



**LOW NOISE PREAMPLIFIER**

**CA5360**

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**INSTRUCTION MANUAL**

**NF Corporation**



DA00058741-001

**LOW NOISE PREAMPLIFIER**

**CA5360**

**INSTRUCTION MANUAL**



## Preface

Thank you very much for purchasing our “CA5360 LOW NOISE PREAMPLIFIER”.

Please read, first of all, "Safety Precautions" on the following pages, to use the instrument in the correct and safe manner.

### ■ Safety Symbols Used in This Manual

Be sure to observe these safety symbols and their contents to ensure the safety of user and avoid damage to the equipment.

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#### **WARNING**

Equipment handling could result in death or serious injury. This symbol contains information to avoid such risk.

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#### **CAUTION**

Equipment handling could result in minor or moderate injury or property damage. This symbol contains information to avoid such risk.

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### ■ This manual has the following chapters.

If using this equipment for the first time, start from Chapter 1.

#### 1. OUTLINE

This chapter describes the overview, specificities, applications, functions and simple principle of operations of this equipment.

#### 2. PREPARATIONS BEFORE USE

This chapter describes important preparation before installation and operation.

#### 3. OPERATION

This chapter describes the functions and basic operations  
Read while operating the instrument.

#### 4. MAINTENANCE

This chapter describes storage, repacking transportation as well as performance testing.

#### 5. SPECIFICATION

This chapter describes the product's specifications (functions and performance).

## — 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 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.

- **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.**

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.

- **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.

- **Waste disposal**

For environmental protection, do not discard this product in domestic household waste. This product shall be disposed of through an appropriate industrial waste disposer.

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# 1. Outline

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## 1.1 Features

The “CA5360 LOW NOISE PREAMPLIFIER” is a low noise preamplifier for a lock-in amplifier and a frequency response analyzer.

- Low Noise  
Input referred noise voltage is low with  $5 \text{ nV}/\sqrt{\text{Hz}}$  below.  
It's most suitable for measurement of the very small voltage.
- High Common Mode Rejection Ratio  
The Common Mode Rejection Ratio is beyond 100 dB (below 100 Hz). It's most suitable for very small voltage measurement with common mode voltage superimposed.
- Wideband  
A voltage signal of up to 1 MHz can be amplified by 100 times (40 dB).
- High Input Impedance  
The input impedance is 100 M $\Omega$ . It's suitable for signal amplification from a high output impedance sensor. Input mode can choose balance or unbalance and input coupling can choose DC or AC.
- Small Design  
The size is 100(W)  $\times$  48(H)  $\times$  80(D) mm. You can put it in the side of a measurement signal source.
- DC Cable  
DC cable PA-001-2372 attaches to this equipment.  
When using locking-in amplifier LI5630,LI5640 or power supply PS-70A, please purchase an option DC cable and use.

### NOTE:

Accessory DC cable (PA-001-2372)

It corresponds to the following equipment.

LI5645 / LI5650 / LI5655 / LI5660 / LP5391 / LP5392 / LP5393 / LP5394

Option DC cable (PA-001-2791)

It corresponds to the following equipment.

LI5630 / LI5640 / PS-70A

## 1.2 Operating Principle

### 1.2.1 Basic Principle

A signal is input from front input connectors, and is changed by a pair of source followers with low noise FETs to low impedance. The signal is supplied to a low noise differential amplifier, amplified by 100 times, and output from the output connector in the rear.

### 1.2.2 Block Diagram

The following shows a schematic block diagram of the CA5360 and describes the main function.

