COSINUS® MESSTECHNIK GMBH

MULTI-CHANNEL LOW NOISE AMPLIFICATION SYSTEM

CMP60116-1/2

INSTRUCTION MANUAL

DA00073361-001

MULTI-CHANNEL LOW NOISE AMPLIFICATION SYSTEM

CMP60116-1/2

INSTRUCTION MANUAL

Preface

Thank you for purchasing the "MULTI-CHANNEL LOW NOISE AMPLIFICATION SYSTEM CMP60116-1/2".

For safe and correct use of this product, please read the "Safety Precautions" section that follows before attempting to use the instrument.

●Marks and symbols

For safe operation by the use and to prevent damage to the instrument, prelase give attention to the following marks and symbols that are used in this manual.

⚠ WARNING

This mark indicates information for preventing the possibiliy of death or serious personal injury from electrical shock or other hazards or damage to the instrument in the use or handling of this instrument.

⚠ CAUTION

This mark indicates information for preventing the possibility of injury to the use or damage to the instrument and the use for handling of this instrument.

●This manual consists of the following chapters.

If using this product for the first time, start from "1. Outline".

1. Outline
   This chapter gives an overview and describes the features and applications of this product and the simple operating principle of the product.
2. Preparation before Use
   This chapter describes important preparations to be made before installation and operation.
3. Panel Features and Basic Operations
   This chapter explains the basic operations of the panels.
4. Maintenance
   This chapter describes a method for simply inspecting operation.
5. Specifications
   This chapter gives specifications (functions and perfoemance).

Safety Precautions

To ensure safe use, be sure to observe the following safety precautions.

NF Corporation shall not be held liable for damages that arise from a failure to observe these safety precautions or warnings or cautions in the instruction manual.

● Be sure to observe the information of the instcutions manual.

The instruction manual contains information for the safe operation of the product.

Be sure to read the information first before using the product.

All the warnings in the instruction manual are intended for preventing risks that may lead to serious accidents. Ensure to obey them.

● Check the power supply voltage.

This product operates on the power supply voltage indicated in the instruction manual. Prior to connecting the power supply, check that the voltage of the power supply matches the rated power supply of the product.

● If you notice anything strange.

If this product emits smoke, an unusual smell or strange sound, immediately power it off and stop using it.

If such an anomaly occurs, prevent anyone from using this product until it has been repaired, and immediately report the problem to NF Corporation or one of out representatives.

● Do not operate in an explosive atmosphere.

An explosion or other such hazard may result.

● Do not remove the cover.

Never remove the cover.

Even when the inside of this producti needs to be inspected, do not touch the inside. All such inspections are to be performed by service technicians designated by NF Corporation.

● Do not modify the product.

Never modify the product. Modification to the product may pose a new risk. We may refuse the repair of a modified product.

● Ensure that water does not get into this product.

Using the product in wet condition may cause electric shock and fire. When water etc. get into the product, immediately power it off, and contact NF Corporation or one of our representatives.

● If lightning occures, power off and disconnect this product.

A lightning may cause an electric shockm a fire and a failure.

● Safety symbols

Caution, refer to instruction manual.

This notifies the user of potential hazards and indicates that he/she must refer to the instruction manual.

Caution, possibility of electric shock.

This indicates that an electric shock may occur under specific conditions.

Warning

⚠ WARNING

This contains information to avoid risks in equipment handling that could result in loss life or bodily injury.

Caution

⚠ CAUTION

This contains information to avoid risks equipment handling that could result in minor or moderate injury to person or damage to property or the equipment.

● Other symbol

This indicates that the terminal or the outer conductor of the connector is connected to the signal ground.

● Disposal of this product

a) Use the servies of an industrial waste disposal contractor for disposal of the entire product.
b) This product does not include batteries.
c) This product does not include mercury.

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1. Outline

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1.1 Overview

This product is a multi-channel amplification system that incorporates four low noise differential amplifiers. This product has the following performance.

CMP60116-1

・Input resistance	100 kΩ
・Voltage gain	40 dB
・Frequency characteristic	DC to 1 MHz

CMP60116-2

・Input resistance	1 MΩ
・Voltage gain	40 dB
・Frequency characteristic	DC to 20 MHz

1.2 Features

(1) Easy multi-channeling
(2) Multi-functional
Input coupling:
DC / AC
Input mode:
Single-ended input / Differential input / GND
LPF selection:
THRU / LPF (fc = 1 MHz)
Offset adjustment:
Adjustable to 0 V
Selection of power supply GND potential:
FLOAT / EXTERNAL(Connection with the earth of the power supply)
(3) Connector with excellent shielding characteristics
Input and output connectors:
SMA connectors

1.3 Applications

The CMP60116-1/2 is high gain, wide-bandwidth, and low noise. It is widely used for amplification of small signals.

(1) Preamplifier for the magnetic flux measurement by SQUID sensor, etc.

(2) Preamplifier for small voltage after voltage conversion of SEM, etc.

(3) Preamplifier for the sensor such as inertial, pressure, sonic, etc.

(4) Preamplifier for biological and chemical sensor.

(5) Improvement of noise characteristics for a lock-in amplifier.

1.4 Circuit functions

This product is a voltage amplifier that amplifies the voltage difference between the A and the −B terminal. The gain is 40 dB. The input resistance of the CMP60116-1 is 100 kΩ, and the input resistance of the CMP60116-2 is 1 MΩ. The output resistance is 50 Ω for both models.

Setting of input coupling mode (DC / AC), setting of input mode (differential input, single-ended input, GND), setting of output low-pass filter (THRU / LPF), setting of power supply GND (FLOAT / EXTERNAL) can be changed by each switch.

