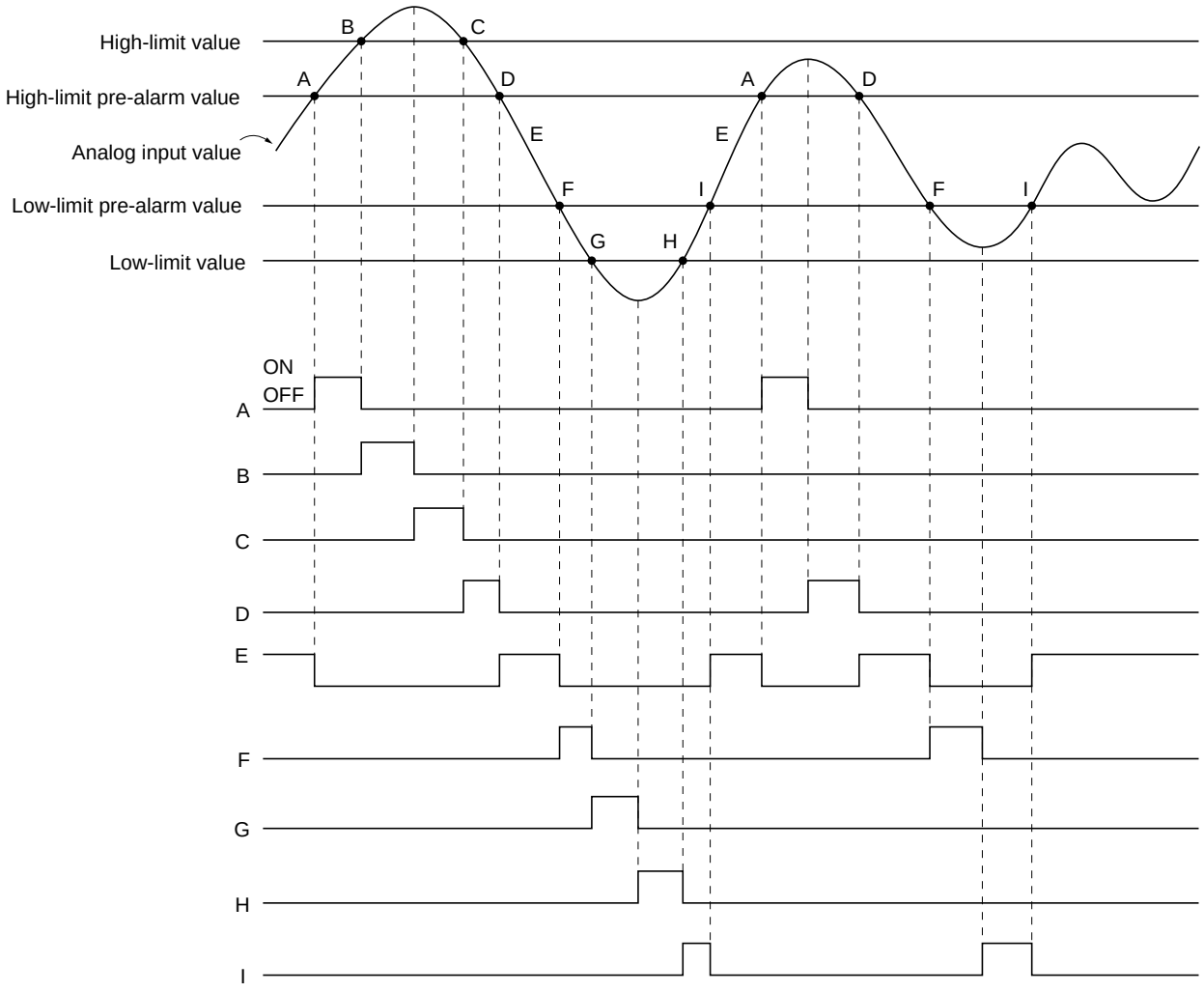
<Scaling data error: bit 5>
This bit is set ON when the set data for scaling is as follows:
1)When a value is input that is smaller than the minimum value of selected range or greater than the maximum value
2)When offset value and gain value are reversed in magnitude
3)If resolution differs between plus and minus sides with respect to offset when ±5V, ±10V or ±20mA range is selected
(How to reset error)
Error is reset when the setting of scaling is stopped (when bit 7 of the operating setting range is set OFF). However, because the previously set scaling data is stored, error is finally reset when the content of above 1) to 3) is modified.

<Pre-alarm value: bit 7 to 15>
- When the pre-alarm function has been set in the operation area, it is possible to detect pre-alarm points A through I.
- The pre-alarm function facilitates the processor to check the output value if specific input data changes. By using this function for constant monitoring, it is possible to simplify application programs since the need for data comparison by an application program is eliminated.
- The AI module compares an analog input value with the previous analog input value in each sampling period to check whether analog input values are increasing or decreasing and the level of each set point, and sets only one of the points A-I to “1” (all the other points set to “0”) to detect pre-alarm information. When the scaling function is performed, the pre-alarm function is enabled after the scaling function.

Pre-alarm point on/off conditions

Point	Condition for on	Condition for off
A	An increasing analog input value coincides with the high-limit pre-alarm value of the selected input range.	An analog input value coincides with the high-limit of the selected input range or reaches a peak.
B	An increasing analog input value coincides with the high-limit value of the selected input range.	An increasing analog input value reaches a peak.
C	An increasing analog input value exceeds the high-limit value of the selected input range and reaches a peak.	An analog input value decreases below the peak and coincides with the high-limit value of the selected input range.
D	A decreasing analog input value coincides with the high-limit value of the selected input range.	A decreasing analog input value coincides with the high-limit pre-alarm value of the selected input range.
E	An analog input value is below the gain pre-alarm value and above the low-limit pre-alarm value.	The condition for "on" shown at left has disappeared.
F	A decreasing analog input value coincides with the low-limit pre-alarm value.	An analog input value coincides with the lower-limit value or reaches a peak.
G	A decreasing analog input value coincides with the lower-limit value.	A decreasing analog input value reaches a bottom.
H	An analog input value decreases below the low-limit value and reaches a bottom.	An analog input value exceeds a peak and coincides with the low-limit value.
I	An analog input value is increasing in the range from low-limit value and low-limit pre-alarm value.	An increasing analog input value coincides with the low-limit pre-alarm value

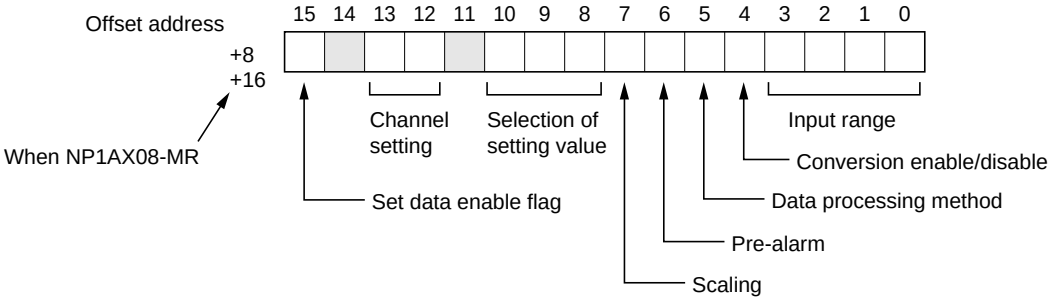
Relationship between A-I points of pre-alarm value and analog input value



4-1 Analog Input Module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

(3) Operation setting area

For each channel of the analog input module, set the desired operations by an application program.



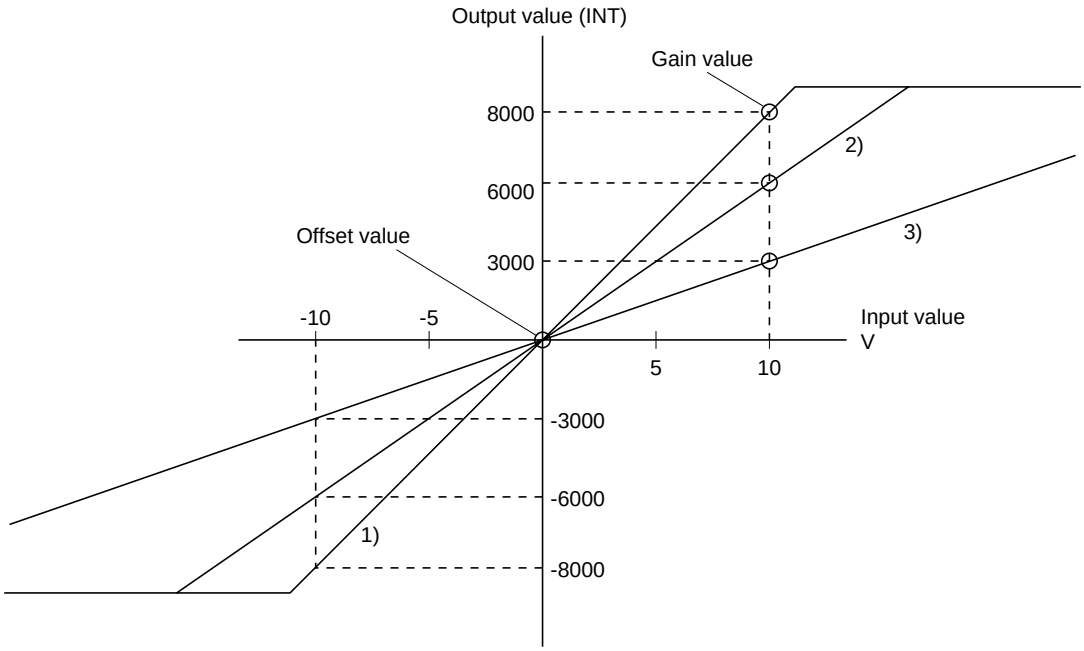
Bit	Operation mode	Contents
0	Setting of input range	0000: 0 to 10V
1		0001: 0 to 5V
2		0010: 1 to 5V
3		0011: ± 5V
		0100: ± 10V
		0101: 0 to 20mA
		0110: 4 to 20mA
		0111: ± 20mA
		1000 to 1111: Reserved
4	Conversion enable/disable	0: Conversion enabled, 1: Conversion disabled
5	Setting of data processing method	0: Sampling process, 1: Averaging process
6	Setting of pre-alarm	0: Not set, 1: Set
7	Setting of scaling	0: Not set, 1: Set (Unused for NP1AX04-MR or NP1AX08-MR)
8	Selection of setting value	000: Not selected
9		001: Offset scaling data (Unused for NP1AX04-MR or NP1AX08-MR)
10		010: Gain scaling data (Unused for NP1AX04-MR or NP1AX08-MR)
		011: Number of times of averaging
		100: Pre-alarm value
		101: Offset value } Disabled for NP1AX08-MR. If set, conversion characteristic may be changed.
		110: Gain value
		111: Gain/offset decision
11	Not used	
12	Setting of channel	000: Channel 1 100: Channel 5
13		001: Channel 2 101: Channel 6
		010: Channel 3 110: Channel 7
		011: Channel 4 111: Channel 8
14	Not used	
15	Set data enable flag	0: Not enabled, 1: Enabled

Note: The setting of module operation, etc. is stored in the module internal EEPROM. Therefore, each time a setting program is executed (when the set data enable flag is set ON/OFF), it is written in the EEPROM. Be careful not to exceed the warranted write operation cycles of the EEPROM (100,000 cycles)

(4) Set value area

<Scaling data>

When the setting of scaling has been specified in the operation area, it is possible to set scaling by setting 1) scaling data of offset-value and 2) scaling data of gain-value in the set value area.



