

Datenblatt

NF-CA-Serie

Inhalt:

CA5351

Seite2

CA5350

Seite7

CA5360

Seite10

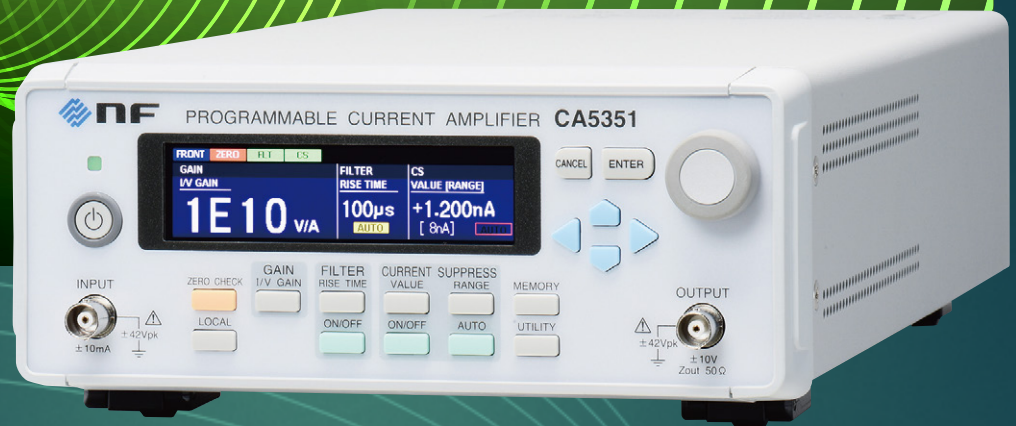
Programmable Current Amplifier

CA5351

Various applications from beam position monitoring in synchrotron radiation to quantum electronics, semiconductor, MEMES and Biochemistry research.

PROGRAMMABLE
CURRENT
AMPLIFIER

NEW



High Gain

10^3 V/A to 10^{10} V/A (8 ranges, 10-time step)

Wide Bandwidth

DC to 500 kHz (10^6 V/A), DC to 70 kHz (10^9 V/A)

Fast Response

0.7 μ s (10^6 V/A)

Low Noise

2.5 fA/ $\sqrt{\text{Hz}}$ (10^{10} V/A, at 55 Hz)

Current Suppression

± 8 nA to ± 8 mA (7 ranges)

High sensitive detection of signals from current output sensor such as PD, APD and PMT.