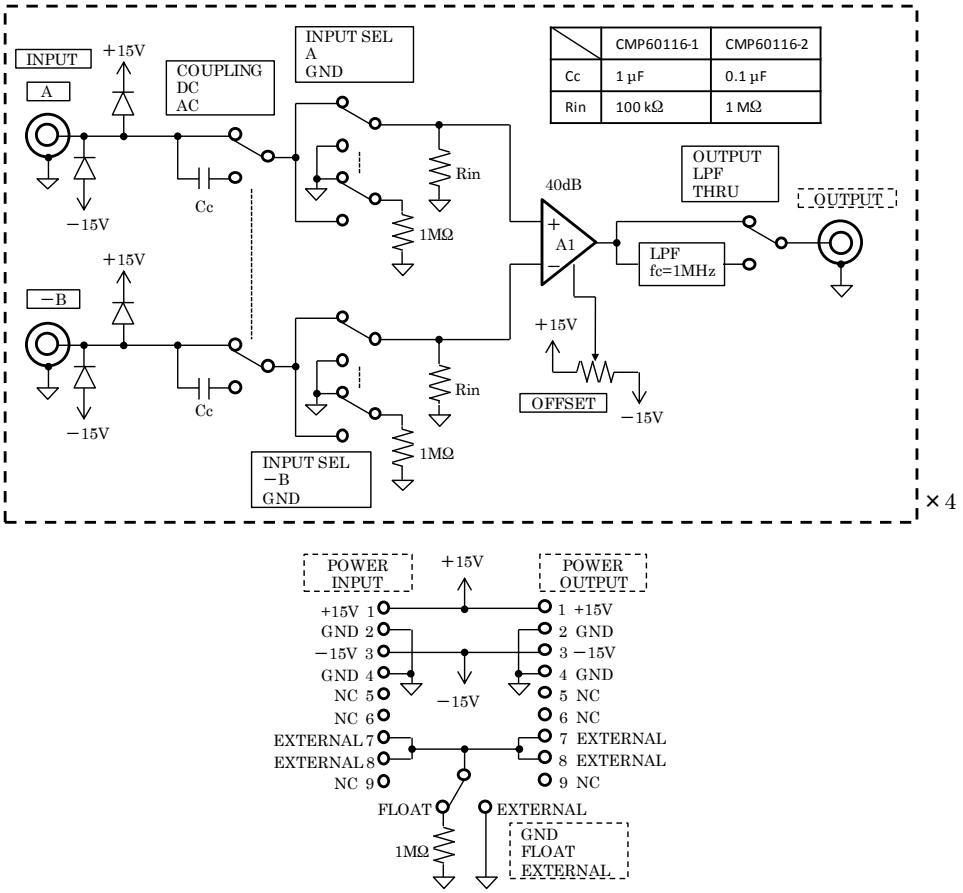

Figure 1-1 Block diagram.

2. Preparation before Use

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2.1 Checking before use

■ Safety check

Before using this product, read the following section of this manual.

- [Safety Precautions] at the beginning of this instruction manual.
- [2.3 Power supply]

■ Check apperance and accessories

First check for any damage that may have occurred during transportation.

After unpacking the product, refer to "Table 2-1 List of contents" and confirm that all items are present in the quantities listed.

Table 2-1 List of contents

● Main unit ·····1
● Instruction manual ·····1

● Optional Item

Optional items below are separately available. If required, please contact NF or one of our agents.

2.2 Conditions for installation location

- The installation location shall meet the following temperature and humidity conditions.

  Specifications guaranteed: 18 °C to 28 °C, 5 %RH to 85 %RH
  Operating: 0 °C to 40 °C, 5 %RH to 85 %RH
  Storage: −10 °C to 50 °C, 5 %RH to 95 %RH

  However, do not use the product if condencation is present.

- Use the product indoors at an altitude of up to 2000 m.

- Do not install the product in the following locations:
  - Locations where flammable gases may be present.
    There is a risk of explosion. Never install or use the product in such locations.
  - Outdoors, locations exposed to direct sunlight, near fire or heat sources.
    The performance may not be satisfied, or a failure may occur.
  - Locations where corrosive gases, water vapor dust, or too humid.
    Malfunction or a failure may occur.
  - Near an electromagnetic filed source, high-voltage product, or power line.
    Noise may increase.
  - Where is a lot of vibration.
    Noise may increase, or a malfunction may result.

2.3 Power supply

This product operates under the following power supply conditions.

- Stabilized DC power supply with ±15 V ±0.5 V, ± 300 mA or higher, ripple noise1 mV_{rms} or lower.

We provide the excellent stability and low noise performance DC power supply LP5391. For information on those products, please contact the NF corporation or one of our agents.

⚠ WARNING

Do not connect this product to an AC outlet, because doing so is dangerous.

Attention

- Incorrect voltage polarity of the power supply will damage this product.
- Supplying a voltage greater than ± 16.5 V will damage this product.
- This product does not operate by single power supply (+30 V / GND). Be sure to use a dual power supply (+15 V / GND / −15 V).

2.3.1 Connecting to low noise DC power supply LP5391

The DC POWER CABLE (CMP60116-4) is available to connect this product to LP5391. If you require the cable, please contact NF or one of our agents.

The following figure shows the connection using the CMP60116-4. The output of LP5391 is set as ±15 V.

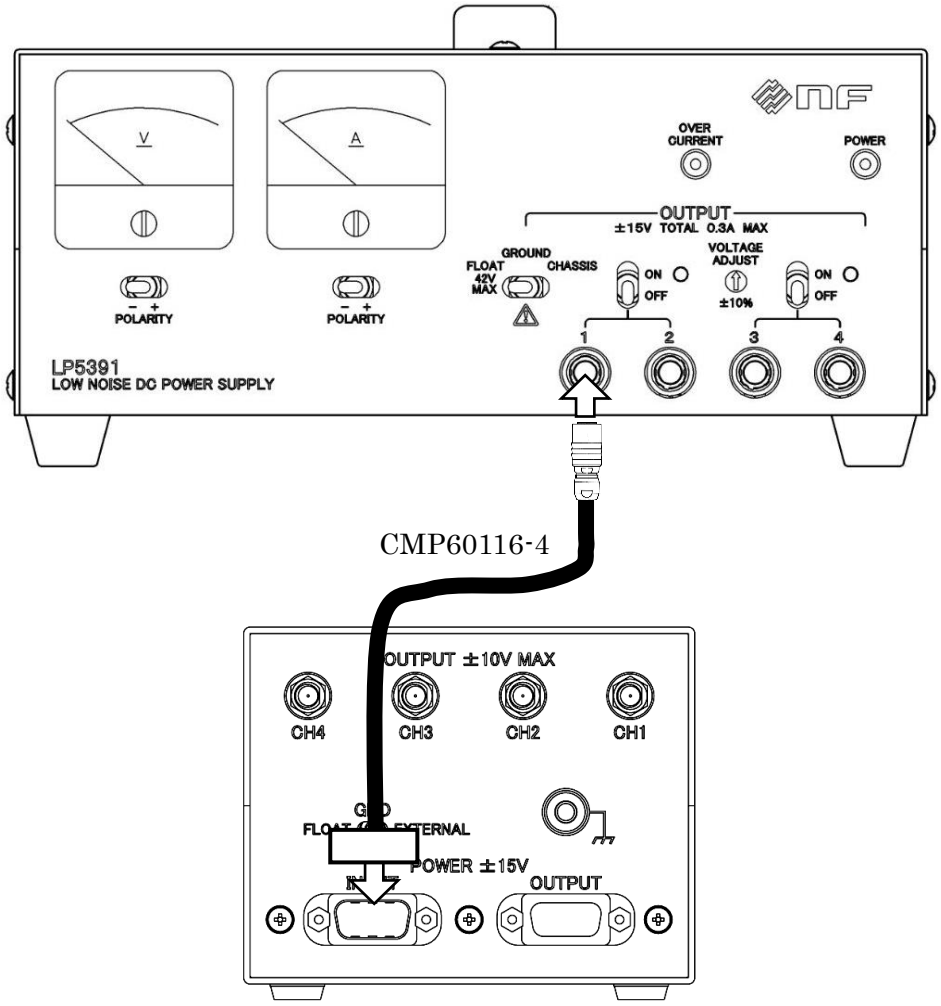

Figure 2-1 Connecting to LP5391.