1) ±10V: ±8000 before scaling (default value)
2) ±10V: When scaled to ±6000
3) ±10V: When scaled to ±3000

Note: When scaling is performed, the overall accuracy depends on the scaling range.

1) Scaling data of offset-value

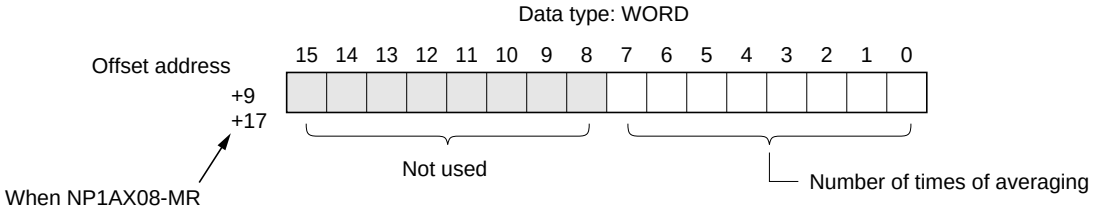
Offset address	
+9	Scaling data (INT type)

2) Scaling data of gain-value

Offset address	
+9	Scaling data (INT type)

4-1 Analog Input Module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

<Setting of number of times of averaging>

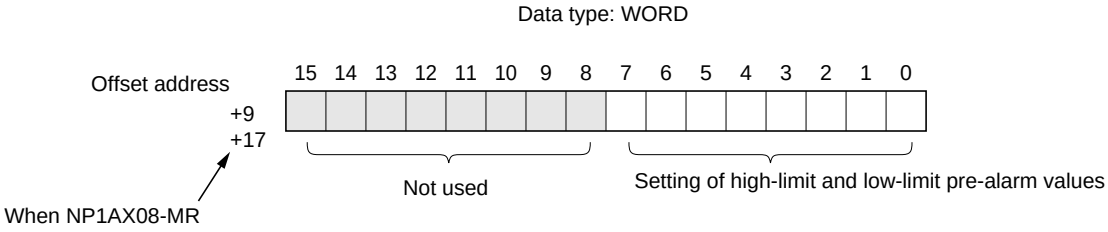


- Setting range for the number of times of averaging:
  NP1AXH4-MR or NP1AX04-MR 1 to 128 cycles (01h to 80h)
  NP1AX08-MR 1 to 64 cycles (01h to 40h)
  However, sampling is performed if 2 or smaller value is set. If a value is set that is greater than the maximum value, the corresponding maximum value is selected for the operation.

- The averaging process time (per channel) can roughly be calculated by the following equation.
  Averaging process time(s) = 75µs + [(n - 3) x 3.4µs] where, n denotes the number of times of averaging (n = 3 or more).

Note: When averaging is performed, averaging process time (s) is added to sampling period.

<Setting of pre-alarm function>
With this function, it is possible to issue a pre-alarm before 45% of the high-limit or low-limit value is reached. Set 30%, 35%, 40%, or 45% for each of the channels.



Bit	Pre-alarm value	Set value	
0	High-limit value	-30%	Select one bit.
1		-35%	
2		-40%	
3		-45%	
4	Low-limit value	+30%	Select one bit.
5		+35%	
6		+40%	
7		+45%	

Example
When the input range, high-limit value, and low-limit value are set to 0 to 10V, -30%, and +40%, respectively, the pre-alarm values become as follows.

- High-limit pre-alarm value 10V - (10V x 30%) = 7V
- Low-limit pre-alarm value 0V + (10V x 40%) = 4V

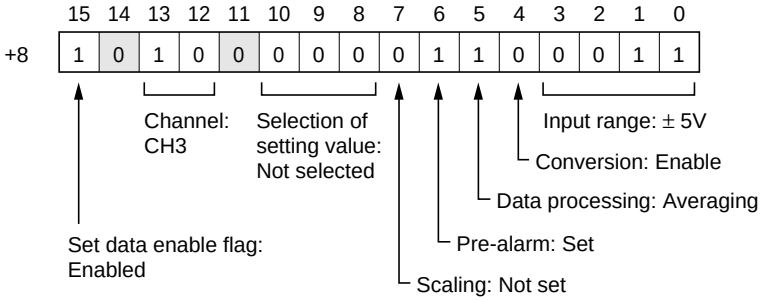
4-1-2 Operation setting procedure

Operation of the analog input module (NP1AXH4-MR or NP1AX04-MR) is set using the registers of offset addresses + 8 and + 9 (offset addresses + 16 and + 17 for NP1AX08-MR).

<Setting procedure>

To set ±5V range, averaging (50 cycles) and pre-alarm 30% (for both high- and low-limit values) for channel 3 of NP1AXH4-MR (supposing that SX station number of the module is “10”)

1) Set the channel (channel 3), selection of setting value (not selected), pre-alarm (set), data processing (averaging), conversion enable/disable (enable), input range (±5V), and set data enable flag (enabled), respectively, in the operation setting area.



Flow of data

%QW10.8 WORD#16#A063

2) Confirm that the command completion flag is ON, then reset the set data enable flag (1 to 0). The command completion flag for channel 3 is the third bit of channel 3 status (offset address +06). When the set data enable flag is reset, the command completion flag of channel 3 turns OFF. Confirm that the command completion flag has turned OFF, then proceed to the next step.

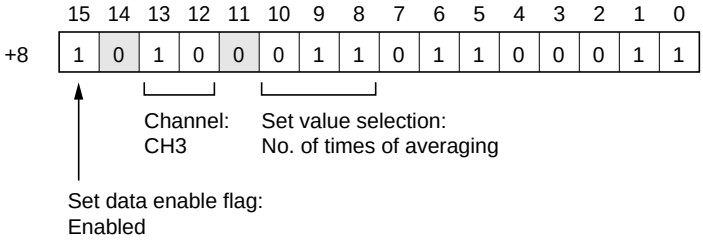
(command completion flag)

%IX10.6.3 TRUE (ON)

%QW10.8 WORD#16#2063

%IX10.6.3 FALSE (OFF)

3) Set the number of times of averaging. Set 50 (32h) in the value setting area and set the set value selection to No. of times of averaging.



%QW10.9 WORD#16#0032

%QW10.8 WORD#16#A363

4) Confirm that the command completion flag is ON, then reset the set data enable flag (1 to 0). When the set data enable flag is reset, the command completion flag of channel 3 turns OFF. Confirm that the command completion flag has turned OFF, then proceed to the next step.

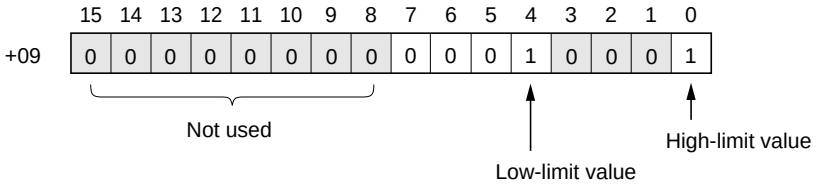
%IX10.6.3 TRUE (ON)

%QW10.8 WORD#16#2363

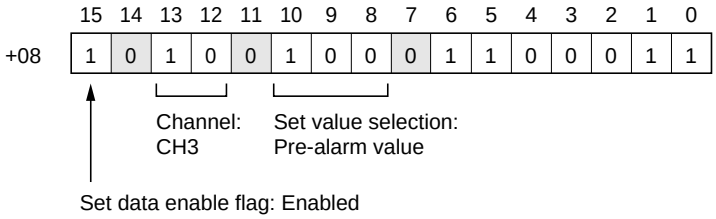
%IX10.6.3 FALSE (OFF)

4-1 Analog Input Module (NP1AXH4-MR, NP1AX04-MR, NP1AX08-MR)

5) Set the pre-alarm value (30%). Set 30% in the value setting area and set the set value selection to Pre-alarm value.

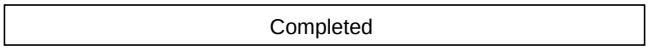


%QW10.9 WORD#16#0011



%QW10.8 WORD#16#A463

6) Confirm that the command completion flag is ON, then reset the set data enable flag (1 to 0). When the set data enable flag is reset, the command completion flag turns OFF.



%IX10.6.3 TRUE (ON)

⇩

%QW10.8 WORD#16#2463

⇩

%IX10.6.3 FALSE (OFF)

4-1-3 Scaling data setting procedure

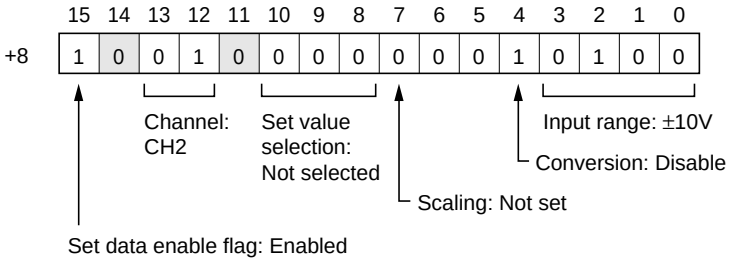
With the Analog input module (NP1AXH4-MR), it is possible to change the gradient of A/D conversion by scaling.