Photodiode

Avalanche
Photodiode

Photomultiplier
Tube

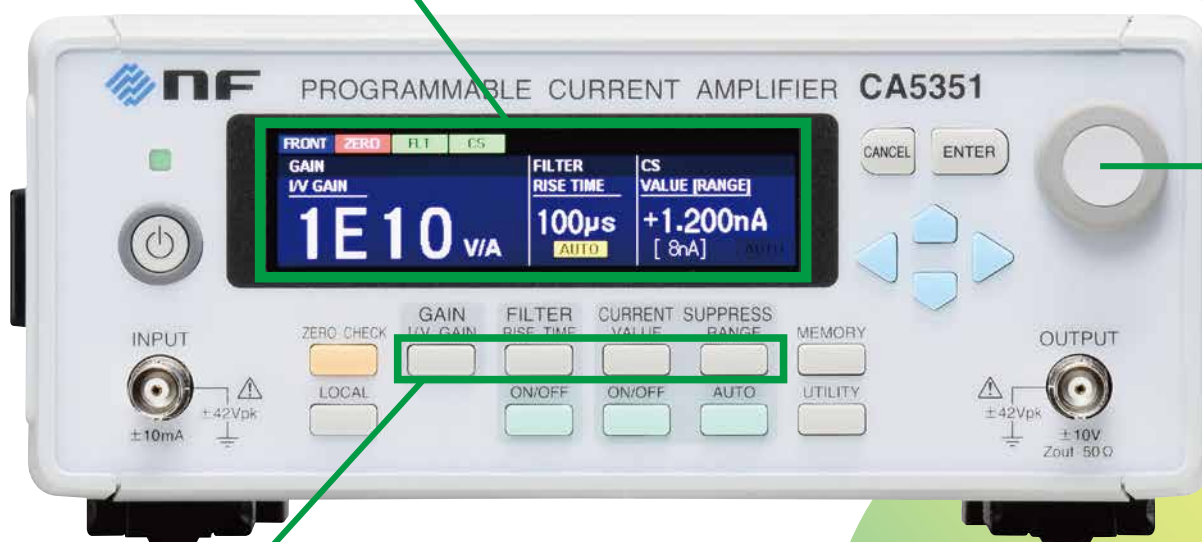
**Excellent
Operability**

Large color LCD display

Gain, filter and current suppression settings are always on display

Easy

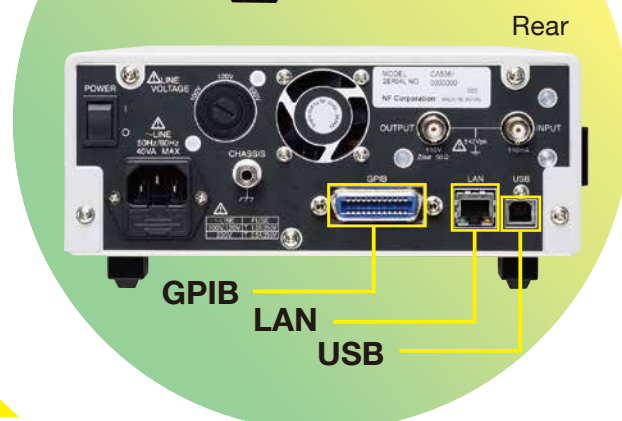
Selecting and setting



One-Push Access

To the most frequently used functions

**Fulfill high needs from
synchrotron radiation facilities**



Application

With high gain, wide bandwidth, fast response and low noise features, The CA5351 is ideal for a variety of small current measurements

Synchrotron Radiation Facilities

Detection of small current signals generated from ion chamber

Biochemistry

Measurement of particles suspended in electrolyte by the Coulter method

Automotive

Light distribution measurement of PWM lighting LED headlight:
Amplification of small photo current of photoconductive cells

- Beam position monitoring for synchrotrons and storage rings
- I-V characteristics measurement for organic thin film devices
- Gate leakage current measurement of FET and IGBT
- Detection of STM (scanning tunneling microscope) tunnel current
- Conductive probe current detection of AFM (atomic force microscope)
- As a pre-amplifier for lock-in amplifiers



High Gain · Wide Bandwidth

10^{10} V/A: DC to 14 kHz, 10^9 V/A : DC to 70 kHz

The model CA5351 achieves a measurement system with both high gain and wide bandwidth, that cannot be found elsewhere. The bandwidth is from DC to 500kHz with a response time of 0.7 μ s (gain: 10^6 V/A or less), so high-speed signal amplification is possible.

Adjustable Gains 10^3 to 10^{10} V/A

$10^3/10^4/10^5/10^6/10^7/10^8/10^9/10^{10}$ (V/A) 8 selectable amplification ranges in decade increments, which allows the most suitable gain setting according to the sensor used and measurement environment.

Fast Response · Stable Operation

A high-speed response of 0.7 μ s is possible with a gain of 10^6 V/A.

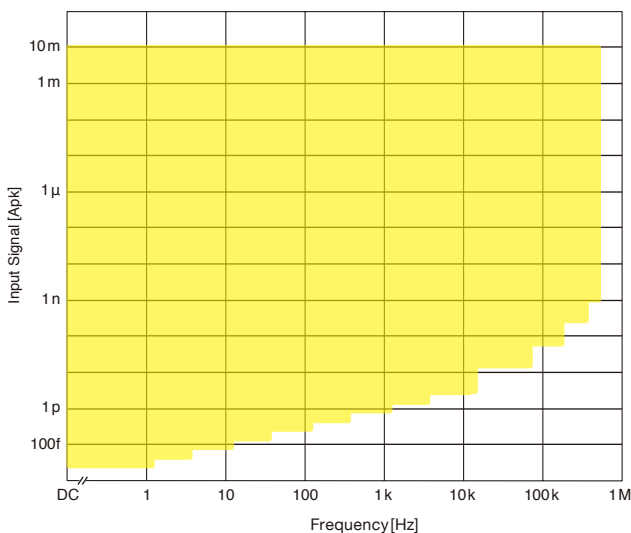
Model CA5351 can process fast pulse signals in optical system measurements.