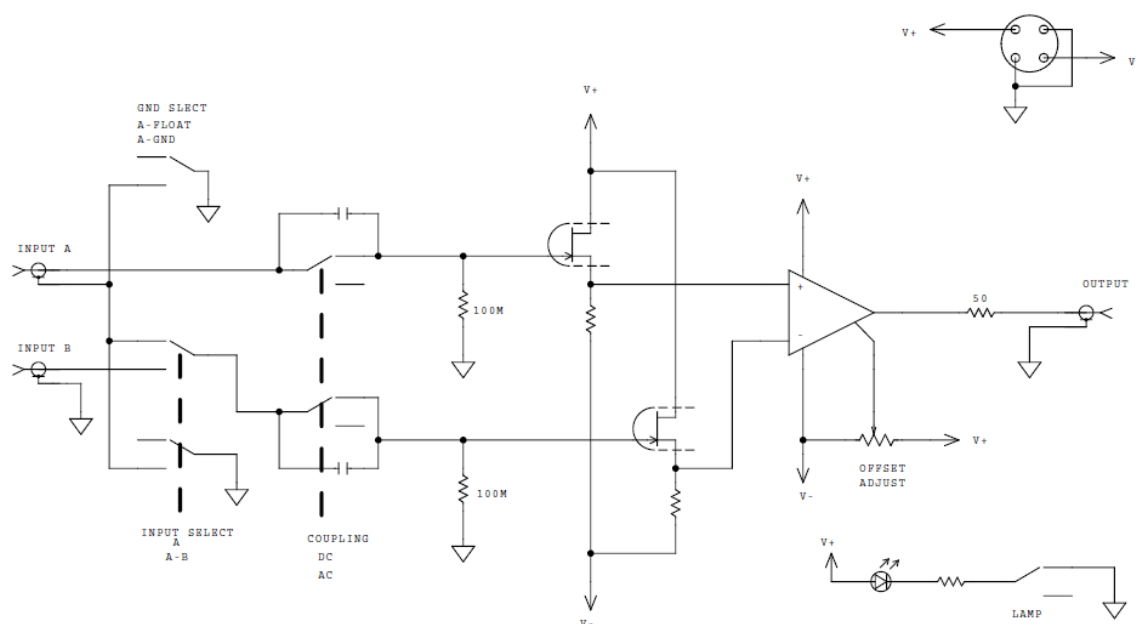


Figure 1-1 Block Diagram

#### a) Input Section

The input section has following functions.

Input connector selection (balance/unbalance)

Input coupling selection (DC/AC)

#### b) Offset Voltage Adjust

It's possible to adjust the offset voltage by potentiometer in a side.

#### c) Power Indicator

The LED which shows that equipment is in the turning on state can be disabled.

## 2. Preparation Before Use

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## 2.1 Checking Before Use

### ■ Appearance Check

Check that the equipment has not been damaged during transport.

### ■ Unpacking

After unpacking, refer to "Table 2-1 Composition List" to check the contents.

Table 2-1 Composition List

CA5360 .....	1
<b>Accessories</b>	
Instruction Manual .....	1
DC cable (PA-001-2372, 2 m) .....	1
Coaxial cable (BNC-BNC, 1 m) .....	3

### ■ Option

PA-001-2791 (DC cable, 2 m)

When using lock-in amplifier LI5630, LI5640 or power supply PS-70A, DC cable of an accessory can't be used. After checking the products, please purchase an option DC cable and use.

#### Note

PA-001-2372 for LI5645 / LI5650 / LI5655 / LI5660 / LP5391 / LP5392 / LP5393 / LP5394



PA-001-2791 for LI5630 / LI5640 / PS-70A



## 2.2 Installation Condition

- **Install this equipment in a place that satisfies the following temperature and humidity conditions.**

Operation: 0 °C to +40 °C, 5 %RH to 85 %RH (Absolute humidity 1 g/m<sup>3</sup> to 25 g/m<sup>3</sup>, non-condensing)

Storage: -10 °C to +50 °C, 5 %RH to 95 %RH (Absolute humidity 1 g/m<sup>3</sup> to 29 g/m<sup>3</sup>, non-condensing)

- **Install the device at an altitude below 2000 m.**

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### CAUTION

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Avoid installation in the following locations.

- Where there is flammable gas  
There is a risk of explosion. Never install or use it in such a location.
  - Outdoors, where exposed to direct sunlight, or near fire or a heat source  
The performance declines or a failure may occur.
  - Where there are corrosive gases and vapors, a lot of dust and particles, salty air and oily smoke, and metal powder, etc.  
Corrosion or a failure may occur.
  - Where there is a lot of vibration  
Malfunction or a failure may occur.
  - Near an electromagnetic field source, high-voltage equipment, power line, or pulse noise source  
Malfunction or a failure may occur.
- 

To ensure correct measurement, warm up the equipment for at least 30 minutes before use.

## 2.3 Connecting to Power Supply

- **The following shows the power supply conditions for this equipment.**

Voltage range	DC ±15 V, ±20 V or ±24 V ±5 %
Maximum output current	less than 50 mA
Connector	HR10-7R-4P

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### CAUTION

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Don't supply this equipment with the voltage beyond ±25.2 V. Failure may occur.

---

When using the LP series power supply, set it to ±15 V output voltages before use.