Attention

- Turn off the output switch of the power supply unit before connecting this product to the power supply unit.
- Do not plug / unplug the DC power cable while the power supply is turned on. This product may be damaged.

2.3.2 Connecting to CMP60116-3

The CMP60116-3 attached DC power cable is available to connect this product to CMP60116-3.

The following figure shows the connection using the CMP60116-3 attached DC power cable. The output of CMP60116-3 is set as ±15 V.

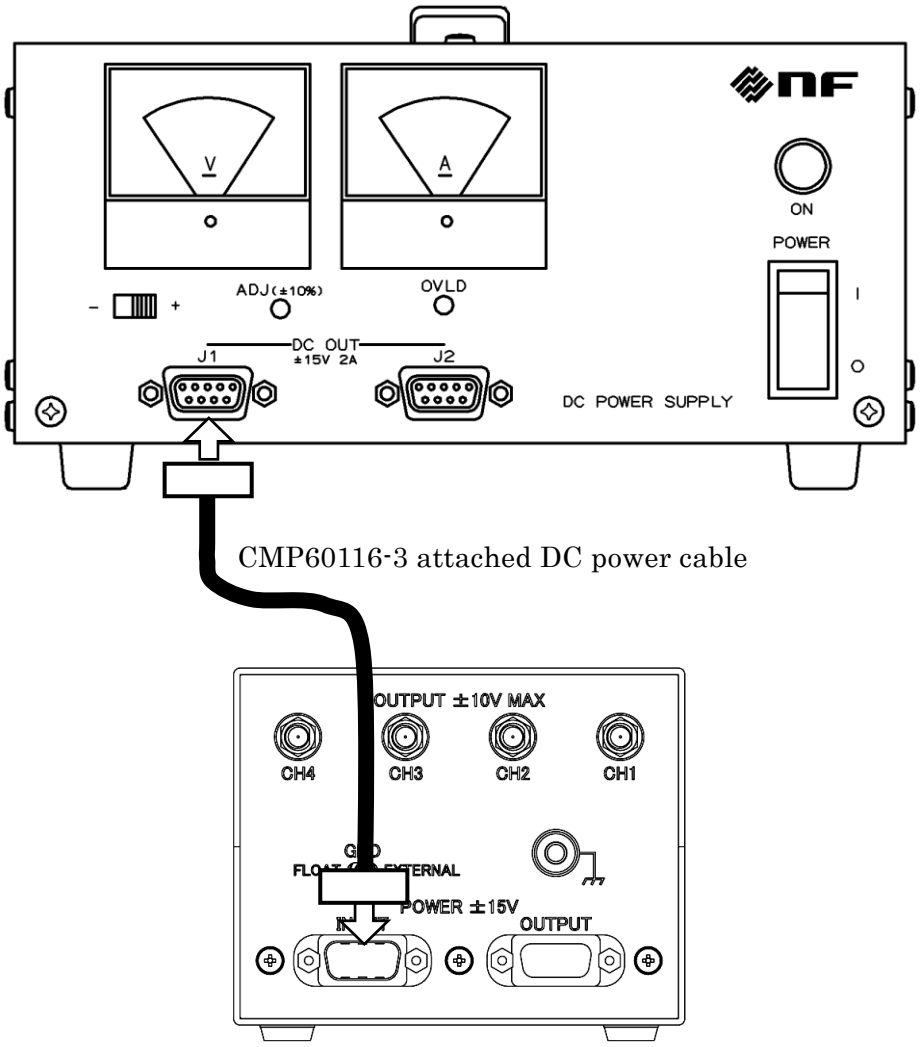

Figure 2-2 Connecting to CMP60116-3.

Attention

- Turn off the output switch of the power supply unit before connecting this product to the power supply unit.
- Do not plug / unplug the DC power cable while the power supply is turned on. This product may be damaged.

The CMP60116-3 can drive up to 8 units (32 CH) of this product. A dedicated DC cable (0.25 m) is available for multiple connection, please contact NF or one of our agents.

The following figure shows the connection for driving 8 units with CMP60116-3. The output of CMP60116-3 is set as ±15 V.

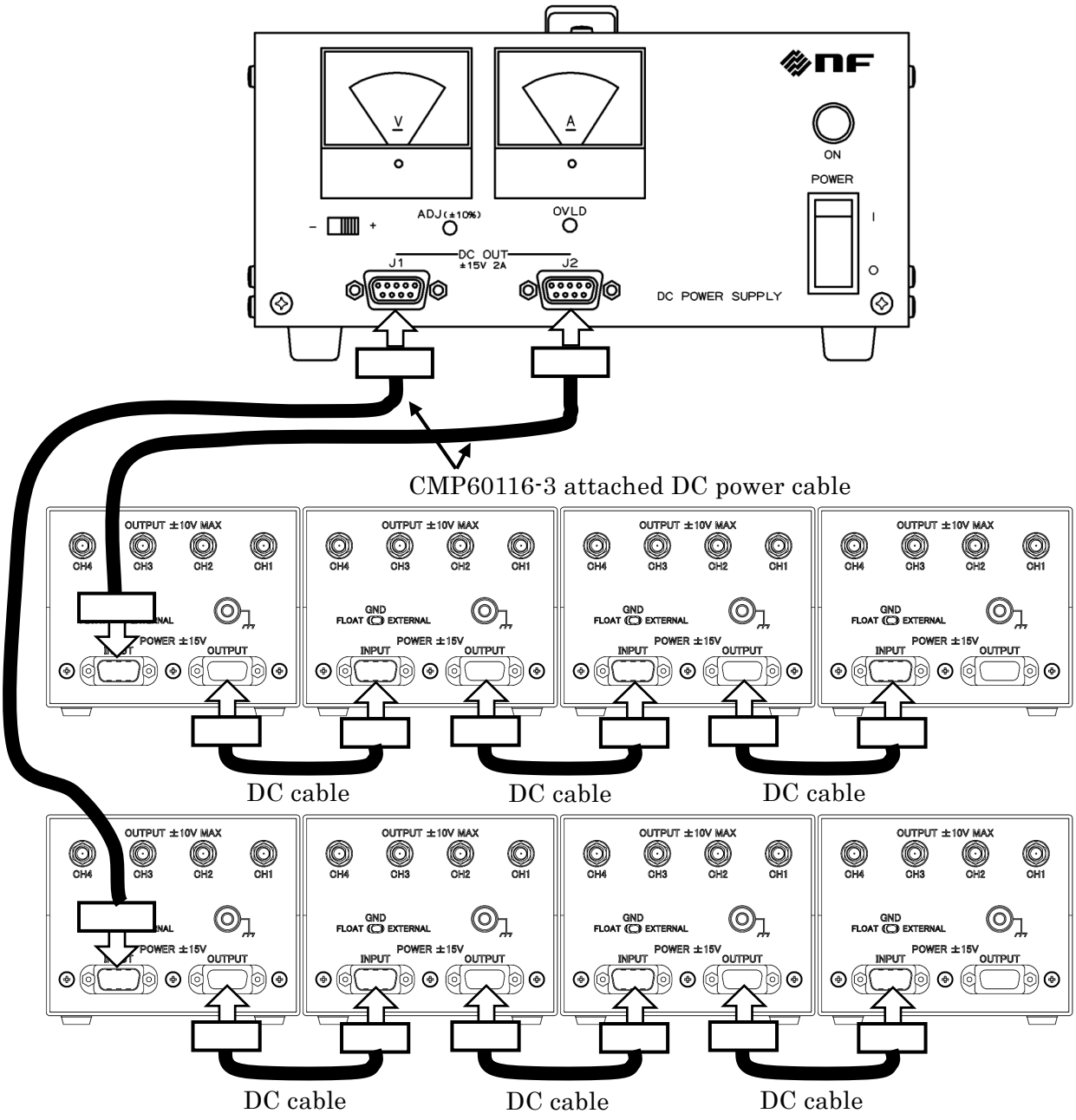

Figure 2-3 Connection when driving 8 products with CMP60116-3.