Resonance does not occur even in the presence of cable or sensor capacitance because of its unique input circuit design and technology.

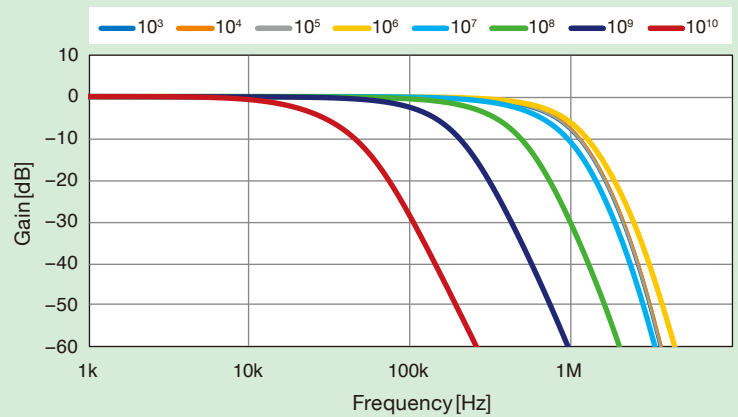
Also there is no overshoot or ringing in the response of pulse input.

Fast response, wide bandwidth and stability towards input capacitance makes this model suitable for various types of sensors.

Wide Input Current Range Coverage For Various Types of Sensors



Gain-Frequency Response



Fast Response

When gain is 10^6 V/A, the rise time is 0.480 μ s.



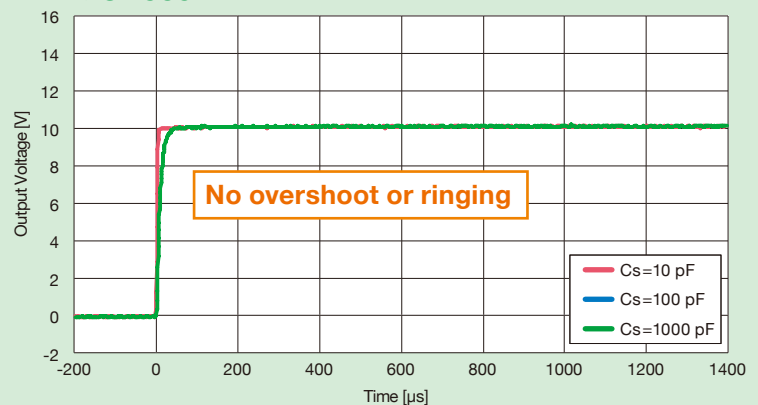
X-axis : 200 ns/div. Y-axis : 2 V/div.

Pulse Response

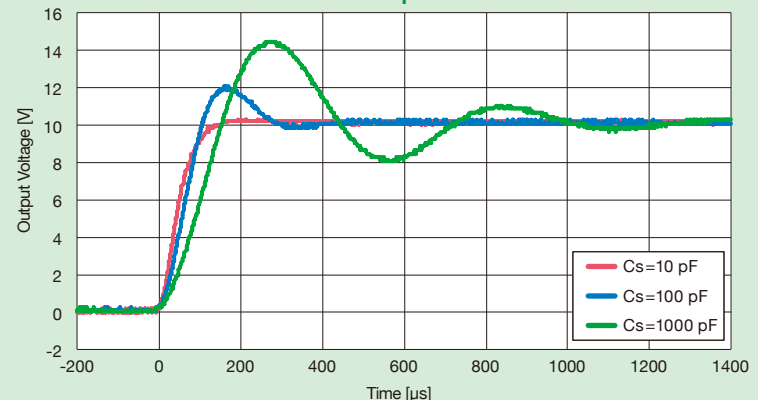
Gain : 10^9 V/A

Cs : Input-GND capacitance

CA5351



Conventional current amplifier





Current Suppression $\pm 8 \text{ nA}$ to $\pm 8 \text{ mA}$

In photoelectric conversion elements such as photodiode and phototransistor, a small current called dark current flows through even when there is no incident light.