## 3. Operation

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3.1 Part Names and Functions

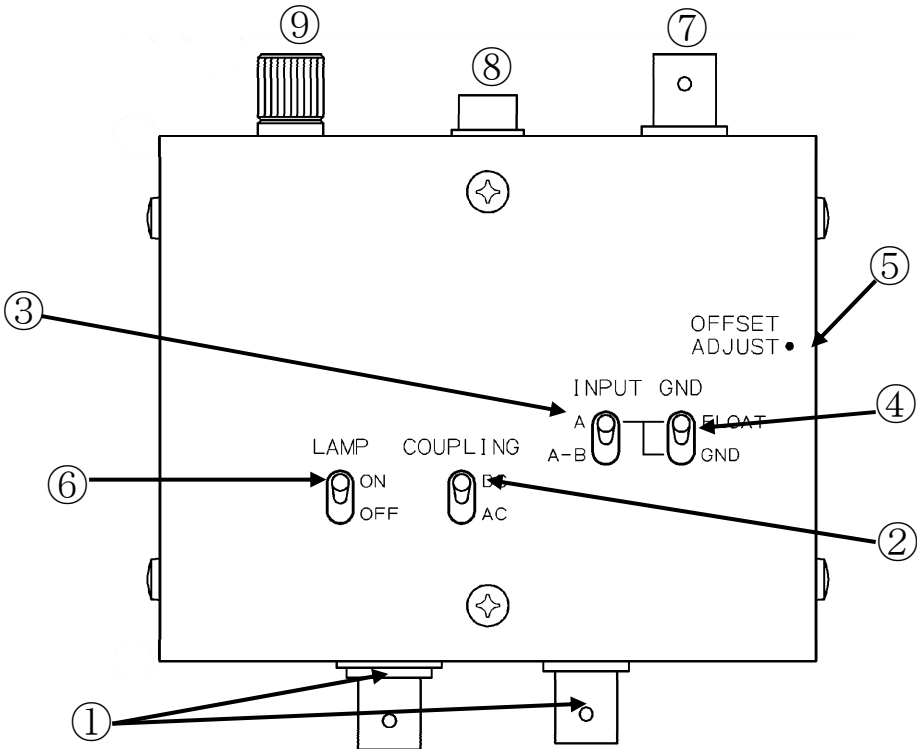


Figure 3-1 Top View

### ① INPUT CONNECTOR

This equipment has 2 signal input BNC (A, B). The input impedance is 100 MΩ. At DC coupling, the maximum input voltage is ±12 V, at AC coupling, it's DC ±40 V or AC ±12 Vpk. When INPUT mode is A (FLOAT), the maximum input voltage between BNC outer contact and the case is ±20 V. Any input voltage over the maximum may damage input stage of this equipment and make it degrade.

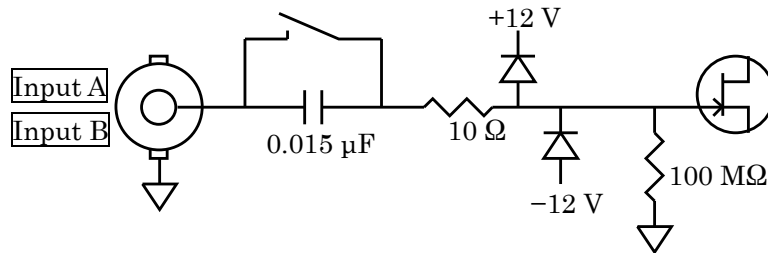


Figure 3-2 Input Circuit (A-B, A (GND))

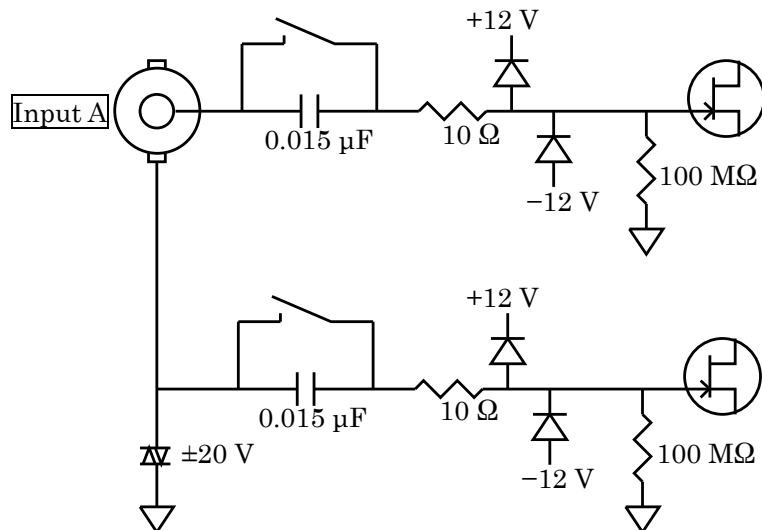


Figure 3-3 Input Circuit (A (FLOAT))

### ② COUPLING SELECTOR

The switch to choose input coupling (DC, AC). Applying excessive force may break this equipment.

