



**TRANSIMPEDANCE AMPLIFIER**

# **IV-202F4 / IV-204F3**

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**INSTRUCTION MANUAL**

**NF Corporation**

## ———— Preface ————

Thank you for purchasing the IV-200 series transimpedance amplifier.

Please read the "Safety Information" on the next page first to ensure the product is used in a correct and safe manner.

- Alert symbols in this manual

This manual uses the following alert symbols. The instructions next to these symbols must be carefully obeyed to ensure the equipment operator's safety and prevent damage to equipment.

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** WARNING**

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This contains information for avoiding electric shock and other risks when handling the equipment that could result in death or bodily injury to the operator.

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** CAUTION**

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This contains information for avoiding risks when handling the equipment that could result in minor or moderate injury to the operator or damage to property.

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## — Safety Information —

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 instruction 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.

- **Be sure to ground the product.**

To prevent electric shock, the enclosure must be connected to an electrical ground.

- **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 abnormal noise, 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 our representatives.

- **Do not operate in an explosive atmosphere.**

An explosion or other such hazard may result.

- **Do not remove the cover.**

The product may contain high-voltage parts. Never remove the cover.

Even when the inside of this product 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 occurs, power off and disconnect this product.**

A lightning may cause an electric shock, a fire and a failure.

● **Electromagnetic compatibility**

This product is a CISPR 11 Group 1 Class A compliant device. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

● **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.



**Protective earth ground terminal**

This indicates that the terminal needs to be grounded in order to prevent electric shock accidents.

Before operating the product, ensure to connect this terminal to an earth ground.



**Warning**

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



**CAUTION**

**Caution**

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

● **Other symbols**



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



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



This indicates that the terminal or the outer conductor of the connector is isolated from the enclosure.

It indicates, however, that the difference of the potential from the ground potential is restricted to 42 Vpk or less for safety (this product is used grounded so the enclosure potential and ground potential are equal).

● **Waste disposal**

This product does not include batteries and is designed in accordance with the RoHS Directive (EU).

Dispose of the product in accordance with the laws and regulations of the area where you use it.

## 1. Before Using Product

### 1.1 About Power Connection

#### 1.1.1 Connecting to Dedicated LP Series Power Supply

To obtain the best noise characteristics, we recommend the dedicated low noise DC power supply LP series.

To connect this product to this series of power supply, use the “Output cable D” (PA-001-3029) as shown below.