In high-gain current amplifiers, when a small DC current input is amplified to a large voltage output, the amplifier becomes saturated, which makes the measurement impossible.

The model CA5351 also incorporates a stable and low noise suppression current supply with high resolution. This current supply can add or offset the input current. For example, by eliminating dark current or leakage current, it can cause higher SN ratio to make the signals detectable. The "Auto Suppression" function automatically changes the current suppression range even if unwanted DC current fluctuates.

Example: When $10\mu\text{A}$ DC current superimposed on the signal

● No Current Suppression

Output saturates when the gain is more than 10^6 V/A

● With Current Suppression

By eliminating $10\mu\text{A}$ of the current, the gain can be set to 10^6 V/A , therefore it becomes possible to measure more detailed fluctuations of signals.



Low Noise

Built-in Variable Filter and Low Noise DC Power Supply

It has achieved the ultimate low noise with an equivalent input noise of $2.5 \text{ fA}/\sqrt{\text{Hz}}$ (at 10^{10} V/A , 55 Hz)

In addition, it incorporates a built-in filter with 12 setting in 1 to 3 sequences within the response speed of $1\mu\text{s}$ to 300 ms , which eliminates the noise and improves the SN ratio.

The optimum SN ratio and response speed can be used for different applications.

Furthermore, the incorporated DC low noise power supply utilized NF's very unique technology in order to pursue and qualify the required low noise level for small current amplifications.

Other Functions

■ Display Backlight Brightness

4 levels of brightness adjustable or OFF
It can be used in experiments that is sensitive to light.

■ Saved Settings up to 10 memories

■ Overdetection

Detect excessive signals and display the conditions.
Detect current-voltage converted signals (input overdetection) and output connector signals (output overdetection) and display them separately.

Data

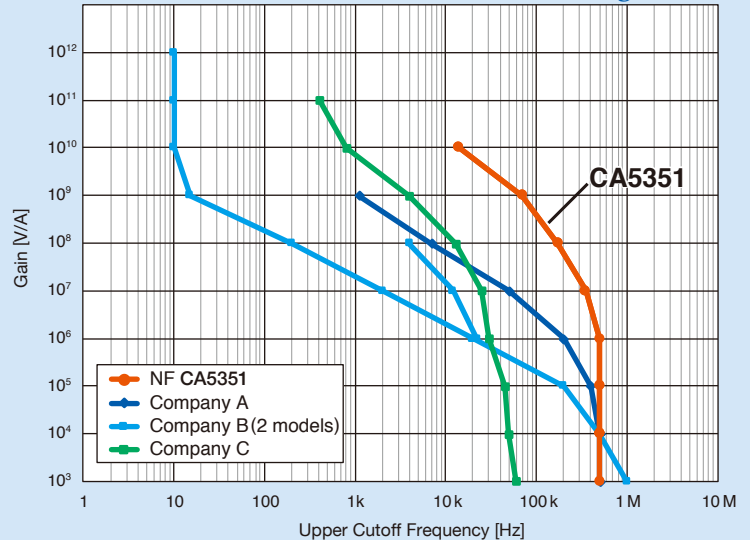
High-quality Performance Supported with Data

The Model CA5351 offers wide bandwidth, high gain and low noise all at the same time, which allows the greatest performance in making tradeoffs.