3. Panel Features and Basic Operations

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3.1 Panel component names and functions

See Figure 3-1, Front and rear panel views.

"Front panel"

① A

② −B

The A is a non-inverting input connector of this product. The −B is inverting input connector. Both connectors are SMA connectors.

Differential signal iput voltage range is ±0.1 V. Common-mode input voltage range is ±5 V.

③ COUPLING

The COUPLING is a switch to select the input coupling method.

DC input coupling can be selected with "DC" and AC input coupling can be selected with "AC".

The lower cutoff frequency is approximately 0.25 Hz when AC coupling is selected.

④ INPUT SEL

This is a switch to select the input mode. The following input modes can be selected by combining two switches.

1) "A" and "－B" : Differential input mode
2) "A" and "GND" : single-ended input mode (Non-inverting amplifier)
3) "GND" and "－B " : single-ended input mode (Inverting amplifier)

⑤ OUTPUT (THRU / LPF)

Selection switch for output stage LPF.

The output of the amplifier is output as it is with "THRU".

It is output through LPF of cutoff frequency 1 MHz with "LPF".

The output resistance is 50 Ω.

⑥ POWER LED

Lights up when the power supply voltage is applied.

⑦ OFFSET

This is a potentiometer to adjust the offset voltage.

Using a screwdriver whose tip does not match or applying excessive force may cause damage. The recommended tip size of screwdriver is 1.8 to 2.0 mm of width and 0.4 to 0.5 mm of thickness. The adjustment torque is 15 mN·m maximum.

"Rear panel"

⑧ OUTPUT

This is output connector of this product. The connector is an SMA connector.

The output resistance is 50 Ω, and the maximum output current is ± 10 mA (load 1 kΩ or more).

Note that the output of this product cannot drive a 50 Ω load directly.

⑨ GND

This switch is used to select the reference potential (GND) of the supply voltage.

This function is used by connecting the power supply ground potential to pins 7 and 8 of the power input connector (POWER INPUT).

In the “FLOAT” setting, GND and the ground potential are isolated by 1 MΩ. The “EXTERNAL” setting shorts GND and ground potential.

In most cases, “FLOAT” has better noise characteristics, but depending on the measurement system and measurement environment, it may be better to short GND and the ground potential.

Please confirm which setting is better for your measurement system and environment.

⑩ "⏚"

This product's CASE potential (GND) pin.

⑪ POWER INPUT

It is a connector for supplying power of this product.

The D-SUB 9-pin connector (male) is adopted.

⑫ POWER OUTPUT

Connector used to drive multiple units of this product.

The D-SUB 9-pin connector (female) is adopted.

Connect the POWER OUTPUT connector to the POWER INPUT connector of another product using a cable.

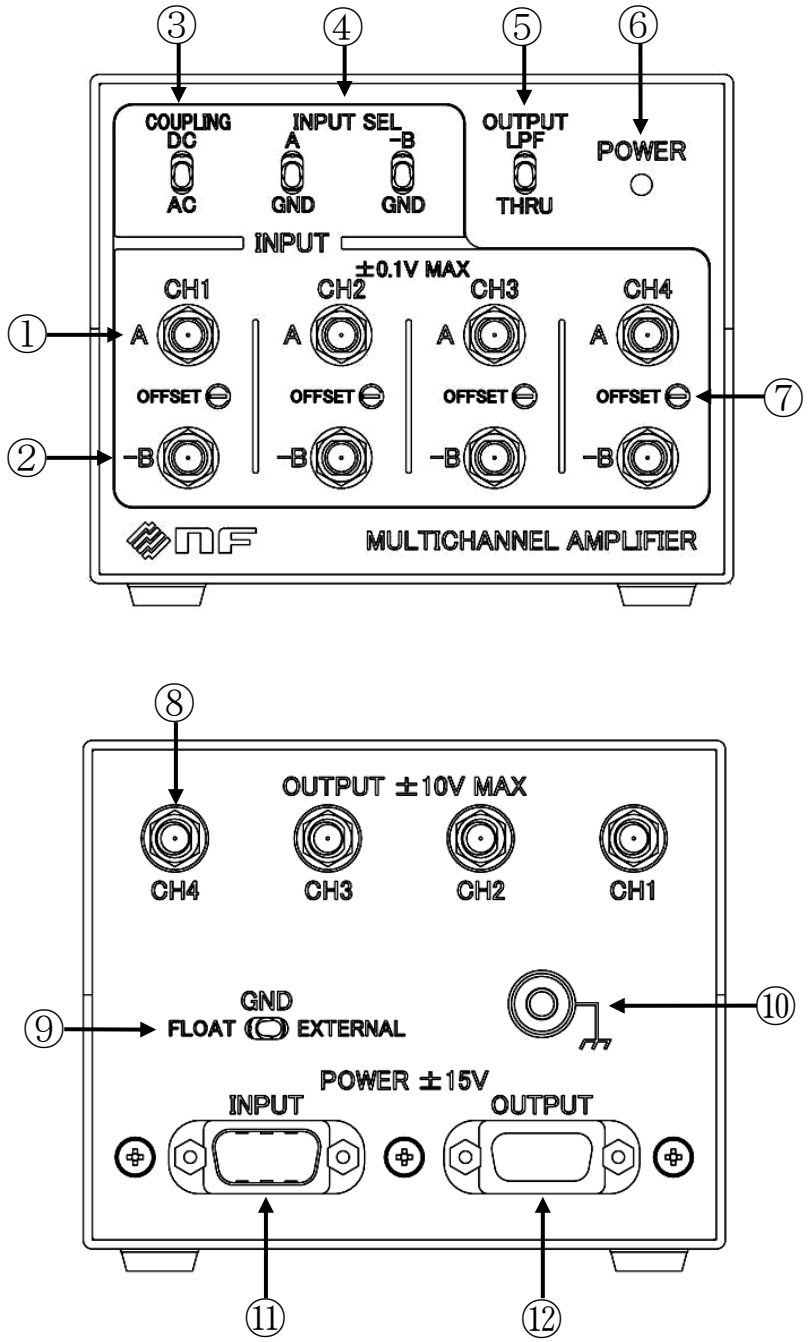

Figure 3-1　Front and rear panel views.