<Setting procedure>

To scale ±10V: ±8000 to ±10V: 4500 for channel 2 (SX bus station number of the module assumed to be “10”):

Flow of data

1) Set “Conversion: Disable” for the channel to be scaled.

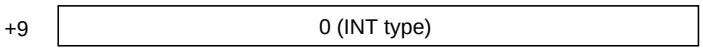


%QW10.8 WORD#16#9014

2) Confirm that the command completion flag is ON, then reset the set data enable flag.
When the set data enable flag is reset, the command completion flag turns OFF. Confirm that the command completion flag has turned OFF, then proceed to the next step.

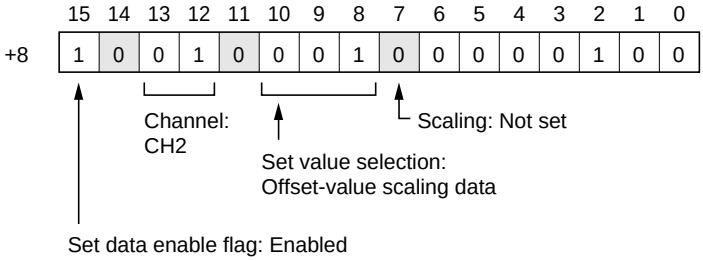
%IX10.5.3 TRUE (ON)
⇩
%QW10.8 WORD#16#1014
⇩
%IX10.5.3 FALSE (OFF)

3) Set the offset-value scaling data in the value setting area.



%QW10.9 INT#0

4) Set the channel (CH2), set value selection (offset-value scaling data), input range (±10V), and set data enable flag (enabled) in the operation setting area.



%QW10.8 WORD#16#9104

5) Confirm that the command completion flag is ON, then reset the set data enable flag.
When the set data enable flag is reset, the command completion flag turns OFF.
Confirm that the command completion flag has turned OFF, then proceed to the next step.

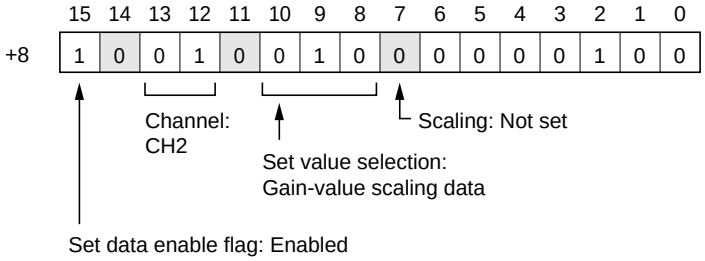
%IX10.5.3 TRUE (ON)
⇩
%QW10.8 WORD#16#1104
⇩
%IX10.5.3 FALSE (OFF)

In this step, the offset-value scaling data is input to the Analog input module (NP1AXH4-MR).

6) Set the gain-value scaling data in the value setting area.

+9	4500 (INT type)	%QW10.9 INT#4500

7) Set the channel (CH2), set value selection (gain-value scaling data), input range (±10V), and set data enable flag (enabled) in the operation setting area.



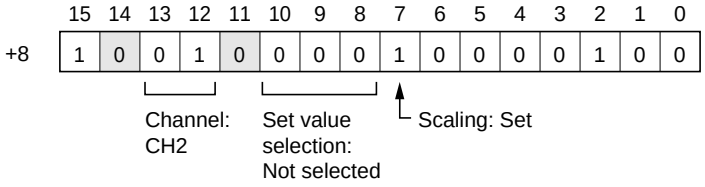
%QW10.8 WORD#9204

8) Confirm that the command completion flag is ON, then reset the set data enable flag. When the set data enable flag is reset, the command completion flag turns OFF.

%IX10.5.3 TRUE (ON)
⇩
%QW10.8 WORD#1204
⇩
%IX10.5.3 FALSE (OFF)

In this step, the gain-value scaling data is input to the Analog input module (NP1AXH4-MR).

9) The scaling operation starts. Set the set value selection (not selected), scaling (set), and set data enable flag (enabled) in the operation setting area.



%QW10.8 WORD#16#9084

10) Confirm that the command completion flag is ON, then reset the set data enable flag. When the set data enable flag is reset, the command completion flag turns OFF.

%IX10.5.3 TRUE (ON)
⇩
%QW10.8 WORD#16#1084
⇩
%IX10.5.3 FALSE (OFF)

Completed

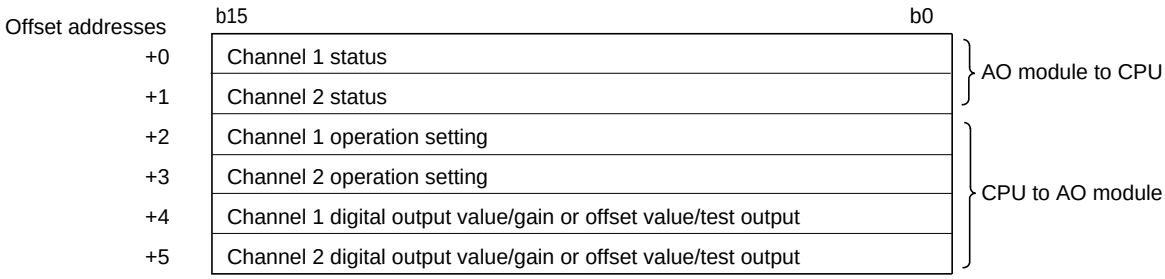
4-2 Analog Output Module (NP1AYH2-MR, NP1AY02-MR)

For the analog output module, specify the following operations by an application program.

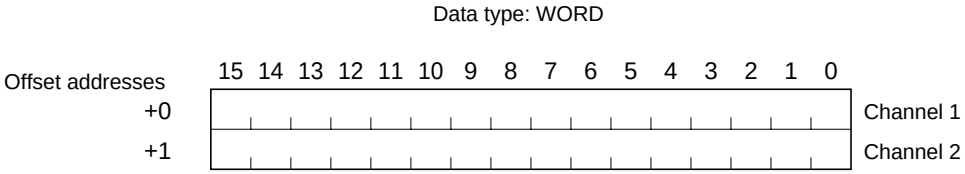
- Setting of analog output range (The output range is factory set to 1 to 5V. When any other output range is used, be sure to specify that range.)
- Output enable/disable
- Negative value output enable/disable
- Test output
- Scaling (NP1AYH2-MR only)

4-2-1 Memory assignment

The analog output module occupies 6 words (2 for input and 4 for output) in the input/output areas.

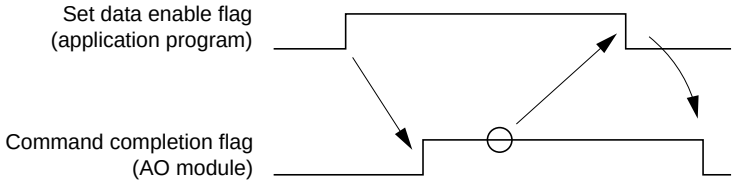


(1) Status (offset addresses +0, +1)



Bit	Status	Contents
0	Status of gain/offset adjustment	0: Adjustment completed, 1: Adjustment being made
1	Gain/offset adjustment error	0: No adjustment error, 1: Adjustment error
2	Command completion	0: No command or command not completed, 1: Completed
3	Not used	
4	Over-range error	0: No over-range error, 1: Over-range error
5	Scaling error	0: No scaling error, 1: Scaling error (Unavailable for NP1AY02-MR)
6 : : 15	Not used	

<Command completion>
Each set data item is input to the analog output module when the enable flag (bit 15 of offset address +2 for channel 1, bit 15 of offset address +3 for channel 2) is set. When the input of data is completed, the command completion flag is set by the analog output module. The user should reset the enable flag by the application program after confirming that the command completion flag has been set.

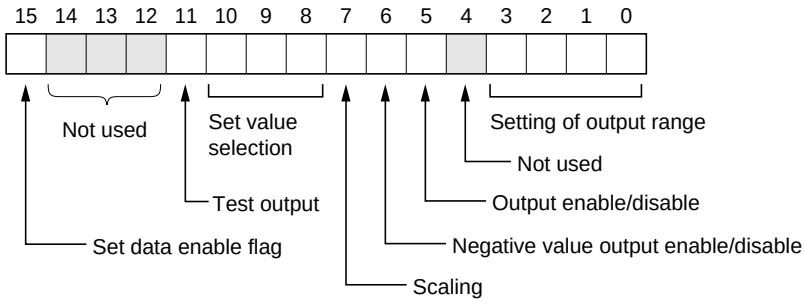


<Over-range error>
If a digital value which is output from the application program exceeds the selected range, this status bit is set to 1.

<Scaling data error>
If the set scaling data exceeds the selected range, this status bit is set to 1.

(2) Operation setting area (offset address +2 for channel 1, offset address +3 for channel 2)
For each channel of the analog output module, set the following operations by an application program.

Data type: WORD



Bit	Operation mode	Contents
0	Setting of output range	0000: 0 to 10V
1		0001: 0 to 5V
2		0010: 1 to 5V
3		0011: ± 5V
		0100: ± 10V
		0101: 0 to 20mA
		0110: 4 to 20mA
		0111: 15 Not used : : 1111: 15 Not used
4	Not used	
5	Output enable/disable	0: Output enable, 1: Output disable
6	Negative value output enable/disable	0: Enable, 1: Disable
7	Scaling	0: Not set, 1: Set (Unavailable for NP1AY02-MR)
8	Selection of setting value	000: Not selected
9		001: Offset scaling data (Unavailable for NP1AY02-MR)
10		010: Gain scaling data (Unavailable for NP1AY02-MR)
		011: Not used : : 111: Not used
11	Test output	0: Output disable, 1: Output enable
12	Not used	
13		
14		
15	Set data enable flag	0: Not enabled, 1: Enabled

(3) Output value setting area
Analog output value(D/A converted value), gain value, offset value, and test output value are set in this area.