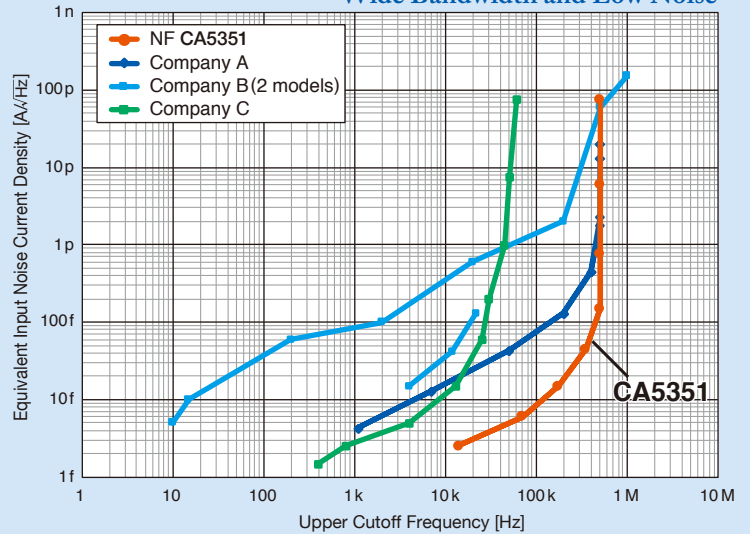
In below graph, it shows the comparison data of the Model CA5351 and products of other manufacturers.

Horizontal axis shows the higher the cutoff frequency is, the wider the bandwidth is.

Wide Bandwidth and High Gain

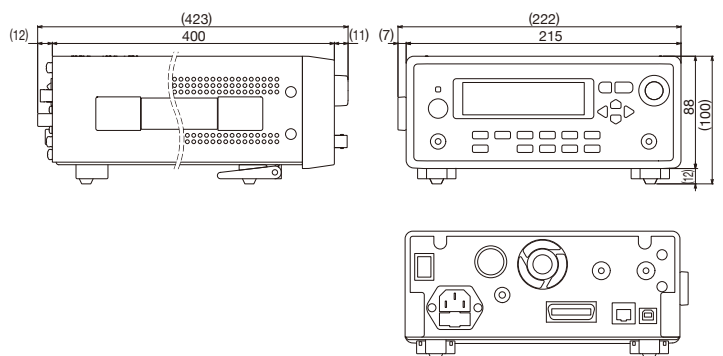


Wide Bandwidth and Low Noise



(Data by NF, September 2020)

■ Dimensions unit : mm



■INPUT

Input Type	DC coupling unbalanced input
Input Connector	BNC receptacle, front panel/rear panel switchable
Non-destructive Maximum Input Current	±30 mA

Gain Setting (V/A)	Maximum Input Current	Input Impedance *1	Recommended Signal-source Resistance *1	Equivalent Input Noise Current Density *1*2
1E10(10 ¹⁰)	±1 nA	30 kΩ (@100 Hz)	1 GΩ or more	2.5 fA/√Hz (@55 Hz)
1E09(10 ⁹)	±10 nA	10 kΩ (@1kHz)	100 MΩ or more	6 fA/√Hz (@200 Hz)
1E08(10 ⁸)	±100 nA	3 kΩ (@1 kHz)	10 MΩ or more	15 fA/√Hz (@200 Hz)
1E07(10 ⁷)	±1 μA	1 kΩ (@1 kHz)	1 MΩ or more	45 fA/√Hz (@1 kHz)
1E06(10 ⁶)	±10 μA	400 Ω (@1kHz)	100 kΩ or more	150 fA/√Hz (@1 kHz)
1E05(10 ⁵)	±100 μA	300 Ω (@1 kHz)	10 kΩ or more	750 fA/√Hz (@1 kHz)
1E04(10 ⁴)	±1 mA	10 Ω (@1 kHz)	1 kΩ or more	6 pA/√Hz (@1 kHz)
1E03(10 ³)	±10 mA	3 Ω (@1 kHz)	100 Ω or more	75 pA/√Hz (@1 kHz)

*1 Supplemental value *2 When input is open with front input, no source capacitance, and filter is on(Auto filtering).