3.2 Input connection and installation

The shielding of the input cable and the method for connecting and installing the product are important for using this product with the best noise characteristics. Follow the instructions below to connect and install this product.

- Install this product as close as possible to the signal sources such as sensors and make the input cable as short as possible. Even if the product cannot be installed near the sensor or signal source, make the input cable length 2 m or shorter.
- An SMA connector and semi-rigid cable are useful for reducing disturbance and noise from the outside.
- Be sure to use shielded cables such as coaxial cables for input and output. Furthermore, install the input cable and output cable as far away from each other as possible (input and output coupling may cause oscillation and instability).
- Longer output cables and power cables are more likely to be affected by external noise and other such factors. The shortest possible cables should be used, but if cable extension is necessary, the cable length should be limited to 2 m.
- Installing this product with the bottom plate connected to it on conductors, such as metals, insulates the product from the object to which it is connected, so GND loop noise can be reduced.
- If there is a product that includes a transformer, such as a DC power supply, install the sensor and this product as far away as possible from it.
- Install this product in a location where there is as little vibration as possible. For small signal detections, it may be subject to the influence of microphonic noise generated by the vibration of the cable.
- Secure this product in a stable location.

⚠ WARNING

Do not connect this product to an AC outlet, because doing so is dangerous.

Attention

・The signal GND and case have the same electric potential. Caution is required when giving a potential to the case or signal GND because doing so may cause electric shock.

3.3 Output connection

The output impedance of this product is 50 Ω, while the maximum output current is 10 mA. If you need ±10 V output, use a load resistance greater than 1 kΩ.

When the output of this product is terminated with a 50 Ω resistance, the rated output voltage cannot be obtained at ± 0.5 V or more. Also note that when the output current exceeds 10 mA, damage to the internal circuits and deterioration of the characteristics may occur.

3.4 Turning on power and warm-up time

This product exhibits the specified performance immediately after the power is turned on, but if you need highly accurate measurement, allows the device to warm up for at least 20 minutes before use.

4. Maintenance

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4.4.3 −B (Inverting) input operation 4-5

4.1 Before maintenance

● This chapter describes the following instructions.

- Daily maintenance
- Precautions and storage method when the product is not used for a long period of time
- Precautions for repacking and transportation
- Function test that is necessary for periodical inspection, incoming inspection, or function check after repair

If the results of function test are not satisfactory, please contact NF or one of our agents to request calibration or repair.

4.2 Dairy maintenance

● If the panels and cases are dirty

Wipe with a soft cloth to clean. To remove stubborn soiling, wipe with a cloth wrung out with neutral detergent.

Never use any volatile solvent like thinner, benzene, or a chemical cleaning cloth, as they may cause the surface finish to deteriorate or peel off.

4.3 Storage, repacking and transportation

● Storage when not used for a long period of time

- Unplug the power supply from this product.
- Store the product in a location free from falling objects and dust, such as a shelf or rack. If dust may be present, cover the product with a cloth or polyethylene cover.
- The environmental conditions for storage are −10 to +50 °C and 5 to 95 %RH. However, avoid a location where the temperature fluctuates significantly or where the product will be exposed to direct sunlight, and store it in an environment as close to room temperature as possible.

● Repacking and transportation

When repacking the product to transport or send it for repairs, pay attention to the following instructions.

- Wrap the product in a polyethylene bag or sheet.
- Prepare a cardboard box that can well withstand the weight of the product and is of a large enough size to accommodate it.
- Fill the cardboard box with a cushioning material so that the six sides of the product can be protected.
- When making a request for transportation, inform the transport operator that the product is a precision instrument.

4.4 Function test

● The function test is to be executed to confirm failures of this product. This function test is to be executed in the incoming inspection, periodic inspection, and when the function check is required after a repair. If the results of the function test do not meet the specifications, calibration or repair is required.

● For the function test, the following instrument devices are required.

a) Digital multimeter
   0.1 mV DC voltage to be measurable
b) DC power supply
   ± 15 V, ± 300 mA or higher
c) Signal generator
   200 $mV_{p\text{-}p}$ (70.7 mV_{rms}) at 1 kHz sine wave to be output
d) Oscilloscope
   Frequency band: 100 MHz or higher
e) Jigs
   SMA to BNC conversion adapter ×2
   BNC divider ×1

● Check the following before the function test.

- Is the power supply voltage ± 15 V within ± 0.1 V?
- Is the ambient temperature within 18 to 28 °C, and is the ambient humidity within 5 to 85 %RH?
- Is there non-condensation?
- Have 20 minutes or more passed after the power is activated?

4.4.1 Consumption Current (with No Signal)

Check the consumption current if the power supply has a current monitor.

If nothing is connected to the input with the settings in Table 4-1, it is normal if the current consumption is within the following range.

CMP60116-1 : ±140 within ±20 m
CMP60116-2 : ±180 within ±20 mA

Table 4-1 Setting when checking current consumption

Switches	COUPLING	INPUT SEL		OUTPUT LPF
Position	DC	GND	GND	THRU

4.4.2 A (Non-inverting) input operation

Make connections as shown in Figure 4-1.

The signal generator outputs a sine wave with an output voltage of 200 $mV_{p\text{-}p}$ (70.7 mV_{rms}), offset of 0 mV and frequency of 1 kHz. If waveforms like those in Figure 4-2 are displayed on the oscilloscope, this product is good.