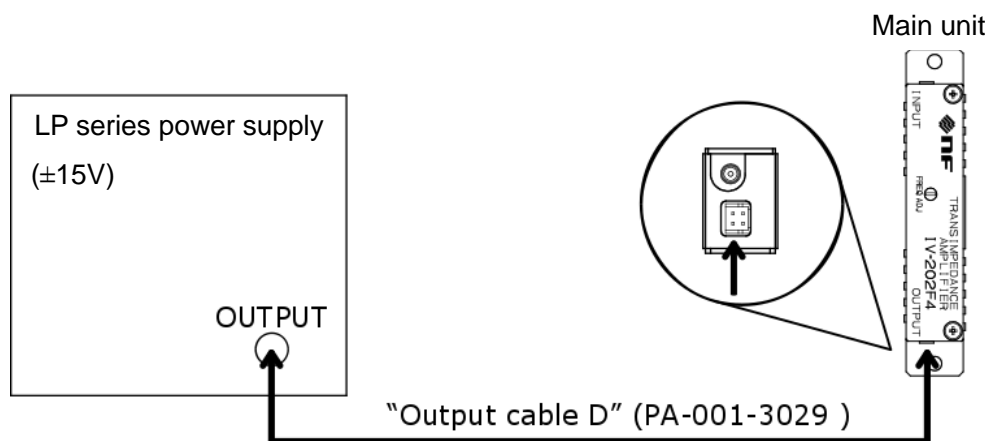


Figure 1-1 Connecting to LP series power supply

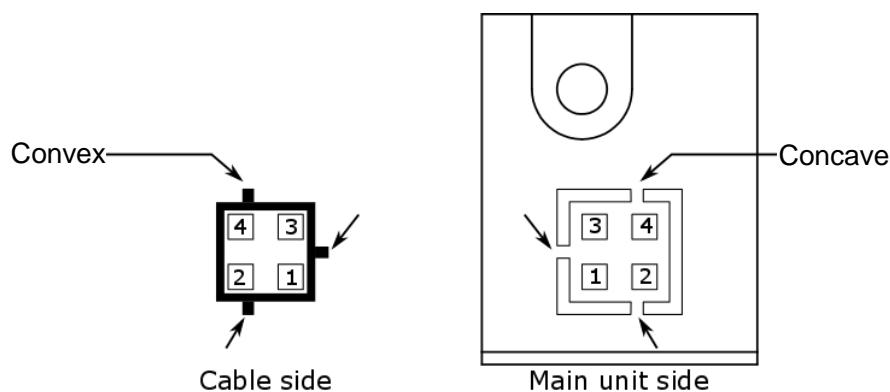


Figure 1-2 Pin assignment

#### Attention

- This product will be damaged by reversely connecting the power supply. Supplying a voltage greater than  $\pm 16.5$  V will damage the internal circuits of this product.
- There are concave and convex parts for the power connector, as shown in Figure 1-2, to prevent the wrong connection. If the orientation of the connector is correct, excessive force is not required. Please be careful of the orientation of the connector.
- Securely connect the cable to the power connector of the main unit.

### 1.1.2 Connecting to Power Supply other than LP Series

To connect this product to a power supply other than one of the LP series, use the supplied power supply cable as shown below.

Connect the connector of the cable to the power connector of the main unit.

Connect the split end of the power supply cable to the  $\pm 15$  V power supply (split end: red to +15 V, black to GND, blue to -15 V).

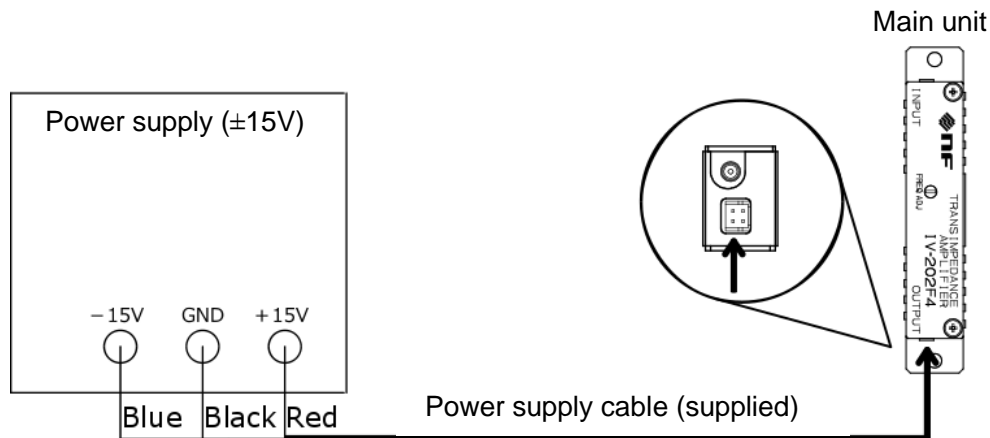


Figure 1-3 Connecting to power supply other than LP series

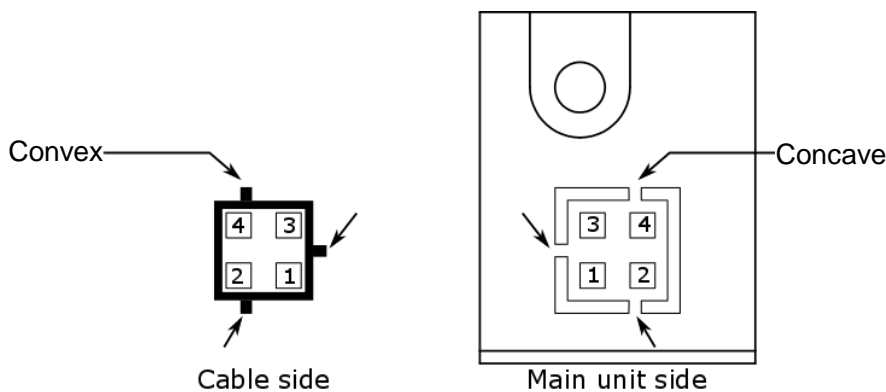


Figure 1-4 Pin assignment

#### Attention

- This product will be damaged by reversely connecting the power supply. Supplying a voltage greater than  $\pm 16.5$  V will damage the internal circuits of this product.
- There are concave and convex parts in the power connector, as shown in Figure 1-4, to prevent the wrong connection. If the orientation of the connector is correct, excessive force is not required. Please be careful of the orientation of the connector.
- Securely connect the cable to the power connector of the main unit.
- This product does not operate on a single power supply (+30 V / GND). Be sure to use a dual power supply (+15 V / GND / -15 V).