■CURRENT SUPPRESSION

Current Suppression		ON or OFF
Range		7 ranges (8 nA, 80 nA, 800 nA, 8 μA, 80 μA, 800 μA, 8 mA)
Range Setting		Manual Setting, Auto Setting
Setting Range	8 nA	–8.000 nA to +8.000 nA Setting resolution 1 pA
	80 nA	–80.00 nA to +80.00 nA Setting resolution 10 pA
	800 nA	–800.0 nA to +800.0 nA Setting resolution 100 pA
	8 μA	–8.000 μA to +8.000 μA Setting resolution 1 nA
	80 μA	–80.00 μA to +80.00 μA Setting resolution 10 nA
	800 μA	–800.0 μA to +800.0 μA Setting resolution 100 nA
	8 mA	–8.000 mA to +8.000 mA Setting resolution 1 μA
Setting Accuracy (Supplemental Value)	8 nA	± (3.0% of Setting + 0.15% of Range)
	80 nA	± (1.5% of Setting + 0.15% of Range)
	800 nA	± (0.8% of Setting + 0.15% of Range)
	8 μA or above	± (0.6% of Setting + 0.15% of Range)

* Auto suppression function is available to automatically select/set current values for input current elimination.

■AMPLIFICATION

● Gain/Accuracy(DC)/Frequency Response (When filter is off, and no source capacitance)

Gain Setting (V/A)	Gain/Accuracy	Frequency Response +0.5 dB/–3.0 dB or less	Response Speed*3*4
1E10(10 ¹⁰)	1×10 ¹⁰ ±1.0%	DC to 14 kHz*5	25 μs
1E09(10 ⁹)	1×10 ⁹ ±1.0%	DC to 70 kHz*6	5 μs
1E08(10 ⁸)	1×10 ⁸ ±0.5%	DC to 175 kHz*6	2 μs
1E07(10 ⁷)	1×10 ⁷ ±0.3%	DC to 350 kHz*6	1 μs
1E06(10 ⁶)	1×10 ⁶ ±0.25%	DC to 500 kHz*6	0.7 μs
1E05(10 ⁵)	1×10 ⁵ ±0.25%		
1E04(10 ⁴)	1×10 ⁴ ±0.25%		
1E03(10 ³)	1×10 ³ ±0.25%		

*3 Squire waveform output rise time (10%–90%) *4 Supplemental values for reference

*5 Reference frequency 1Hz *6 Reference frequency 10Hz

● Filter

Filter	ON or OFF			
Setting Range	Response Speed (Rise Time) : 1 μs to 300 ms, In 1, 3 sequences, auto filtering			
Setting Accuracy	Within ±20% of set time (10%~90% rise time)(Supplemental Value)			
Filter Characteristics	Low pass filter (LPF), Phase linear type			
Attenuation(slope)	12 dB/oct			
Auto Filtering	Filter setting is based on gain setting. If the gain setting is changed during auto filtering, the filter setting will change automatically as well.			
	Gain Setting (V/A)	Filter Setting	Gain Setting (V/A)	Filter Setting
	1E10(10 ¹⁰)	100 μs	1E06(10 ⁶)	10 μs
	1E09(10 ⁹)	100 μs	1E05(10 ⁵)	3 μs
	1E08(10 ⁸)	30 μs	1E04(10 ⁴)	1 μs
	1E07(10 ⁷)	10 μs	1E03(10 ³)	1 us

● Phase between Input and Output

Phase between Input and Output	Reverse phase (when current flows in input connectors, output potential becomes negative)
--------------------------------	---

■OUTPUT

Output Type	DC coupling unbalanced output
Output Connectors	BNC receptacle, Front/Rear panel, Front and rear connectors output the same signals
Maximum Output Voltage	±10 V (No load)
Maximum Output Current	±10 mA Total current of front and rear connectors
Output Impedance	50 Ω (Supplemental Value)
Output Offset Voltage	±30 mV or less (Gain setting 1E10 V/A) ±20 mV or less (Gain setting 1E03 to 1E09 V/A) (Open input, Current suppression OFF)