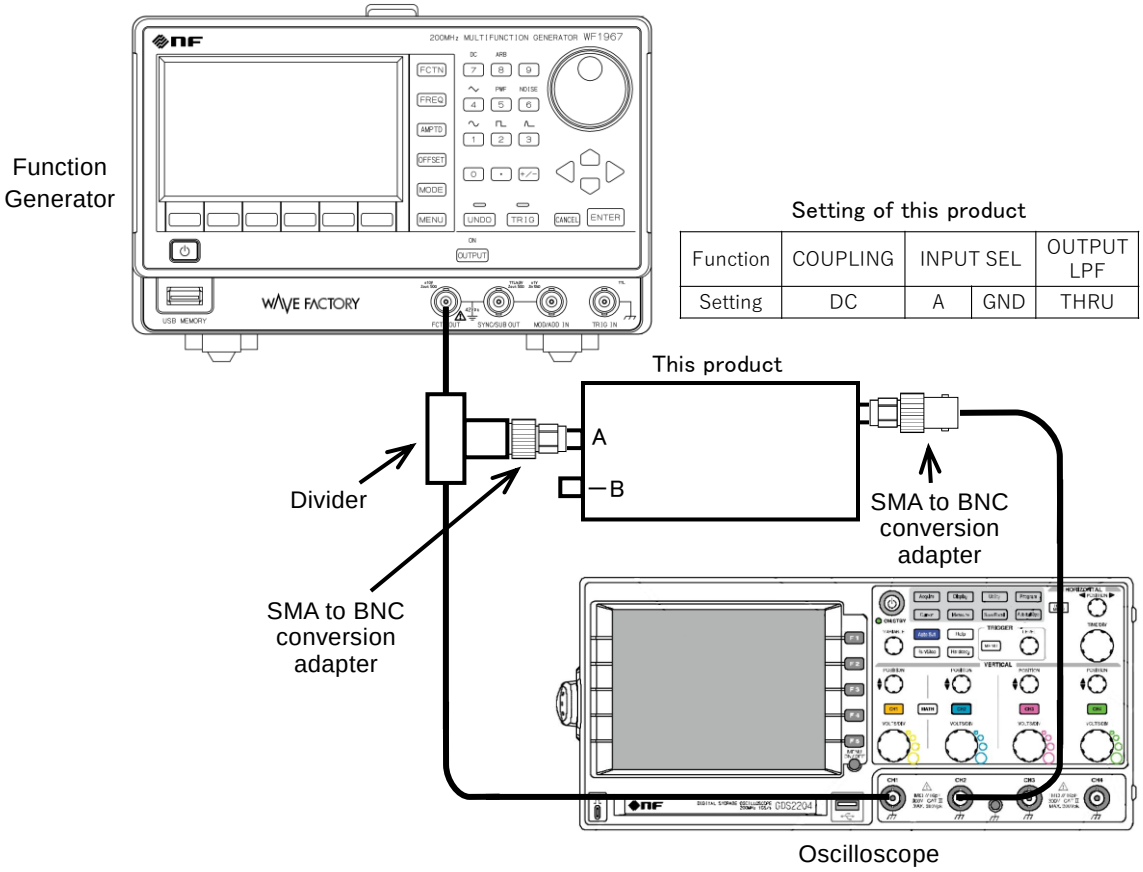

Figure 4-1 Connection diagram for checking non-inverting input operation.

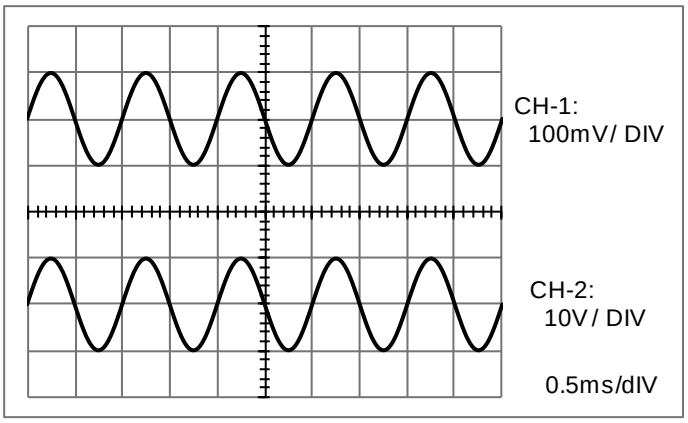

Figure 4-2 Non-inverting input / output voltage waveform.

4.4.3 −B (Inverting) input operation

Make connections as shown in Figure 4-3.

The signal generator outputs a sine wave with an output voltage of 200 $mV_{p\text{-}p}$ (70.7 mV_{rms}), offset of 0 mV and frequency of 1 kHz. If waveforms like those in Figure 4-4 are displayed on the oscilloscope, this product is good.

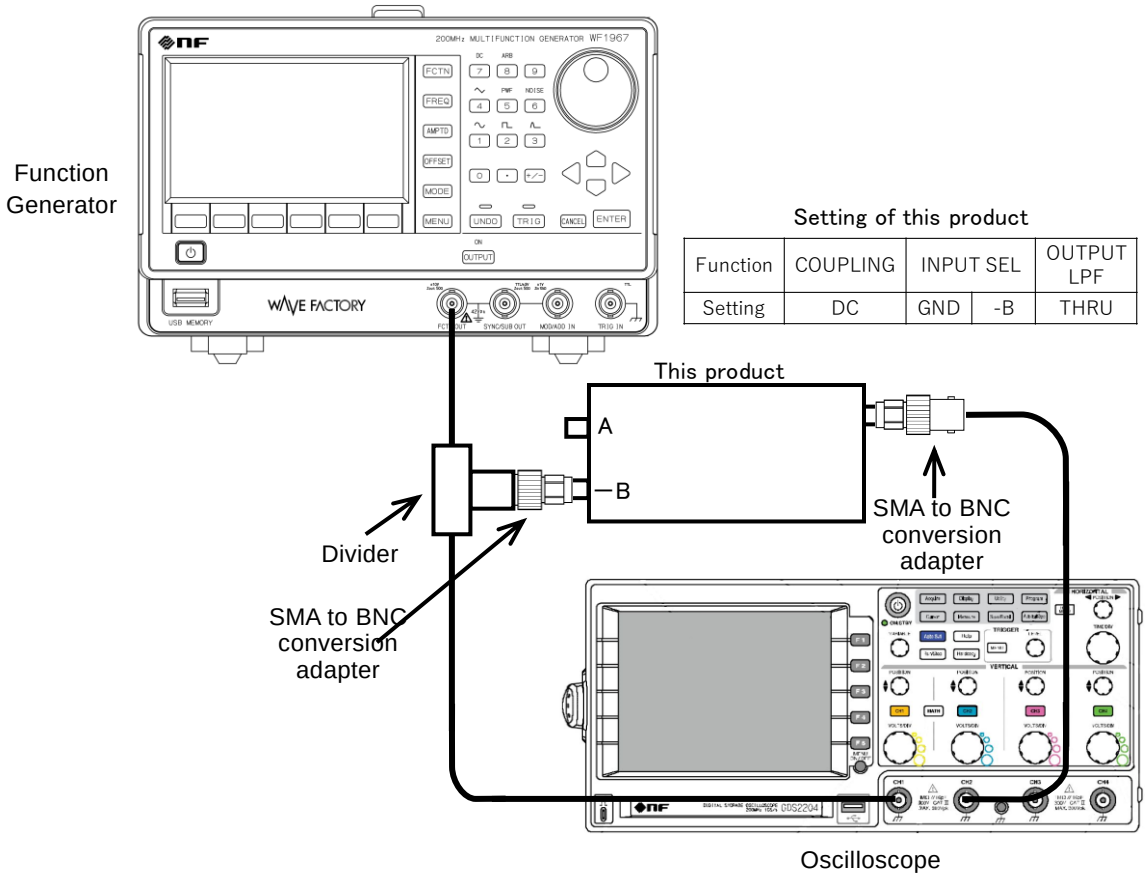

Figure 4-3　Connection diagram for checking inverting input operation.

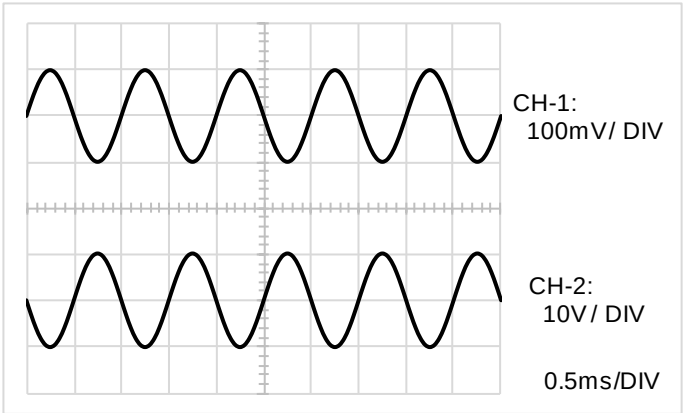

Figure 4-4　Inverting input / output voltage waveform.