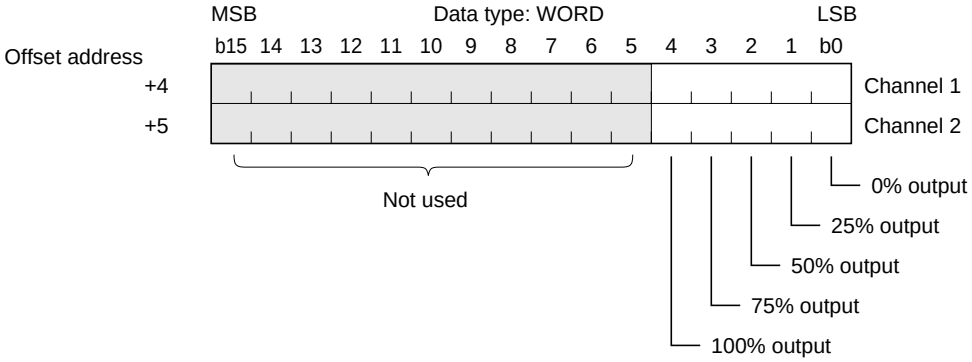
<Analog output value setting area> (offset addresses +4, +5)

Offset address	
+4	Channel 1 output value (INT type)
+5	Channel 2 output value (INT type)

4-2 Analog Output Module (NP1AYH2-MR, NP1AY02-MR)

<Test output value setting area> (offset addresses +4, +5)

• By turning on any one of bits 0 through 4, it is possible to obtain a % output value for the full scale.



Note: If multiple bits are set ON at the same time, the output becomes 0%.

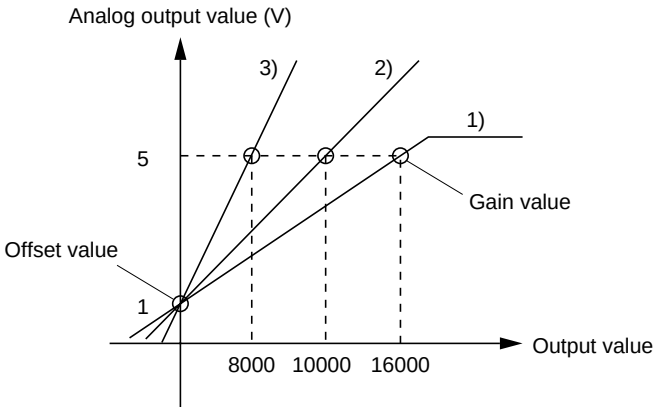
<Examples of output values>

Output / Range	0%	25%	50%	75%	100%
0 to 10V	0V	2.5V	5V	7.5V	10V
± 10V	- 10V	- 5V	0V	5V	10V

<Scaling data>

When “Scaling: Set” has been specified in the setting of operations, it is possible to perform scaling by setting 1) offset-value scaling data and 2) gain-value scaling data in the output value setting area.

Example of scaling



1) 1 to 5V : 16000 before scaling (default value)
2) 1 to 5V : When scaled to 10000
3) 1 to 5V : When scaled to 8000

• Offset-value scaling data

Offset address	
+4	Channel 1 data (INT type)
+5	Channel 2 data (INT type)

• **Gain-value scaling data**

Offset address	
+4	Channel 1 data (INT type)
+5	Channel 2 data (INT type)

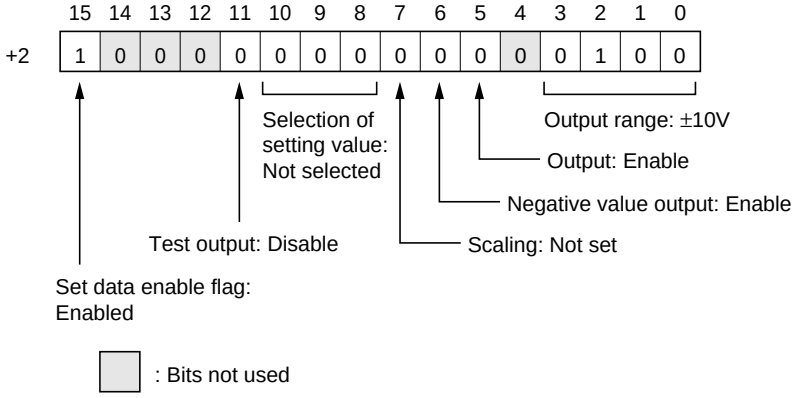
4-2-2 Operation setting procedure

To set operations of the analog output module (NP1AYH2-MR, NP1AY02-MR), use the registers of offset address +2 (for channel 1) and +3 (for channel 2).

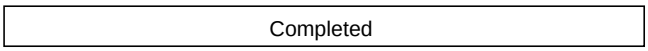
<Setting procedure>

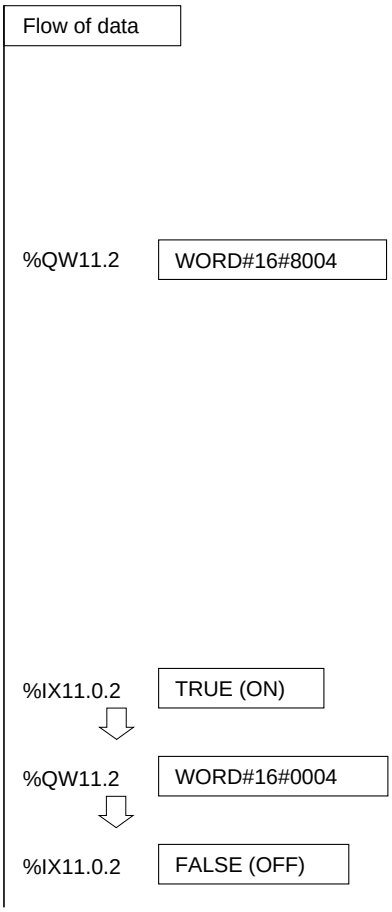
To output channel 1 data in the ±10V range (SX bus station number of the module assumed to be “11”):

1) Set the output range (±10V), output enable/disable (enable), negative value output enable/disable (enable), test output enable/disable (disable), selection of setting value (not selected), and set data enable flag (enabled) in the operation setting area for channel 1.



2) Confirm that the command completion flag is ON, then reset the set data enable flag. When the set data enable flag is reset, the command completion flag for channel 1 turns OFF.





4-2 Analog Output Module (NP1AYH2-MR, NP1AY02-MR)

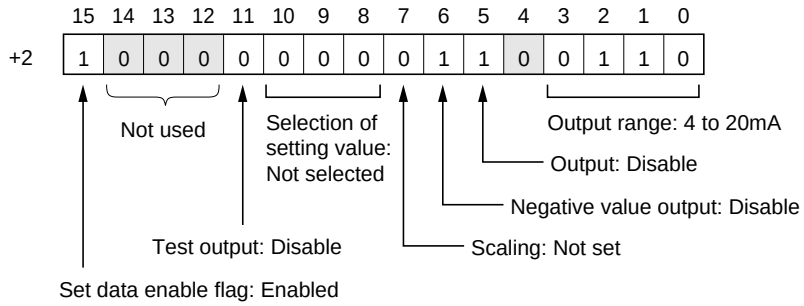
4-2-3 Test output procedure

With the analog output module (NP1AYH2-MR, NP1AY02-MR), it is possible to perform test output using the operation setting area (offset addresses +2, +3) and the output value setting area (offset addresses +4, +5).

<Test output procedure>

To test-output channel 0 data in the 4 to 20mA range at 50% output (12mA) (SX bus station number of the module assumed to be “11”):

1) Set the output range (4 to 20mA), output enable/ disable (disable), negative value output enable/ disable (disable), test output enable/disable (disable), selection of setting value (not selected), and set data enable flag (enabled) in the operation setting area for channel 1.



Flow of data

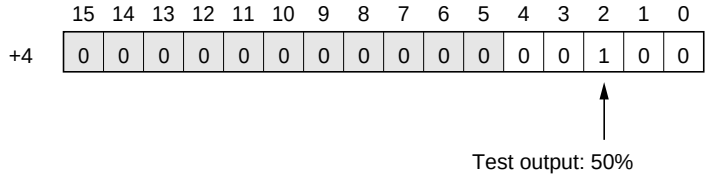
%QW11.2 WORD#16#8066

2) The command completion flag turns ON and the set test output value is output from the module output terminal. Reset the set data enable flag to turn the command completion flag OFF.

%IX11.0.2 TRUE (ON)

%QW11.2 WORD#16#0066

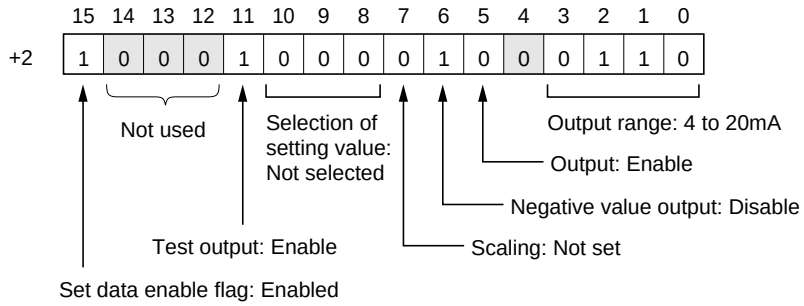
3) Set 50% output (bit 2 “ON”) in the output value setting area (offset address +4 for channel 1).



%IX11.0.2 FALSE (OFF)

%QW11.4 WORD#16#0004

4) Set the output range (4 to 20mA), output enable/ disable (enable), negative value output enable/ disable (disable), test output enable/disable (enable), selection of setting value (not selected), and set data enable flag (enabled) in the operation setting area for channel 1.

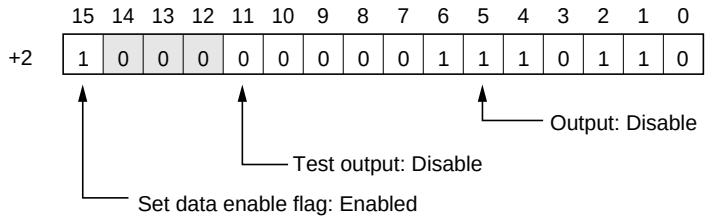


%QW11.2 WORD#16#8846

5) When the command completion flag is set ON, the set data enable flag is reset; when the command completion flag is set OFF, the set test output value is output from the output terminal of the module.