■GENERAL

Display	3.9 inch, TFT color LCD 4 levels of backlight brightness and OFF		
Saved Settings	10 memories (1 memory is for resume. Memory is saved just before the power source is off and the settings will be recalled after restarting.)		
Input/Output Grounds	Input and output signal grounds are isolated from chassis (signal grounds are common) Signal ground -Withstand voltage between chassis : 42 Vpk (DC+ACpeak)		
Overdetection	Detects excessive signal and displays conditions on LCD screen. Overdetection is to detect current-voltage converted signals and output connectors signals and display them separately.		
External Control	USB : USB1.1, Device class CDC GPIB : IEEE488.2 LAN : 10BASE-T / 100BASE-T, TCP/IP(socket communication)		
Power Supply	AC100 V±10% / 120 V±10% / 230 V +10%, -14% (250 V or less) 50 Hz/60 Hz ±2 Hz, Power consumption: 40 VA or less Overvoltage Category : II		
Chassis Cooling	Forced air cooling. Rear Exhaust.		
Environmental Conditions	Operation	0°C to +40°C, 5% to 85%RH (Absolute humidity is 1 to 25 g/m³, no condensation)	
	Performance Guarantee	23°C±5°C, 5% to 85%RH (Absolute humidity is 1 to 25 g/m³, no condensation)	
	Storage	-10°C to +50°C, 5% to 95%RH (Absolute humidity is 1 to 29 g/m³, no condensation)	
	Pollution Degree	2 (offices, laboratories, test stations)	
Warm-up Time	30 min		
RoHS	Directive 2011/65/EU		
Safety Regulations and EMC	EN 61010-1, EN 61010-2-030 EN 61326-1(Group1, ClassA), EN 61326-2-1		
Dimensions	215(W)×88(H)×400(D) mm (excluding protrusions)		
Weight	approx. 4.5 kg (excluding accessories)		
Accessories	Power cord set (3 pin, 2 m) 1, fuse ^{*7} (1 A/250 V time lag, φ5.2×20 mm) 1, instruction manual 1		

*7 Spare fuse. There are 2 fuses in the inlet, 1 working fuse and 1 spare fuse.

■OPTIONS

- PA-001-3512 Rackmount Kit (EIA, 1 unit)
- PA-001-3513 Rackmount Kit (EIA, 2 units)
- PA-001-3514 Rackmount Kit (JIS, 1 unit)
- PA-001-3515 Rackmount Kit (JIS, 2 units)

*Note: The contents of this catalog are current as of October 14th, 2020.

Product appearance and specifications are subject to change without notice.

Before purchase, contact us to confirm the latest specifications, price and delivery date.

PROGRAMMABLE CURRENT AMPLIFIER

CA5350

**Supports a Variety of Small Current Measurements,
Using Various Optical Sensors (PD, APD, PMT)**

Applications

- ▶ Photodetection with PMTs and Photodiodes
- ▶ Scanning Tunneling Microscopy
- ▶ Spectroscopy
- ▶ Quantum Electronics
- ▶ Semiconductors
- ▶ MEMS
- And more...



High Gain

10^4 V/A to 10^{10} V/A (7 ranges, x10 increments), 10^{11} V/A maximum

Broad Bandwidth

DC to 500 kHz (10^6 V/A), DC to 70 kHz (10^9 V/A)

Fast Response

0.7 μ s (10^6 V/A)

Low Noise

2.5 fA/ $\sqrt{\text{Hz}}$ (10^{10} V/A, at 55 Hz)

Current Suppression

± 8 nA to ± 800 μ A (6 ranges)

With its unique circuitry, high gain and broad bandwidth, as well as stable operation with additional input capacitance.

The CA5350 programmable current amplifier is a variable gain type, current-input, voltage-output amplifier. Gain can be set from 10^4 V/A to a maximum of 10^{11} V/A. In addition, the included current suppression function enables the canceling of the dark current that cannot be avoided with photoelectric conversion elements such as photodiodes.

BNC connectors are used for input and output, so special cables or an external power supply are not required. The various settings, including gain, are easy to perform using the dial and keys on the front panel, and the set values are displayed on the screen.