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Unless otherwise specified, ± 15 V (LP5391, or equivalent is used), load resistance of 1 MΩ, common-mode input is 0 V, input coupling is DC, low-pass filter is set to THRU.

Numerical values that have accuracy ranges indicated ("and above", "and below", "within", etc.) are guaranteed.
The values that do not have accuracy ranges indicated are reference values.

5.1 Absolute maximum ratings

Supply voltage (± V_S)	±16.5 V	
Signal input voltage	Differential input	Power on ± 1 V
		Power off ± 0.7 V
	Common-mode input	Power on ± 7 V
		Power off ± 0.7 V

* If a stress exceeding the above-mentioned absolute maximum rating is applied, permanent damage can be caused to the product.

5.2 CMP60116-1

5.2.1 Input

Number of amplifiers
4
Input coupling
DC / AC
Input coupling selection method
By COUPLING switch
Input mode
Differential input(A–B) / Single-ended input(A or –B) / GND
Input mode selection method
By INPUT SEL switches
Input connector
SMA connector
Input resistance
100 kΩ
Input capacitance
75 pF
Input coupling capacitance
1 μF When AC is selected
Differential signal input voltage range
Within ± 0.1 V
Common-mode signal input voltage range
Within ± 5 V

Equivalent input noise voltage density

1.3 nV/$\sqrt{\text{Hz}}$	f=1 kHz, input shorted

Equivalent input noise current density

3 pA/$\sqrt{\text{Hz}}$	f=1 kHz

Equivalent input offset voltage

Within ±55 μV	Input shorted Adjustable to 0 V by OFFSET volume
Within ±0.2 μV/°C	Input shorted, 0 °C to 40 °C

Input bias current

±30 nA	Increase by 2 times at about 7 °C rise

Input bias current

±10 nA	Increase by 2 times at about 7 °C rise

5.2.2 Output

Output form

DC couple, unbalanced single-ended output

Output connector

SMA connector

Maximum output voltage

±10 V	f=1 kHz, Output load 1 kΩ or higher

Maximum output current

±10 mA	f=1 kHz

Slew rate

22 V/μs

Output impedance

50 Ω

5.2.3 Amplifier

Voltage gain

40 dB within ± 0.2 dB	f=1 kHz

Voltage gain frequency characteristic

DC to 1 MHz	Within +0.5 dB / −3.0 dB, Output level 2 $V_{p\text{-}p}$, Reference frequency is 1 kHz

Low cutoff frequency(AC)

2.5 Hz	Output level 2 $V_{p\text{-}p}$, Reference frequency is 1 kHz

Total harmonic distortion(THD)

0.006 %	Output level 2 $V_{p\text{-}p}$, f=1 kHz, and sum up to 5th harmonic, noise is not included

5.2.4 Low-pass filter

Selection method

By the OUTPUT switch

Voltage gain

0 dB within ± 0.2 dB	f=1 kHz

Cutoff frequency

1 MHz	Output level 2 $V_{p\text{-}p}$, Reference frequency is 1 kHz

5.2.5 Power supply

Power supply connector

Input D-SUB 9-pin (male) connector

Output D-SUB 9-pin (female) connector

Operating supply voltage range

±15 V within ± 0.5 V

GND potential selection

By the GND switch

Consumption current

±140 mA	No signal
Within ±240 mA	Maximum output voltage, Output load 1 kΩ

5.3 CMP60116-2

5.3.1 Input

Number of amplifiers

4

Input coupling

DC / AC

Input coupling selection method

By COUPLING switch

Input mode

Differential input(A–B) / Single-ended input(A or –B) / GND

Input mode selection method

By INPUT SEL switches

Input connector

SMA connector

Input resistance

1 MΩ

Input capacitance

50 pF

Input coupling capacitance

0.1 μF	When AC is selected

Differential signal input voltage range

Within ± 0.1 V

Common-mode signal input voltage range

Within ± 5 V

Equivalent input noise voltage density

2.5 nV/$\sqrt{\text{Hz}}$	f=1 kHz, input shorted

Equivalent input noise current density

15 fA/$\sqrt{\text{Hz}}$	f=1 kHz

Equivalent input offset voltage

Within ±100 μV	Input shorted Adjustable to 0 V by OFFSET volume
Within ±5 μV/°C	Input shorted, 0 °C to 40 °C

Input bias current

±30 pA	Increase by 2 times at about 7 °C rise

Input bias current

±10 pA	Increase by 2 times at about 7 °C rise

5.3.2 Output

Output form

DC couple, unbalanced single-ended output

Output connector

SMA connector

Maximum output voltage

±10 V	f=1 kHz, Output load 1 kΩ or higher

Maximum output current

±10 mA	f=1 kHz

Slew rate

600 V/μs

Output impedance

50 Ω

5.3.3 Amplifier

Voltage gain

40 dB within ± 0.2 dB	f=1 kHz

Voltage gain frequency characteristic

DC to 20 MHz	Within +0.5 dB / −3.0 dB, Output level 2 $V_{p\text{-}p}$, Reference frequency is 1 kHz

Low cutoff frequency(AC)

2.5 Hz	Output level 2 $V_{p\text{-}p}$, Reference frequency is 1 kHz

Total harmonic distortion(THD)

0.006 %	Output level 2 $V_{p\text{-}p}$, f=1 kHz, and sum up to 5th harmonic, noise is not included

5.3.4 Low-pass filter

Selection method

By the OUTPUT switch

Voltage gain

0 dB within ± 0.2 dB	f=1 kHz

Cutoff frequency

1 MHz	Output level 2 $V_{p\text{-}p}$, Reference frequency is 1 kHz

5.3.5 Power supply

Power supply connector

Input D-SUB 9-pin (male) connector

Output D-SUB 9-pin (female) connector

Operating supply voltage range

±15 V within ± 0.5 V

GND potential selection

By the GND switch

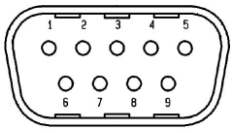
Consumption current

±180 mA	No signal
Within ±240 mA	Maximum output voltage, Output load 1 kΩ

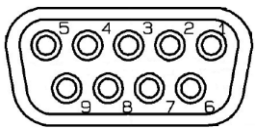
5.4 Power Connector Pin Assignment

Table 5-1 Power Connector Pin Assignment

Pin No.	POWER INPUT / POWER OUTPUT	Note
1	＋15 V	−
2	GND	−
3	−15 V	−
4	GND	−
5, 6	NC	−
7, 8	EXTERNAL	EXTERNAL is the ground potential of the power supply that drives this product. The GND connection of this product can be switched by the GND switch. FLOAT : This product's GND and EXTERNAL potentials are isolated by 1 MΩ EXTERNAL : Connect GND and EXTERNAL potential of this product
9	NC	−