%IX11.0.2 TRUE (ON)
⇩
%QW11.2 WORD#16#0846
⇩
%IX11.0.2 FALSE (OFF)

6) To stop the test output, set the test output (disable) and the set data enable flag (enabled) in the operation setting area for channel 1.



%QW11.2 WORD#16#8066

7) The command completion flag turns ON and the test output stops. Reset the set data enable flag to turn the command completion flag OFF.

%IX11.0.2 TRUE (ON)
⇩
%QW11.2 WORD#16#0066
⇩
%IX11.0.2 FALSE (OFF)

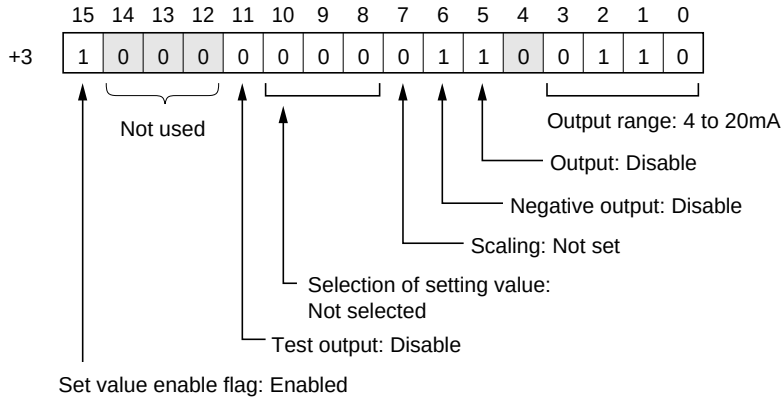
4-2-4 Scaling data setting procedure

With the analog output module (NP1AYH2-MR), it is possible to change the gradient of A/D conversion by scaling.

<Setting procedure>

To scale 4 to 20mA:0 to 16000 for channel 2 to 4 to 20mA:0 to 10000 (SX bus station number of the module assumed to be "11"):

1) Set the test output (disable), selection of setting value (offset-value scaling data), negative value output (disable), output (disable), output range (4 to 20mA), and set data enable flag (enabled) in the operation setting area.



Flow of data

%QW11.3 WORD#16#8066

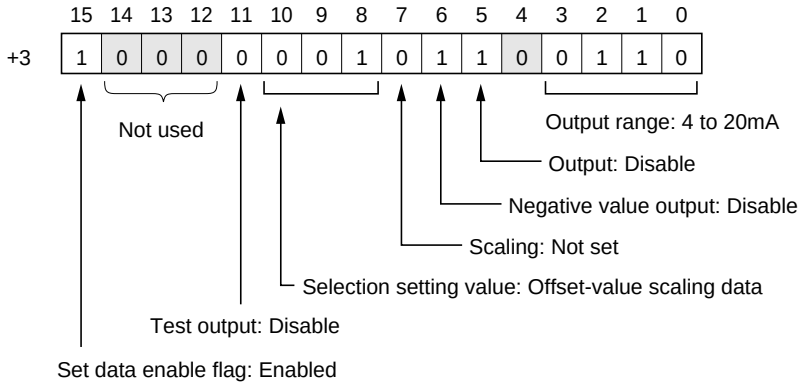
2) Confirm that the command completion flag is ON, then reset the set value enable flag. When the set data enable flag is reset, the command completion flag turns OFF. After confirming that the command completion flag has turned OFF, proceed to the next step.

%IX11.1.2 TRUE (ON)
⇩
%QW11.3 WORD#16#0066
⇩
%IX11.1.2 FALSE (OFF)

3) Set the gain-value scaling data in the value setting area.

+5	0 (INT type)	%QW11.5 INT#0

4) Set test output (disable), selection of setting value (offset-value scaling data), negative value output (disable), output (disable), output range (4 to 20mA), and set data enable flag (enabled) in the operation setting area.



5) Confirm that the command completion flag is ON, then reset the set value enable flag. When the set data enable flag is reset, the command completion flag turns OFF. Confirm that the command completion flag has turned OFF, then proceed to the next step.

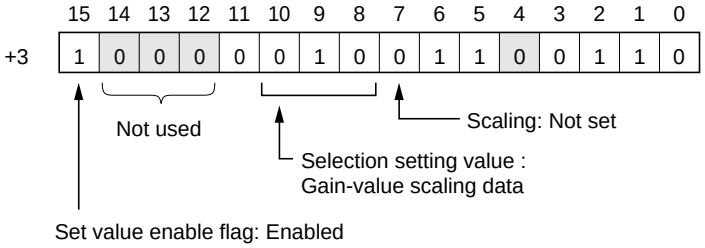
%IX11.1.2 TRUE (ON)
⇩
%QW11.3 WORD#16#0166
⇩
%IX11.1.2 FALSE (OFF)

In this step, the offset-value scaling data is input to the module (NP1AYH2-MR).

6) Set the gain-value scaling data in the value setting area.

+5	10000 (INT type)	%QW11.5 INT#10000

7) Set test output (disable), selection of setting value (gain-value scaling data), negative value output (disable), output (disable), output range (4 to 20mA), and set data enable flag (enabled) in the operation setting area.



8) Confirm that the command completion flag is ON, then reset the set value enable flag. When the set data enable flag is reset, the command completion flag turns OFF.

%IX11.1.2 TRUE (ON)
⇩
%QW11.3 WORD#16#0266
⇩
%IX11.1.2 FALSE (OFF)

In this step, the gain-value scaling data is input to the module (NP1AYH2-MR).

9) Before scaling is started, input a data that makes the output zero, from the output data that are scaled in the setting area. (In order to prevent erroneous output)

+5	0 (INT type)	%QW11.5 INT#0

10) The scaling starts. Set selection of setting value (not selected), scaling (set), and set data enable flag (enabled) in the operation setting area.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
+3	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	%QW11.3 WORD#16#80C6

Selection of setting value: Not selected

Scaling: Set

Output: Enable

11) Confirm that the command completion flag is ON, then reset the set data enable flag. When the set data enable flag is reset, the command completion flag turns OFF.

Completed	%IX11.1.2 TRUE (ON) ⇩ %QW11.3 WORD#16#00C6 ⇩ %IX11.1.2 FALSE (OFF)

Note on multi-CPU system

When the analog output module is used on a multi-CPU system, use only one CPU to set operation modes (range setting, scaling, etc.) for the same channel.
Do not use more than one CPU to set operation modes for the same channel.

Section 5 Wiring

Page

Section 5 Wiring
5-1 Wiring Precautions

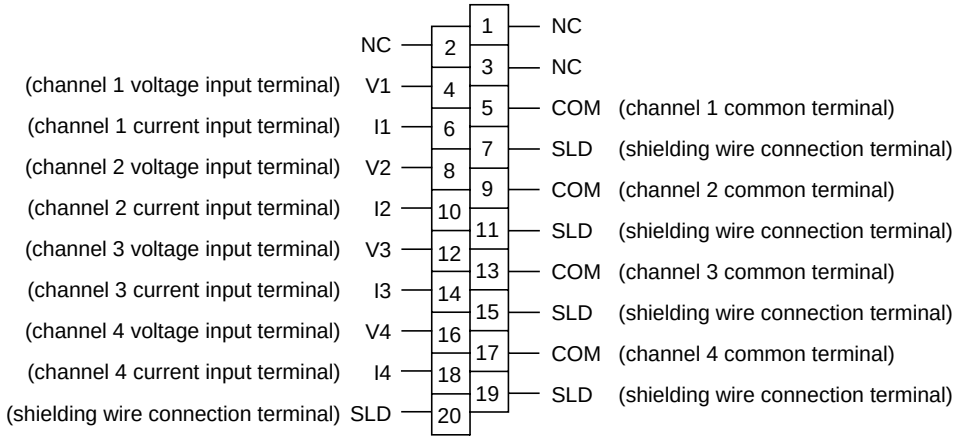
1) Do not remove the module's attached dust-cover seals during wiring. After wiring, be sure to remove the dust-cover seals.
2) Perform the following to the terminals that are not used.
   Input module ..... Short-circuit terminals V.I and COM.
   Output module .... Keep the terminals open.
3) Isolate the module power supply line and input/output lines from high-voltage lines and power lines. Also, avoid wiring them in parallel with each other.
4) Ground the shielding wires or the shields of shielding cables at a single point on the PLC side. Depending on the condition and type of external noise, however, external grounding may be better.
   When grounding the shielding wire on the outside, leave the module SLD terminal open.
5) It is recommended that a shielded twisted pair wire be used to wire the module.
6) In wiring the module, be sure to use a suitable wire and crimp terminals.
   The applicable wire sizes and crimp terminals are shown below.

Maker	Form	Type	Cable size	
			AWG #	mm^2
AMP	Round terminals	36467	22 to 18	0.3 to 0.8mm^2
		34104		
		34105		
Nichifu	Round terminals	0.3-3	24 to 20	0.2 to 0.5mm^2
		0.3-3N		
		1.25-3	22 to 16	0.3 to 1.3mm^2
		1.25-3N		
		1.25-3S		
		1.25-3.5N		
		1.25-3.5S		
		2-3N	16 to 14	1.3 to 2.0mm^2
	Angle edge terminals	0.3Y-3	24 to 20	0.2 to 0.5mm^2
		1.25Y-3	22 to 16	0.3 to 1.3mm^2
		1.25Y-3N		
		1.25Y-3S		
		1.25Y-3.5		
		2Y-3	16 to 14	1.3 to 2.0mm^2
		2Y-3.5S		
		AT1-10	22 to 16	0.3 to 1.3mm^2
		AT2-10	16 to 14	1.3 to 2.0mm^2
JST	Round terminals	SRA-20-3.2	22 to 18	0.3 to 0.8mm^2
		SRA-20T-3.2		
NTK	Round terminals	0.4-3	26 to 22	0.2 to 0.3mm^2
		1.25-3	22 to 16	0.3 to 1.3mm^2
	Angle edge terminals	VR1.25-3		
		VD1.25-3		
		VD2-3S	16 to 14	1.3 to 2.0mm^2

7) For any of the above crimp terminals, use a tightening torque of 0.5 to 0.7N·m.