### ⚠ CAUTION

Change input select while no signal. Otherwise failure may occur.

### ③ INPUT SELECTOR

The switch to choose input channel (A, A-B). Applying excessive force may break this equipment.

---

**⚠ CAUTION**

---

Change input coupling while no signal. Otherwise failure may occur.

---

④ GND SELECTOR

The switch to choose the connection of input A's outer contact (FLOAT, GND) when input channel A is chosen. Applying excessive force may break this equipment.

⑤ OFFSET ADJUST

Inserting a suitable screwdriver enables to adjust the output offset voltage. Applying excessive force may break this equipment.

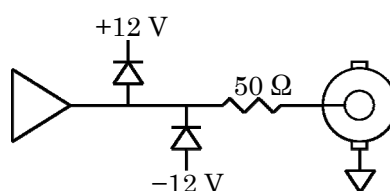
⑥ LAMP

The switch to inactivate the power indicator. This switch is required by optical laboratories. Applying excessive force may break this equipment.

⑦ OUTPUT CONNECTOR

The output connector is a BNC. Output impedance is 50 Ω. The maximum output current is  $\pm 2.5$  mA (2 kΩ load at 5 V).

Note that this equipment can't drive 50 Ω load sufficiently.



**Figure 3-4 Output Circuit**

⑧ POWER INPUT

A power supply input connector of this equipment. DC cable of an accessory or option is connected to this connector.

⑨ GROUND TERMINAL

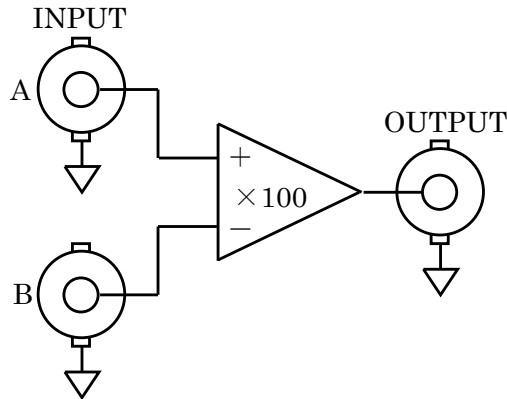
This terminal is connected to the case. The case is connected to the common of the power supply. If you want to connect the case to the ground, this terminal may be used.

## 3.2 Installation and Connection

There are 3 way of connections between signal source and this equipment.

1) Balanced connection (A-B)

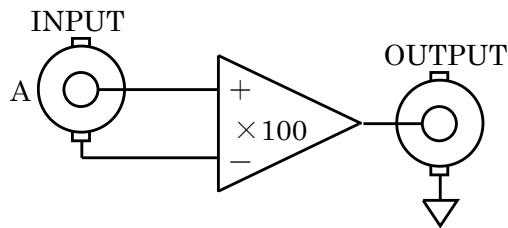
A signal source should be connected between input A and B. This equipment operates in true differential mode. The ability to reject common mode noise is highest. This connection can be used for every use.



2) Unbalanced connection

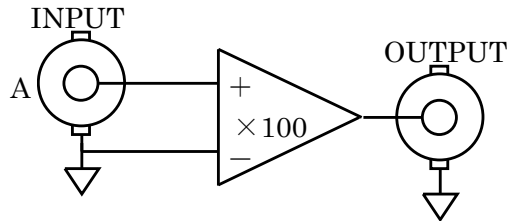
● A (FLOAT)

A signal source should be connected to input A. The interior is differential input, and the common of input A is floated. But the ability to reject common mode noise is less than input mode A-B.



- A(GND)

A signal source should be connected to input A. There is no ability to reject common mode noise. When common mode noise is very little or the signal level is big, it can be used.



Connection and installation methods are important to low noise measurement. Connect and install by the following way.

- This equipment should be installed near the sensor or the signal source as much as possible, and make input cable short.
- Use BNC and coaxial cable for connection to reduce disturbance and noise.
- When there is an equipment which has a transformer built-in for its power supply, the sensor and this equipment should be separated from that transformer.
- Install in the stable place. Vibration may make microphonic noise.
- For input and output, coaxial cables should be used. Otherwise shielded cables should be used. Input cables should be separated from output cable.
- Please fix on a stable place and use.
- Signal GND and a case are the same electric potential. When giving the electric potential to a case or signal GND electrical shock may occur.
- Input DC voltage should be discharged before switching input selector.