### 1.2 Signal Input and Output Connection

An SMB connector is used for signal input and output. However, there is a restriction in the connector portion due to the product's outer shape. Use a connector with an external diameter of  $\phi 6.2$  mm or smaller for connection.

If a large parallel capacitance is connected to the input of this product, overshooting, ringing, or oscillation may occur. Make the input wiring as short as possible. We recommend 50- $\Omega$  coaxial cables with lengths of approximately 10 cm and 40 cm for the IV-202F4 and IV-204F3, respectively.

The absolute maximum rating of the input current is  $\pm 20$  mA. Be aware of this value to avoid causing damage.

Be careful of input short-circuits that could damage devices connected to the output.

### 1.3 Adjuster for Frequency Response (FREQ ADJ)

If a large input parallel capacitance ※1 is connected to this product, overshooting, ringing, or oscillation may occur. In this case, the FREQ ADJ adjuster may be able to improve measurement stability.

To compensate for input parallel capacitance, make adjustments by turning the adjuster clockwise. However, the upper cut-off frequency becomes lower as you turn the adjuster clockwise.

※1 : Approximately 20 pF or higher (IV-202F4). Approximately 50 pF or higher (IV-204F3).

2. Reference Data

This chapter provides reference data. Although the performance of this product may not achieve the level of these data, please understand that each item of all products has been strictly tested and confirmed to meet the specifications before shipment.

2.1 Frequency Characteristics

The frequency characteristics shown below represent the gain based on 10 kHz.

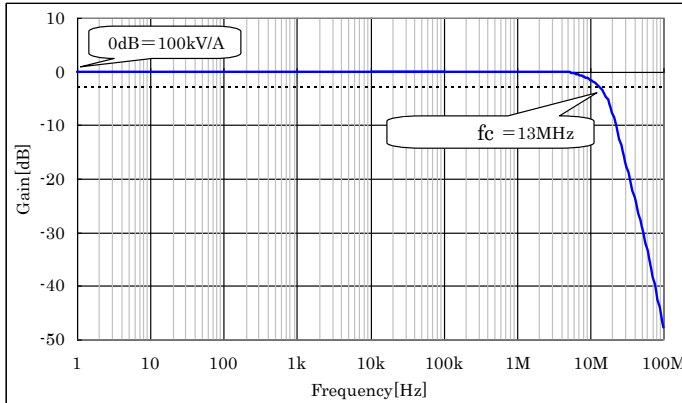


Figure 2-1 Frequency characteristic (IV-202F4)

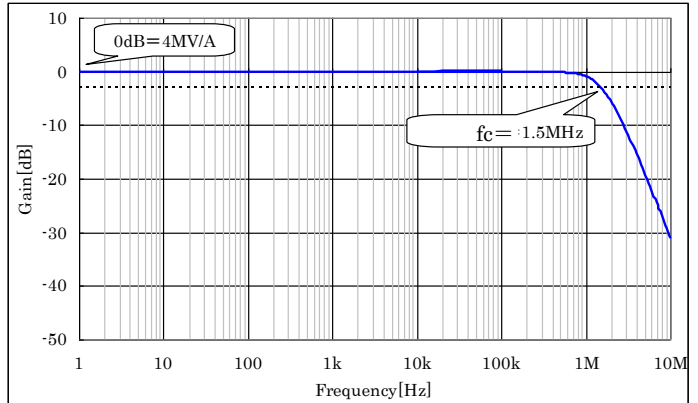


Figure 2-2 Frequency characteristic (IV-204F3)

2.2 Equivalent Input Noise Current Density

The characteristics shown below are calculated by dividing the output noise voltage density by the current gain.