POWER INPUT



POWER OUTPUT

5.5 General

Specified temperature range

23 °C within ± 5 °C

Operating temperature and humidity ranges

0 to 40 °C, 5 to 85 %RH, non-condensation

Storage temperature and humidity ranges

−10 to 50 °C, 5 to 95 %RH, non-condensation

Pollution degree

2 (indoor use)

Altitude

2000 m or lower

External dimensions

105 × 210 × 83 mm without protrusions

Weight

Approx. 1 kg

5.6 Notes

- Incorrect voltage polarity of the power supply will damage this product.
- This product does not operate by single power supply (+30 V / GND). Be sure to use a dual power supply (+15 V / GND / −15 V).
- Short circuit of the output terminal is not allowed. Output short circuit of overload drive may damage the internal circuit and deteriorate the performance.
- Use beyond the absolute maximum ratings and operating temperature range may load to characteristic deterioration of damage on the internal circuit.
- Static electricity may cause characteristic deterioration or damage.

5.7 External view

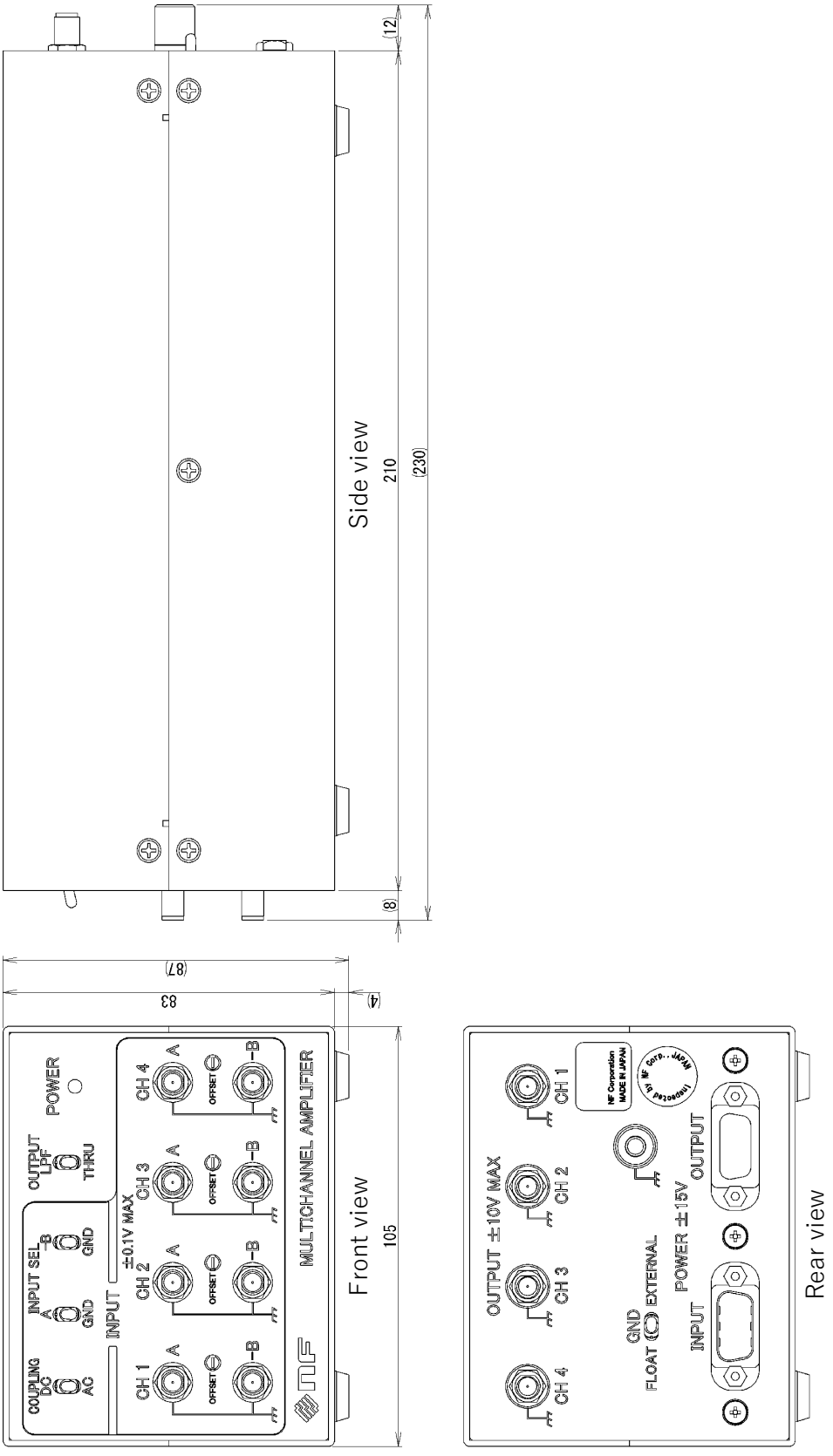


Figure 5-1 External view.

WARRANTY

NF Corporation certifies that this product was thoroughly tested and inspected and found to meet its published specifications when it was shipped from our factory. In the unlikely event that you experience an issue during use, please contact our company or agency of our company from which you purchased the product.
All NF products are warranted against defects in materials and workmanship for a period of one year from the date of shipment. During the warranty period, NF will repair the defective product without any charge for the parts and labor.
For repair service under warranty, the product must be returned to either NF or an agent designated by NF. The Purchaser shall prepay all shipping cost, duties and taxes for the product to NF from another country, and NF shall pay shipping charges to return the product to the purchaser.

This warranty shall not apply when corresponding to following particulars.

A) Failure caused by improper handling or use of the product in a manner that does not conform with the provisions of the Instruction Manual.
B) Failure or damage caused by transport, dropping, or other handling of the product after purchase.
C) Failure caused by repair, adjustment, or modification of the product by a company, organization, or individual not approved by NF.
D) Failure caused by abnormal voltage or the influence of equipment connected to this product.
E) Failure caused by the influence of supply parts from the customer.
F) Failure caused by such as corrosion that originate in the use of causticity gas, organic solvent, and chemical.
G) Failure caused by the insect or small animal that invaded from the outside.
H) Failure or damage caused by fire, earthquakes, flood damage, lightning, war, or other uncontrollable accident.
I) Failure caused by the reason that was not able to be foreseen by the science and technology level when shipped from our company.
J) Replacement and replenishment of consumables such as batteries.

NF Corporation

If there are any misplaced or missing pages, we will replace the manual. Contact the sales representative.

NOTES

- Reproduction of the contents of this manual is forbidden by applicable laws.
- The contents of this manual may be revised without notice.
- Information provided in this manual is intended to be accurate and reliable. However, we assume no responsibility for any damage regarding the contents of this manual.
- We assume no responsibility for influences resulting from the operations in this manual.

CMP60116-1/2 INSTRUCTION MANUAL

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