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**⚠ CAUTION**

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Don't input the voltage beyond the maximum input voltage. It may damage this equipment.

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### 3.3 Output

Output impedance of this equipment is  $50\ \Omega$ , but the biggest output current is  $\pm 2.5\ \text{mA}$ . When needing  $5\ \text{V}$  output, the load resistance must be  $2\ \text{k}\Omega$  or more.

When load resistance is less than  $2\ \text{k}\Omega$ , the prescriptive output voltage isn't obtained.

### 3.4 Warm up time

To ensure correct measurement, warm up the equipment for at least 30 minutes before use.

# 4. Maintenance

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## 4.1 Preface

Maintenance is required to keep the equipment in top condition.

- Operation Inspection      Check whether the equipment operates correctly.
- Performance Test      Check whether the equipment satisfies the specifications.
- Adjustment and Calibration      If the specifications are not satisfied, adjustment and calibration are performed by NF Corporation to recover proper performance.
- Fault Repair      NF Corporation would repair the equipment.

This manual describes basic operation inspecting and performance testing procedures.

For advanced inspection, adjustment, calibration and fault repair, contact NF Corporation or our agent.

## 4.2 Daily Maintenance

When the panel or case needs cleaning, wipe with a soft cloth. To remove persistent contamination, wipe with a soft cloth soaked with neutral detergent and wrung out. Do not use any organic solvents like thinner or benzene, or any chemical cleaning cloth, as they may cause the surface finish to deteriorate, tarnish, or come off.

## 4.3 Storage, Repacking, and Transportation

- Storage  
DC cable should be removed from the equipment.  
This equipment should be stored in the place where there are no falling object and dust.  
In order not to gather dust, it is effective to cover the equipment with cloth or polyethylene.  
For details, refer to "2.2 Installation Condition"
- Repacking and Transportation  
When repacking for transport, use a carton with adequate strength and enough space for sufficient padding to withstand the weight and protect the equipment.  
During transport, handle with care to avoid strong impact.



---

## 4.4 Performance Test

Performance test is conducted as part of preventative maintenance to prevent performance deterioration of the CA5360. A performance test is conducted when necessary to verify performance during acceptance inspection, periodic inspection and after repair.

If the result of a performance test does not meet the specifications, calibration or repair is required. Contact with NF Corporation or one of our agents.

### 1) Test environment confirmation

- Ambient temperature :23±5°C
- Ambient humidity :20 to 70 %RH, non-condensing
- Power supply voltage : DC±15 V
- Warm-up time :At least 30 minutes

### 2) Test instruments required

- a) Digital Multi Meter (for example Model 34401A (Keysight))
  - DC Voltmeter (100 mV range)  
Accuracy: ±0.1 %
  - AC Voltmeter (true rms, 100 mV range to 10 V range)  
Accuracy: ±0.34 % (400 Hz)
- b) DC Power Supply (for example Model LP5391 (NF Corporation))
  - ±15 V, >0.1 A, with current measuring function
- c) Generator (for example Model WF1947 (NF Corporation))
  - Waveform: Sine wave
  - Amplitude: 10 mVrms (at 400 Hz)
  - (An attenuator may be used.)
- d) Other
  - BNC cable: 50 Ω (×2)
  - Shorting Plug: BNC (×2)
  - BNC (f)-Banana plug (×1)

### 4.4.1 Gain Accuracy

Setting: Lamp on, Input A (GND), Coupling DC, Load  $\geq 1\text{ M}\Omega$

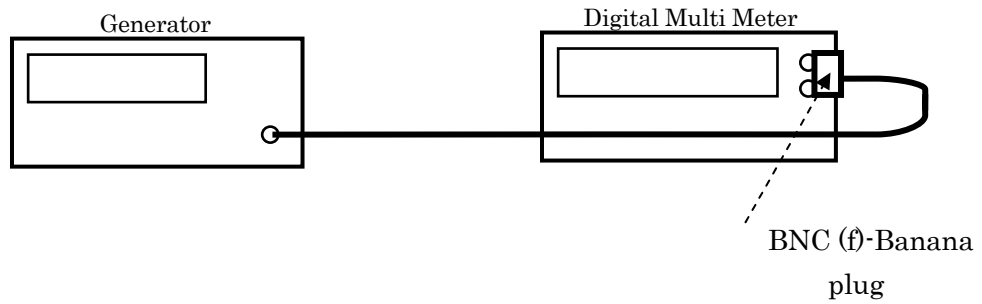
Measurement instrument setting:

Generator: sine wave, 400 Hz, 10 mVrms

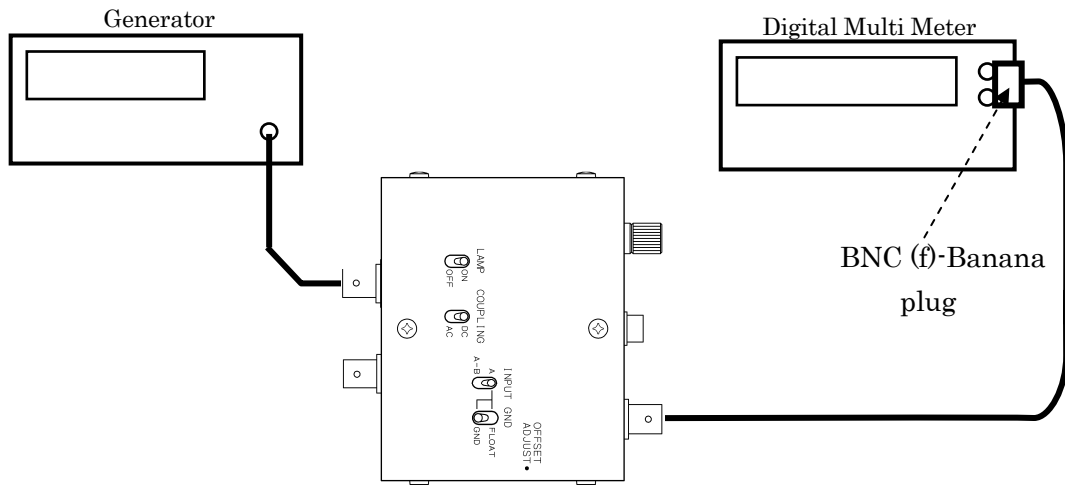
Digital Multi Meter: AC Volt

Measurement method:

- 1) The output voltage ( $V_{in}$ ) of the generator is measured with the digital multi meter.



- 2) The output voltage ( $V_{out}$ ) of the CA5360 is measured with the digital multi meter.



$$\text{Gain} = V_{out} / V_{in}$$

Allowance:  $99 \leq \text{Gain} \leq 101$

### 4.4.2 Offset Voltage Check

Setting: Lamp on, Input A-B, Coupling DC, Load  $\geq 1\text{ M}\Omega$

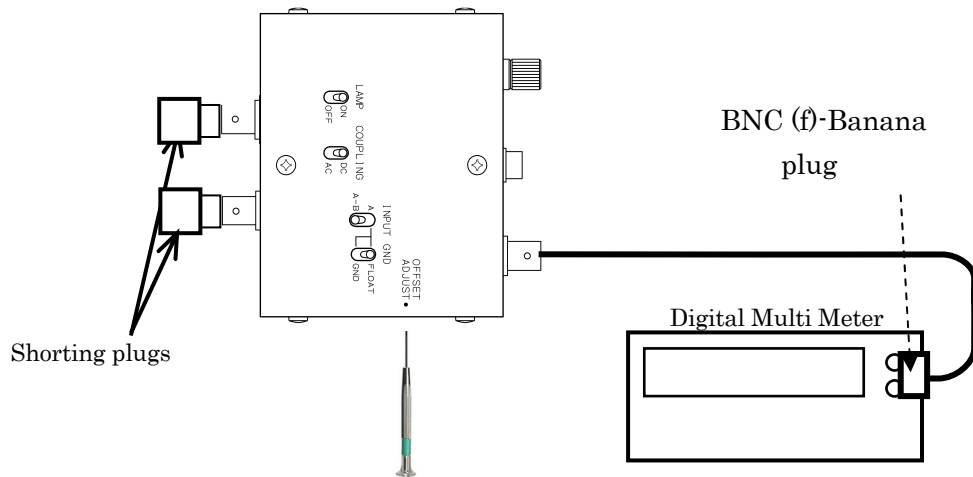
Input A and B: Short-circuited

Measurement instrument setting:

Digital Multi Meter: DC Volt

Measurement method:

The output voltage is measured with Digital Multi Meter with the OFFSET ADJUST turned fully,



Allowance: The output DC voltage can be varied more than  $\pm 1\text{ V}$  by OFFSET ADJUST in a side.

## 5. Specifications

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Nominal, Typical, Supplement and Approximate values

These values show the supplemental data of this equipment and do not guarantee the performance.

Unless otherwise mentioned the following condition is applied.