5-2 Wiring of Analog Input Module

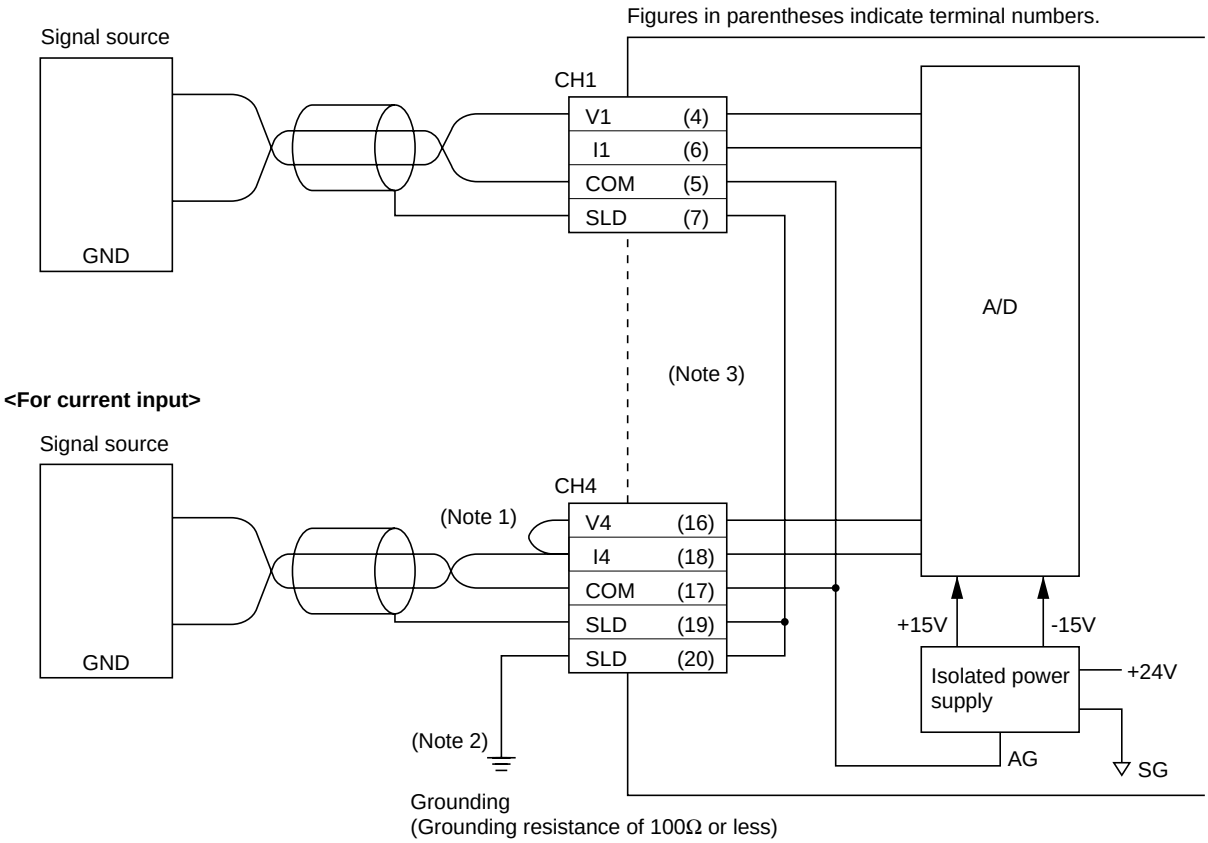
5-2-1 Terminal arrangement (NP1AXH4-MR, NP1AX04-MR)



Note: “NC” indicates a terminal not connected to an internal circuit. Do not use NC terminals as repeating terminals.

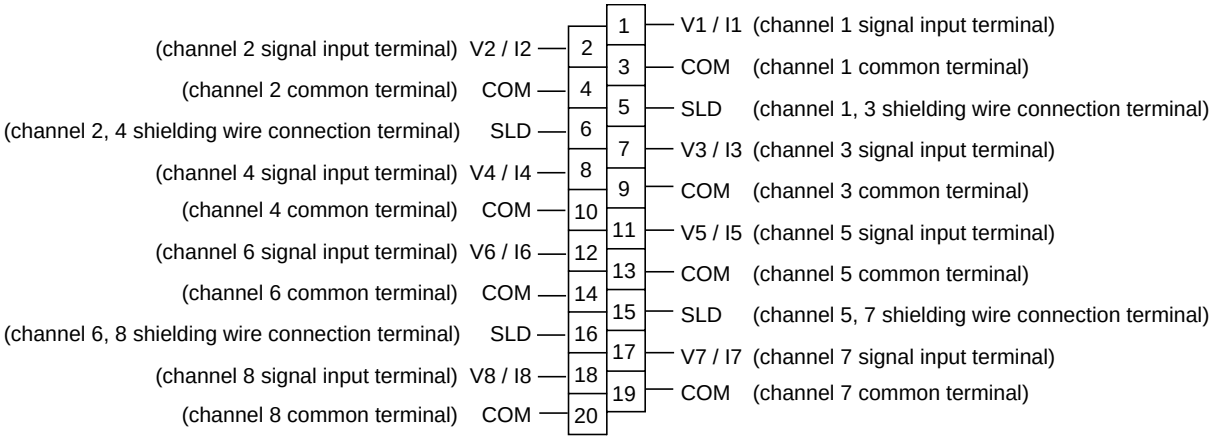
5-2-2 Wiring example

<For voltage input>



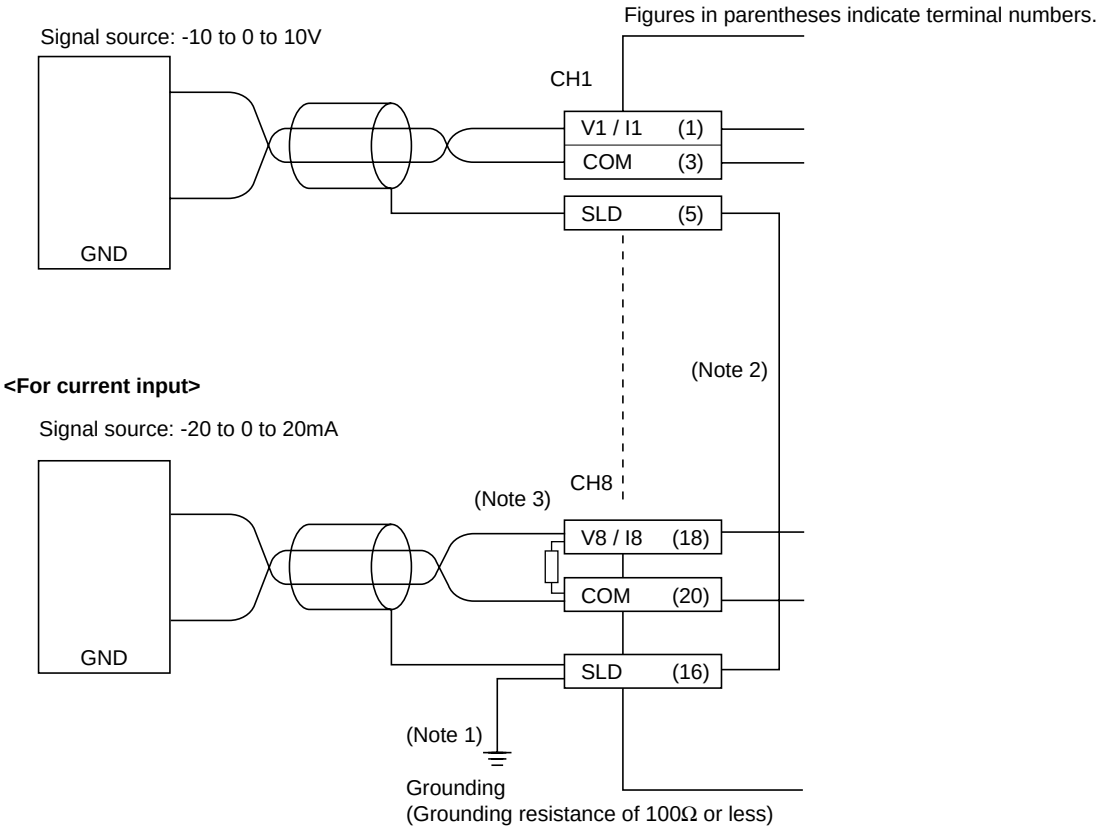
Note : 1) When current input is used, short-circuit terminals V and I.
2) When there is excessive noise, ground as grounding resistance of 100Ω or less.
3) The SLD terminals are connected internally.

5-3-1 Terminal arrangement



5-3-2 Wiring example

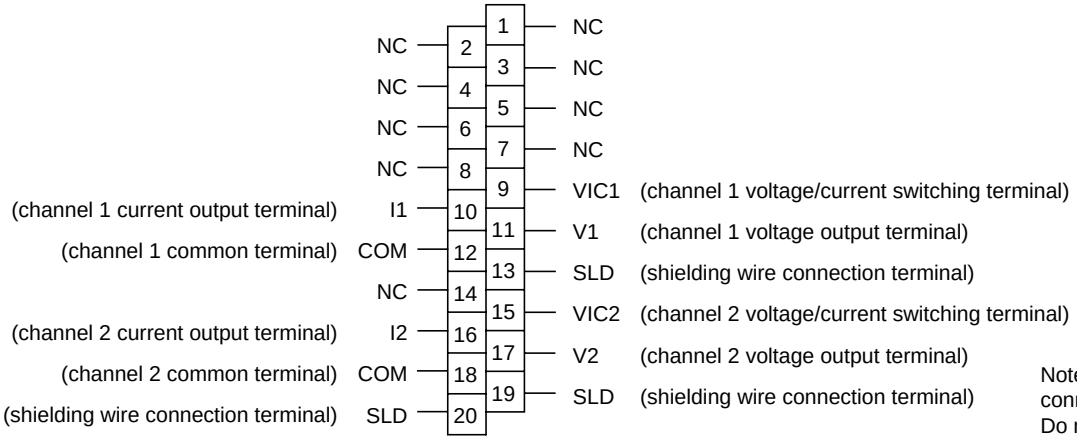
<For voltage input>



Note : 1) When there is excessive noise, ground as grounding resistance of 100Ω or less.
2) The SLD terminals are connected internally.
3) When used as a current input, connect the resistors supplied with the module between individual VI terminal and COM terminal.
4) For wiring, be sure to use shielded twisted-pair cable. When large size cable is used, the terminal cover may not be able to be closed.