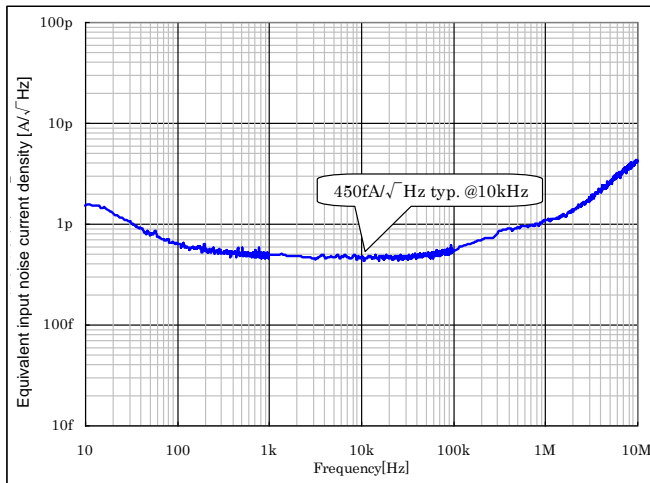


Figure 2-3 Noise characteristic (IV-202F4)

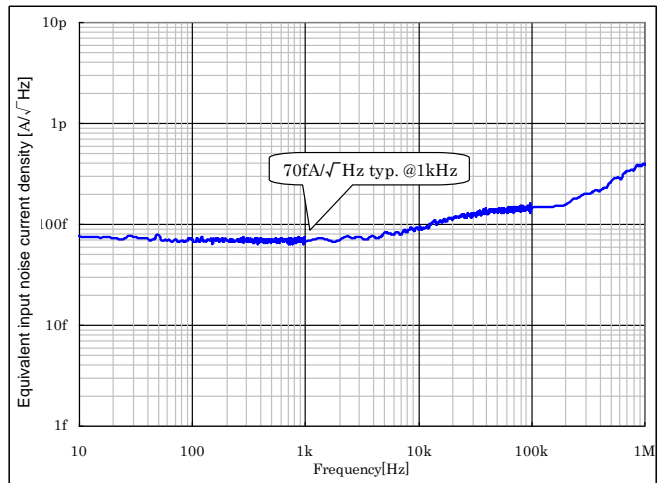


Figure 2-4 Noise characteristic (IV-204F3)



### 3. Specifications

#### 3.1 Overview

The IV-202F4 and IV-204F3 are compact current-to-voltage conversion amplifiers with low noise characteristics. Wide bandwidths of up to 10 MHz and 1 MHz are realized for the IV-202F4 and IV-204F3, respectively.

These products stably operate for up to an input parallel capacitance of approximately 20 pF (IV-202F4) or 50 pF (IV-204F3) without adjustment.

#### 3.2 Configuration

Main unit	×1
Power supply cable	×1
Instruction manual	×1

#### 3.3 Absolute Maximum Rating

Power supply voltage ( $\pm V_s$ )	$\pm 18$ V
Input current	$\pm 20$ mA

#### 3.4 Electrical Characteristics

Unless otherwise specified, power supply voltage  $V_s = \pm 15$  V, temperature  $23 \pm 5$  °C, and input parallel capacitance  $C_s = 5$  pF.

##### 3.4.1 Input Section

Item/Model	IV-202F4	IV-204F3	Note
Input form	DC coupling unbalanced single ended input		SMB connector (male)
Input impedance	30 $\Omega$ or lower	1.2 k $\Omega$ or lower	at DC
Input bias current	5 pA typical		—
Maximum input current	$\pm 100$ $\mu$ A	$\pm 2.5$ $\mu$ A	—
Equivalent input noise current density	600 fA/ $\sqrt{\text{Hz}}$ or lower 450 fA/ $\sqrt{\text{Hz}}$ typical	90 fA/ $\sqrt{\text{Hz}}$ or lower 70 fA/ $\sqrt{\text{Hz}}$ typical	Input opened IV-202F4: at 10 kHz IV-204F3: at 1 kHz
Equivalent input noise current	20 nA <sub>rms</sub> or lower typical	1.1 nA <sub>rms</sub> or lower typical	Input opened BW: 3 Hz to 20 MHz
Recommended signal source impedance	25 k $\Omega$ or higher, 20 pF or lower	1 M $\Omega$ or higher, 50 pF or lower	—

##### 3.4.2 Output Section

Item/Model	IV-202F4	IV-204F3	Note
Output form	DC coupling unbalanced single ended output		SMB connector (male)
Phase between input and output	Inverting		—
Output impedance	50 $\Omega \pm 10$ %		—
Maximum output voltage	$\pm 10$ V		—
Maximum output current	$\pm 5$ mA		—
Output offset voltage	$\pm 10$ mV		Input opened