Warm up time 30 minutes, Load  $\geq 1 \text{ M}\Omega$ , Input A-B, Coupling DC

## 5.1 Specifications

- Input
 

Coupling	DC, AC
Connector	BNC-R
Input mode	A-B (balance) A (FLOAT) (unbalance) A (GND) (unbalance)
Impedance	100 M $\Omega$ (nominal value), $\leq 50$ pF in parallel (A and B) 0.015 $\mu$ F (nominal value) at AC coupling
Common mode voltage	$\pm 5$ V (DC to 100 Hz)
Common mode rejection ratio	$\geq 100$ dB (DC to 100 Hz)
Input referred noise	$\leq 5$ nV/ $\sqrt{\text{Hz}}$ at 1 kHz (input short) (at LP5390 series used)
Input referred offset voltage	Adjustable (at side) $-10$ mV to $+10$ mV 10 $\mu$ V/ $^{\circ}$ C (supplementary value)
Nondestructive maximum voltage	$\pm 12$ V at DC coupling DC $\pm 40$ V, AC 12 Vpk at AC coupling
- Output
 

Connector	BNC-R (unbalance)
Maximum Voltage	$\pm 5$ V (load $\geq 2$ k $\Omega$ , DC to 500 kHz)
Maximum Current	$\pm 2.5$ mA
Impedance	50 $\Omega$ (nominal value) (400 Hz)
- Input-output characteristic (output voltage = 1 Vrms)
 

Gain	$\times 100$ (40 dB) $\pm 1$ % (400 Hz)
Frequency characteristic (+1 dB / -3 dB)	DC to 1 MHz at DC coupling 0.2 Hz to 1 MHz at AC coupling
Harmonic distortion	$\leq 0.03$ % (at 1 kHz)
- Power supply
 

Input voltage	$\pm 15$ V / $\pm 20$ V / $\pm 24$ V $\pm 5$ %
Input current	$\pm 50$ mA
Connector	HR10-7R-4P (HIROSE ELECTRIC CO., LTD. equivalent)
Power indicator	It's possible to turn off the lights.

## 5.2 General Specifications

- Environmental conditions

Operating

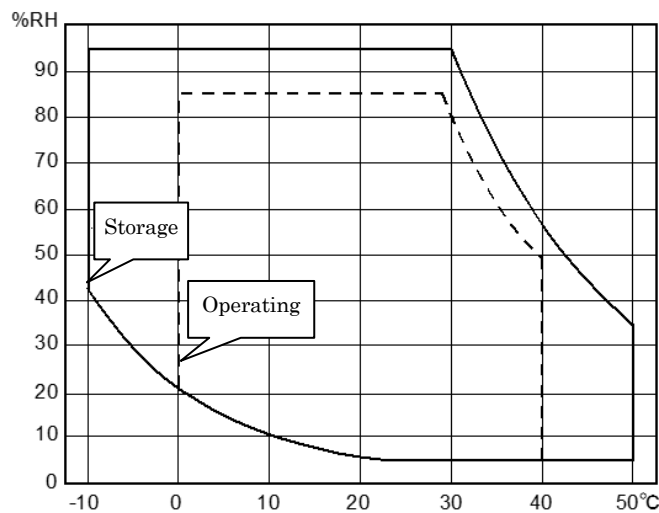
Temperature 0 °C to +40 °C

Humidity 5 °C to 85 %RH, absolute humidity 1 g/m<sup>3</sup> to 25 g/m<sup>3</sup>,  
non-condensing

Altitude 2000 m or less

Storage Temperature -10 °C to +50 °C

Humidity 5 % to 95 %RH, absolute humidity 1 g/m<sup>3</sup> to 29 g/m<sup>3</sup>,  
non-condensing



- Pollution degree 2 (indoor use)
- Warm-up time 30 minutes
- Safety EN 61010-1 \*1  
EN 61010-2-030 \*1
- EMC EN 61326-1 (Group 1, Class A) \*1  
EN 61326-2-1 \*1
- RoHS Directive 2011/65/EU \*1
- External dimensions 100 (W) × 48 (H) × 80 (D) mm, excluding protrusions
- Weight Approx. 250 g, except for accessories

Note:

\*1: It's applied to a product with CE marking indication in a bottom.