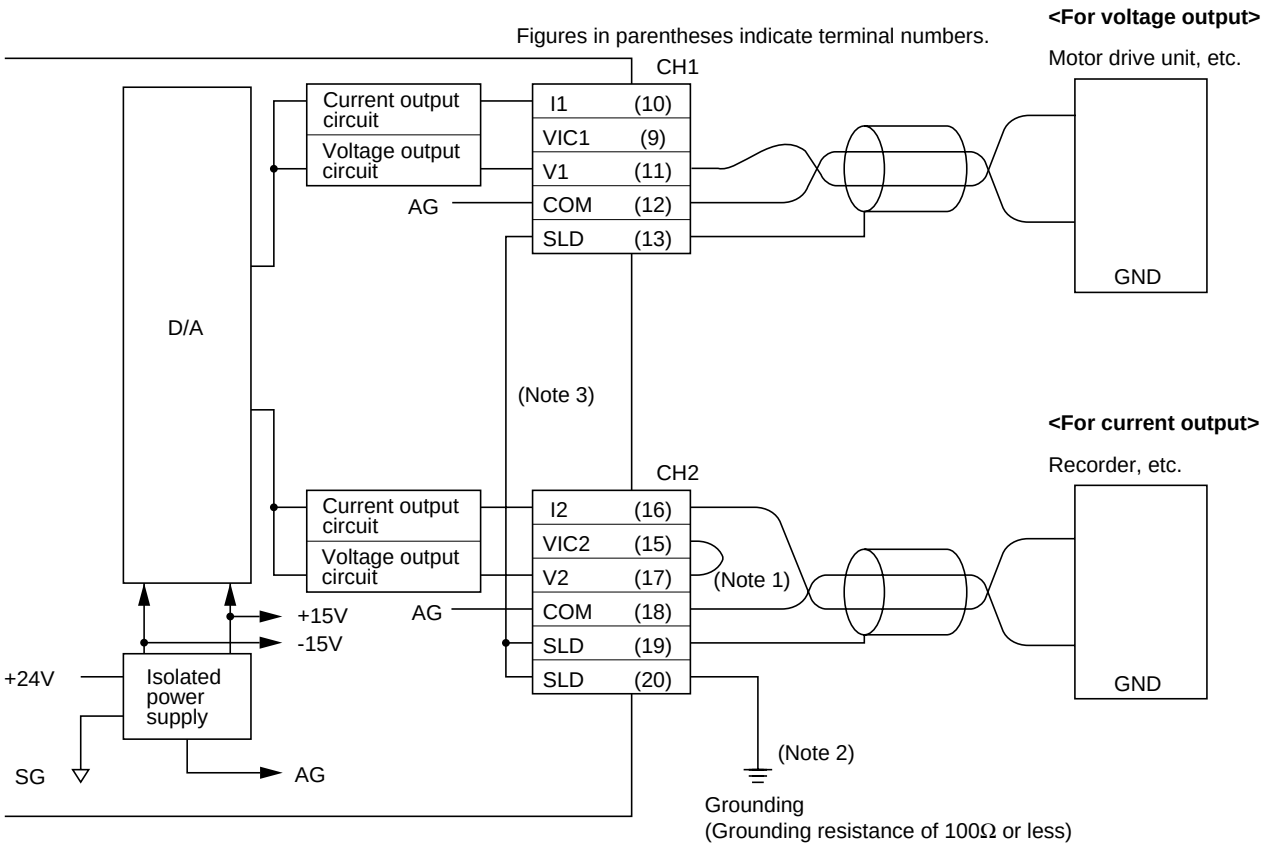
5-4 Wiring of Analog Output Module

5-4-1 Terminal arrangement (NP1AYH2-MR, NP1AY02-MR)



Note: “NC” indicates a terminal not connected to an internal circuit. Do not use NC terminals as repeating terminals.

5-4-2 Wiring example



Note : 1) When current output is used, short-circuit the voltage/current switching terminal and voltage output terminal.
2) When there is excessive noise, ground as grounding resistance of 100Ω or less.
3) The SLD terminals are connected internally.
4) When two channels are used, short-circuit the COM terminals in order to improve noise immunity.

Section 6 Gain/Offset Adjustment

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Section 6 Gain/Offset Adjustment

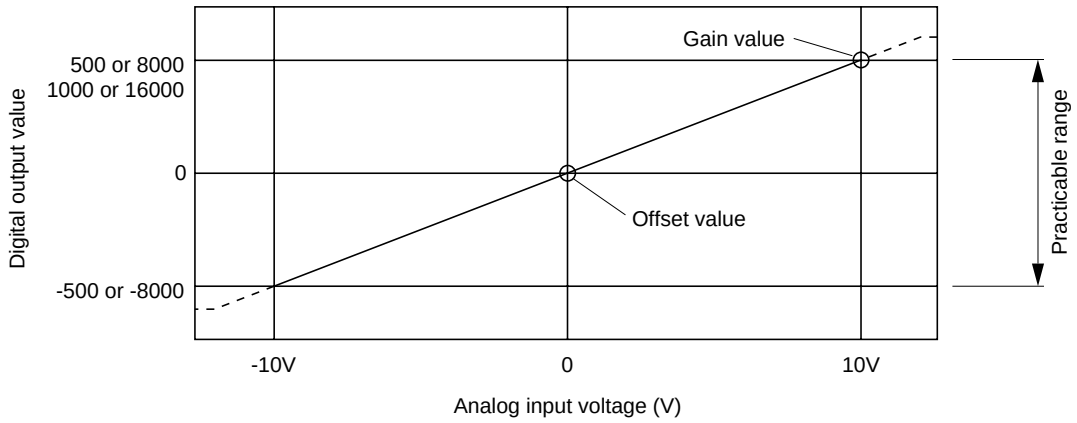
6-1 Gain/Offset Adjustment

The purpose of gain/offset adjustment is to correct any deviation from the selected characteristic range caused by ambient temperature and the performance of electronic parts of an A/D or D/A converter, etc. The gain/offset adjustment should be made for each channel. NP1AX08-MR requires no gain or offset adjustment.
During factory shipment, the gain/offset adjustment is set at the ±10V input range for the analog input module and the 1 to 5V output range for the analog output module. When other range is used, gain and offset adjustment is necessary.

6-1-1 Gain/offset values of analog input module (NP1AXH4-MR, NP1AX04-MR)

Offset value: The input voltage/current value that makes the digital output value 0.
Gain value (NP1AXH4-MR): The input voltage/current value that makes the digital output value 8000 or 16000.
Gain value (NP1AX04-MR): The input voltage/current value that makes the digital output value 500 or 1000.

I/O conversion characteristics



Gain/offset values of analog input module

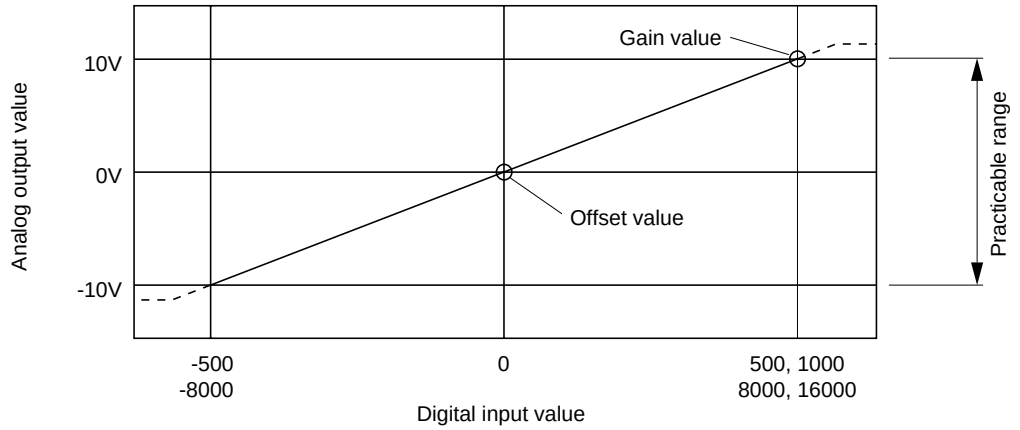
Analog input range	NP1AXH4-MR			NP1AX04-MR		
		Offset value	Gain value		Offset value	Gain value
± 5V	-8000	0	8000	-500	0	500
0 to 5V		0	16000		0	1000
1 to 5V		0	16000		0	1000
0 to 10V		0	16000		0	1000
± 10V	-8000	0	8000	-500	0	500
0 to 20mA		0	16000		0	1000
4 to 20mA		0	16000		0	1000
-20 to 20mA	-8000	0	8000	-500	0	500

6-1 Gain/Offset Adjustment

6-1-2 Gain/offset values of analog output module (NP1AYH2-MR, NP1AY02-MR)

Offset value: The analog output voltage/current value when the value that is D/A-converted is 0.
Gain value (NP1AYH2-MR): The analog output voltage/current value when the value that is D/A-converted is 8000 or 10000.
Gain value (NP1AY02-MR): The analog output voltage/current value when the value that is D/A-converted is 500 or 1000.