### 3. Specifications

#### 3.4.3 Amplifier Section

Item/Model	IV-202F4	IV-204F3	Note
Gain	$1 \times 10^5 \text{ V/A} \pm 5\%$	$4 \times 10^6 \text{ V/A} \pm 5\%$	—
Frequency bandwidth	DC to 10 MHz	DC to 1 MHz	Based on 10 kHz +1 to -3 dB

#### 3.5 Power Supply

Item/Model	IV-202F4	IV-204F3	Note
Operating supply voltage range	$\pm 15 \pm 1 \text{ V}$		—
Consumption current	$\pm 40 \text{ mA}$ or lower $\pm 25 \text{ mA}$ typical		No signal $V_s = \pm 15 \text{ V}$
Connector	DF11-4DP-2DS(52) , 4 pins, male by Hirose Electric Co., Ltd.		—

#### Pin Assignment

Pin number	1	2	3	4
Function	+Vs	GND	GND	-Vs

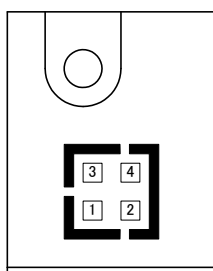


Figure 3-1 Pin assignment diagram

#### 3.6 General

Performance guarantee temperature range	$23 \pm 5^\circ\text{C}$
Operating temperature and humidity ranges	0 to $40^\circ\text{C}$ , 10 to 90 %RH (non-condensation)
Storage temperature and humidity ranges	$-10$ to $60^\circ\text{C}$ , 10 to 80 %RH (non-condensation)
External dimensions	$80 \times 15 \times 21 \text{ mm}$ (without protrusions)
Weight	Approximately 25 g
RoHS	Directive 2011/65/EU

#### 3.7 Adjuster for Frequency Response (FREQ ADJ)

If a large input parallel capacitance  $*_{3-1}$  is connected to this product, overshooting, ringing, or oscillation may occur. In this case, the FREQ ADJ adjuster may be able to improve measurement stability.

To compensate for input parallel capacitance, make adjustments by turning the adjuster clockwise. However, the upper cut-off frequency becomes lower as you turn the adjuster clockwise.

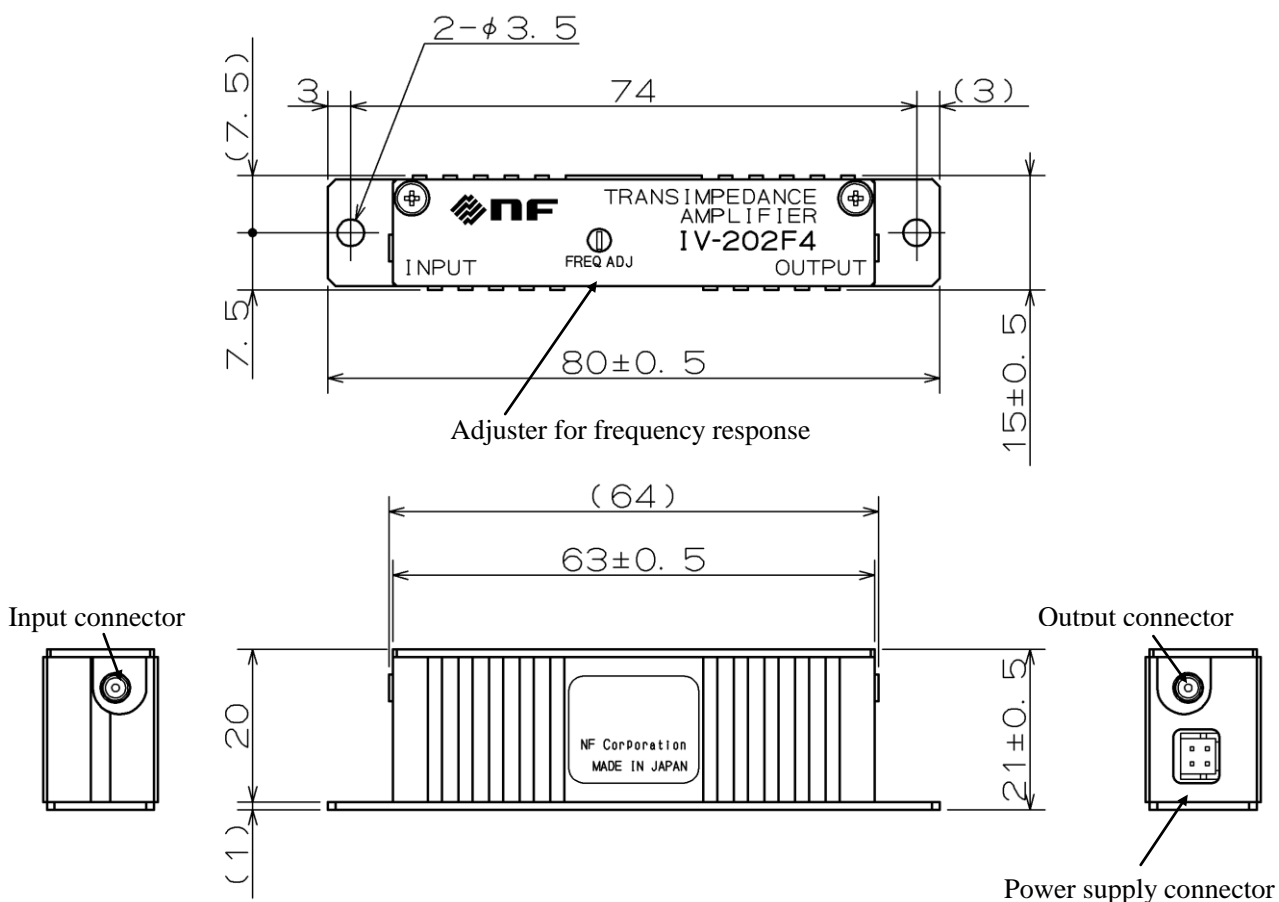
\* 3-1: approximately 20 pF or higher (IV-202F4). Approximately 50 pF or higher (IV-204F3).