5.3 External Dimensions

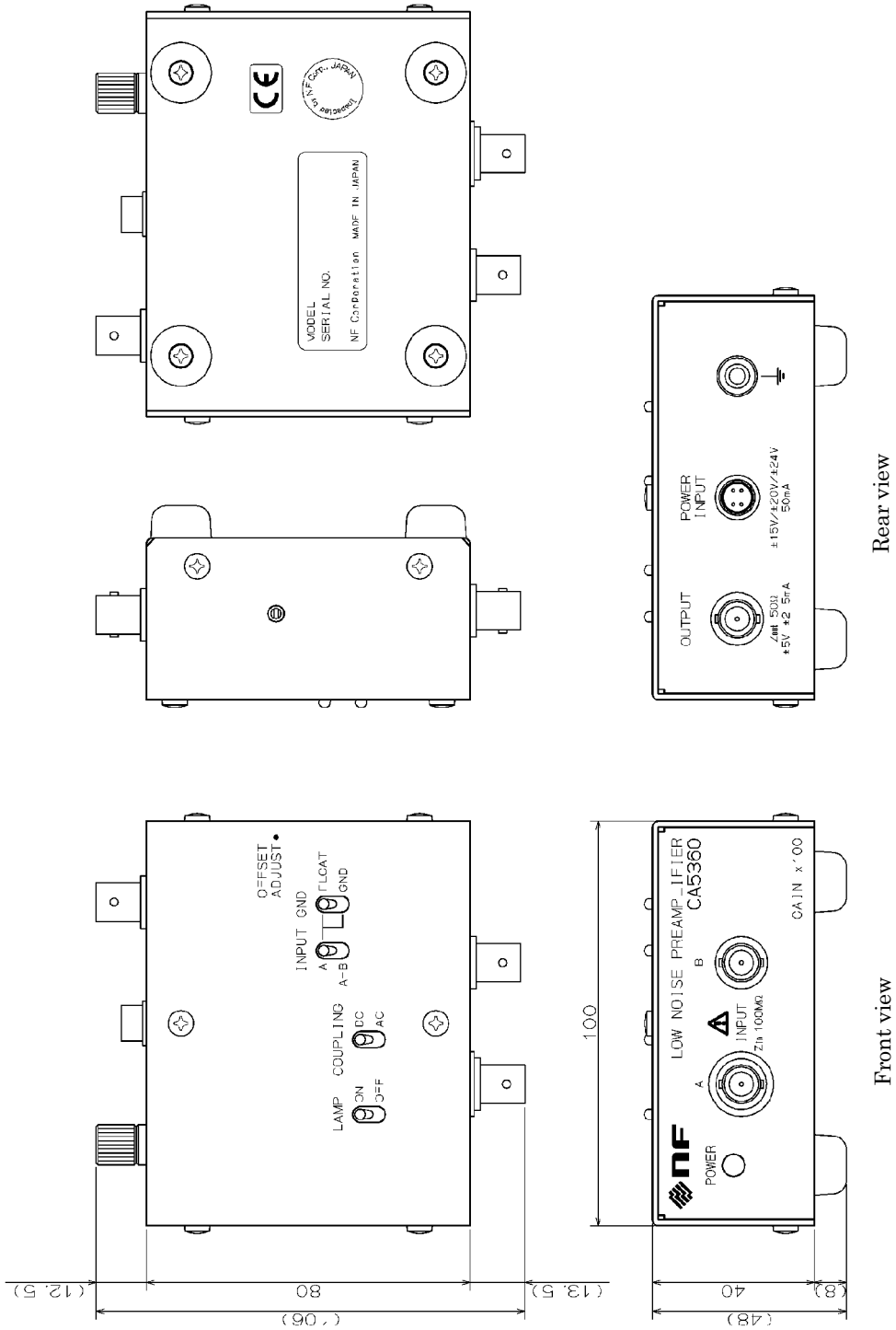


Figure 5-1 External Dimensions

# WARRANTY

**NF Corporation** certifies that this equipment 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 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**. Purchaser shall prepay all shipping charge, duties and taxes for the product to either **NF** or the agent from another country, and shipping charge for the return of the product to purchaser shall be paid by **NF** side.

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) modification by purchaser or personnel other than **NF** representatives.

**NF Corporation**

## Request for Repair

When a failure occurred and the product was found to be defective or you have any uncertainty, please get in touch with NF Corporation or one of our representatives.

In such a case, let us know the model name (or product name), serial number (SERIAL No. given on the nameplate), and symptom and operating conditions as detail as possible.

Though we will make efforts to reduce the repair period, when five or more years have passed since you purchased the product, it may take time due to, for instance, the out of stock of repair parts.

Also, if the production of repair parts is discontinued, the product is extremely damaged, or the product is modified, we may decline the repair.



WABUN: (DA00054323-001)

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.

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#### CA5360 INSTRUCTION MANUAL

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