I/O conversion characteristics

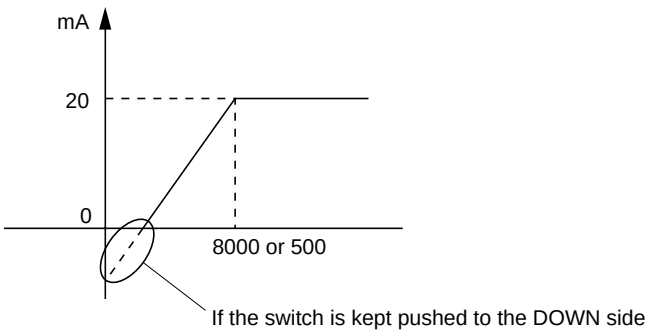


Gain/offset values of analog output module

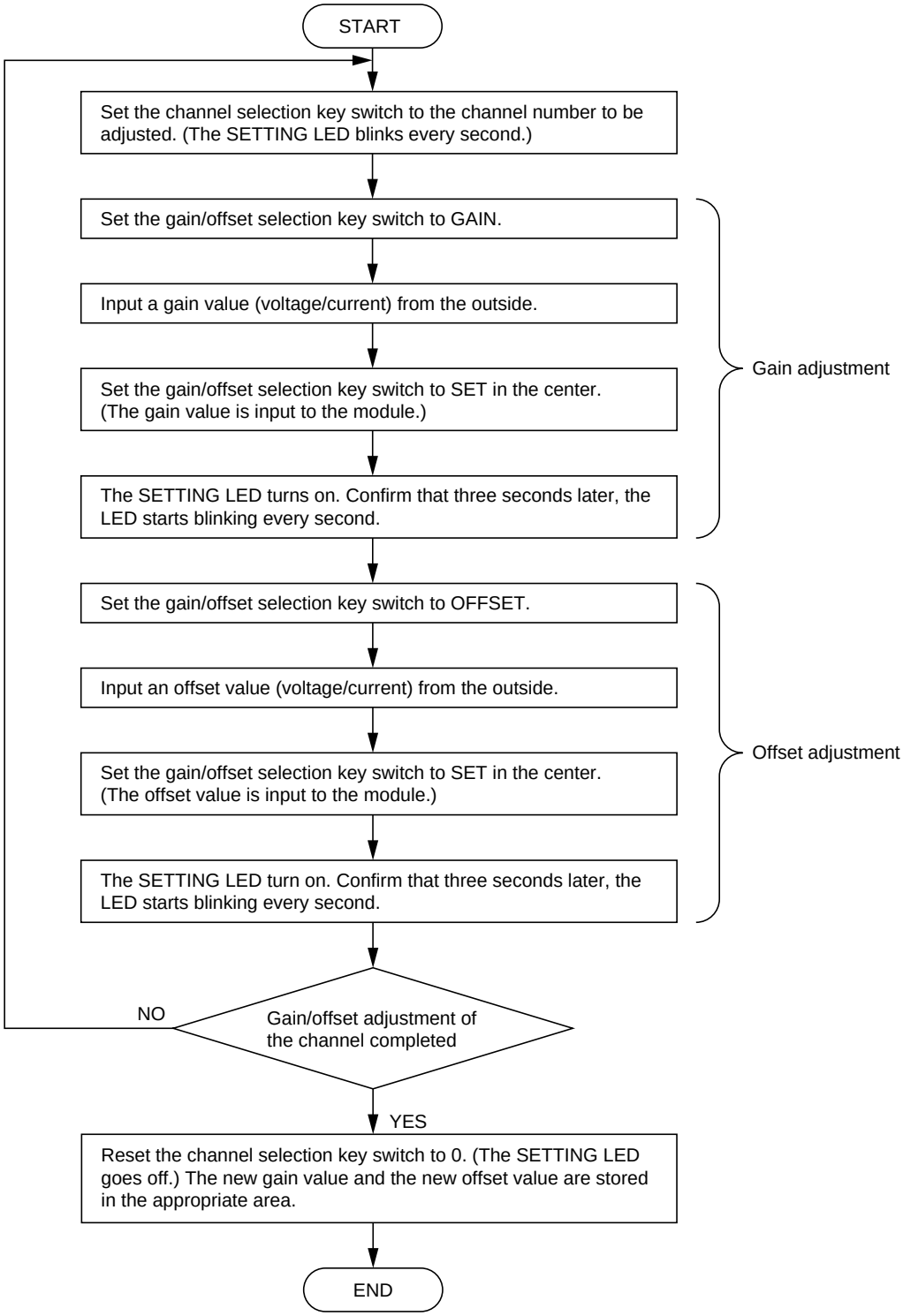
Analog output range	NP1AYH2-MR			NP1AY02-MR		
		Offset value	Gain value		Offset value	Gain value
± 5V	-8000	0	8000	-500	0	500
0 to 5V		0	16000		0	1000
1 to 5V		0	16000		0	1000
0 to 10V		0	16000		0	1000
± 10V	-8000	0	8000	-500	0	500
0 to 20mA		0	16000		0	1000
4 to 20mA		0	16000		0	1000

Note:

- When current output is used with the analog output module (NP1AYH2-MR, NP1AYH2-MR), any currents smaller than 0mA are not output. Therefore, when making the gain/offset adjustment, adjust the gain first, then adjust the offset to 0mA using the UP/DOWN switch. (If the switch is kept pushed to the DOWN side during offset adjustment, the characteristic becomes as shown below.) In doing so, be sure to raise once beyond 0 mA and then lower and stop when 0 mA is reached.
  If DOWN side is kept pressed for offset adjustment without stopping at this point, the characteristic curve becomes as shown below.



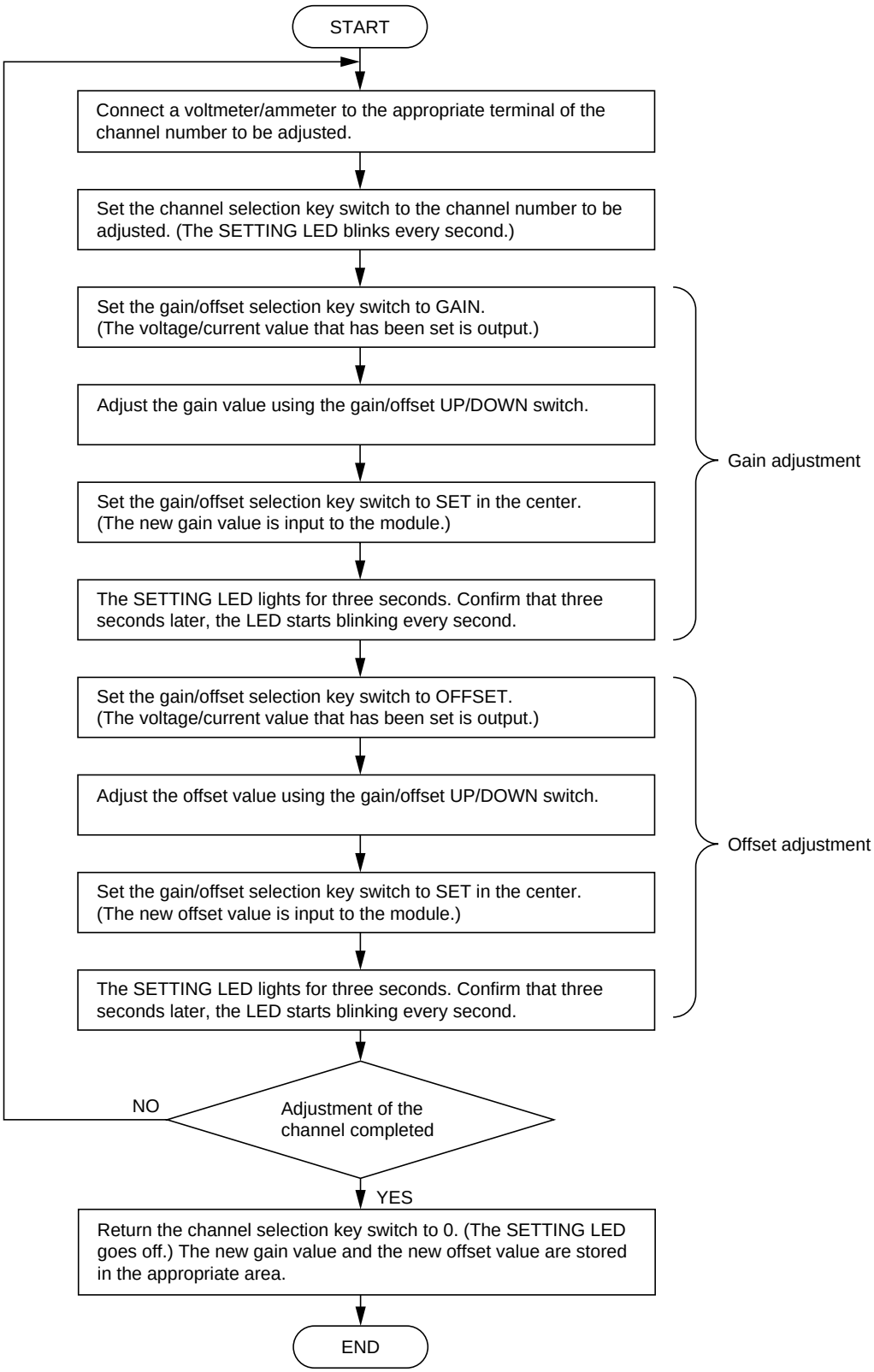
6-2 Adjustment Procedure for Analog Input Module (NP1AXH4-MR, NP1AX04-MR)



Notes:

- When changing the gain or offset, be sure to set both a gain value and an offset value even if either one does not need not to be changed. (To set a gain value (offset value), set the gain/offset selection key switch to the appropriate side.)
- The gain value must be greater than the offset value. Otherwise, a setting error results, causing the error flag, as well as the “Being adjusted” flag, to turn on. To recover from the error, return the channel selection key switch to 0. (In this case, the data that has been set before the change remains enabled.)

6-3 Adjustment Procedure for Analog Output Module (NP1AYH2-MR, NP1AY02-MR)



6-3 Adjustment Procedure for Analog Output Module (NP1AYH2-MR, NP1AY02-MR)

Notes:

- When changing the gain or offset, be sure to set both a gain value and an offset value even if either one does not need to be changed. (To set a gain value (offset value), set the gain/offset selection key switch to the appropriate side.)
- The gain value must be greater than the offset value. Otherwise, a setting error results, causing the error flag, as well as the “Being adjusted” flag, to turn on. To recover from the error, return the channel selection key switch to 0. (In this case, the data that has been set before the change remains enabled.)

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