### 3. Specifications

#### 3.8 Power Supply Cable (Supplied)

Length (including connector)	Approximately 50 cm
IV-202F4/IV-204F3 side	DF11-4DS-2C(52), 4 pins, female
	Hirose Electric Co., Ltd.
Power supply side	Split end, 4 wires (0.2 mm <sup>2</sup> )
	Red to +Vs, Blue to -Vs, Black (2 lines) to GND

#### 3.9 External View



#### Material and Surface Treatment

Panel: Aluminum, Alumite treatment

Case: Aluminum, non-chromium chemical conversion coating

Unit: mm

- \* For the SMB connector used as the input and output connector, use a connector with a diameter of φ6.2 mm or smaller.
- \* The external view shown above is that of the IV-202F4. The external dimensions of the IV-204F3 are the same; only the model name is different.

Figure 3-2 External view

3.10 Block Diagram

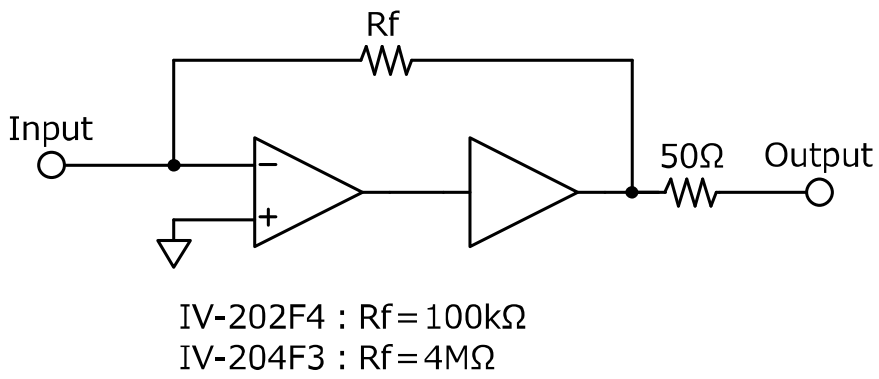


Figure 3-3 Block Diagram

# — WARRANTY —

The **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.

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 a 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 charges, duties, and taxes for the product to either **NF** or an agent from another country, and the shipping charge for returning the product to the purchaser shall be paid by **NF**.

This warranty shall not apply to any defect, failure, or damage caused by a) improper use; b) improper or inadequate maintenance and care; or c) modifications made by the purchaser or personnel other than **NF** representatives.

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

## NOTES

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- The contents of this manual may be revised without notice.
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- We assume no responsibility for influences resulting from the operations in this manual.

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IV-202F4/IV-204F3 INSTRUCTION MANUAL

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