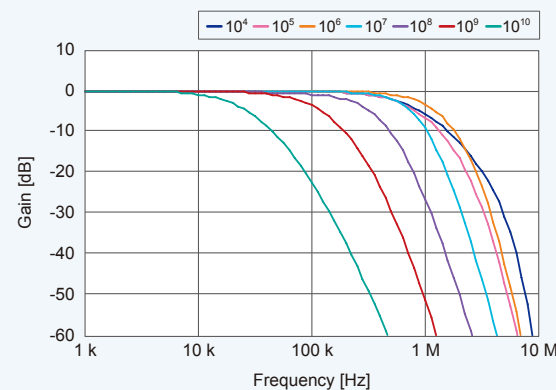
Since the GPIB and USB interfaces make remote control also possible, gain and other settings can be performed from a personal computer, making it easy to configure an automatic measurement system.

With its performance, functions and operability, this programmable current amplifier supports the current amplification of signals from a variety of current output sensors.

High Gain and Broad Bandwidth

The CA5350 realizes unprecedented high gain and broad bandwidth support from DC to 14 kHz at 10^{10} V/A, and from DC to 70 kHz at 10^9 V/A. In addition, it also supports high-speed signals from DC to 500 kHz at 10^6 V/A or less.

Gain-frequency characteristics



Variable Gain 10^4 to 10^{11} V/A

Gain can be set in seven ranges of 10^4 , 10^5 , 10^6 , 10^7 , 10^8 , 10^9 , 10^{10} (V/A), in x10 increments.

This enables the optimal gain setting to match the current and sensor values that vary depending on the measurement conditions.

In addition, if an output amplifier gain of x10 is used, a maximum gain setting of 10^{11} V/A is possible.

Fast Response and Stable Operation

The fast response of 0.7 μ s at 10^6 V/A gain enables support for fast pulse response signal processing in optical systems. Our unique circuit design technology enables stable operations even with the capacitance of the connecting cables and sensors, eliminating any concerns about oscillation. In addition, overshoot and ringing do not occur even for pulse responses.

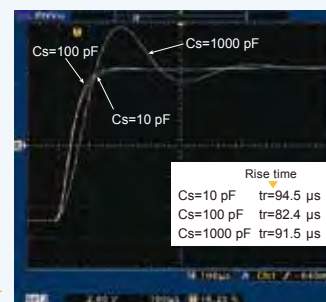
By achieving both fast response and broad bandwidth, as well as stable operation even with additional capacitance on the input side, the CA5350 supports a variety of sensor types.

Pulse response characteristics

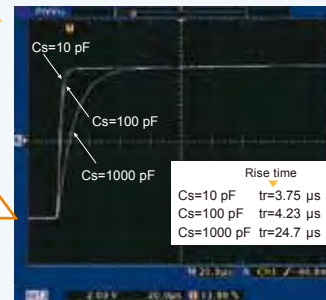
Gain: 10^9 V/A

Cs: Input-ground capacitance

Conventional current amplifiers



CA5350



Ringing and overshoot hardly occur.

Current Suppression

For photoelectric conversion elements such as photodiodes and photo transistors, in the absence of incident light, a weak current called a dark current will flow.

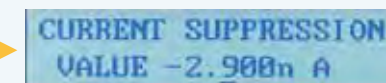
In a current amplifier with high gain, a small DC current input becomes a large voltage when output, and the amplifier is saturated and measurement becomes impossible.

The built-in suppression current source is adjustable to cancel the input of such dark current.

The current suppression setting can be selected in six ranges from ± 8 nA to ± 800 μ A.

In addition, the auto-suppression function can be used to automatically set the range and current value required to suppress the dark current.

Current suppression setting screen



Low Noise

Built-in filters and DC power supply

The CA5350 achieves an ultra-low noise with an input-referred noise of 2.5 fA/ $\sqrt{\text{Hz}}$ (at 10^{10} V/A, 55 Hz).

In addition, in order to remove noise components and to improve the signal-to-noise ratio (SN ratio), the built-in filter can be set to a response speed in the range of 1 μ s to 300 ms to optimize the SN ratio and response speed depending on the application.

And furthermore, in our pursuit of the low noise operation that is essential to the amplification of a weak current, we have adopted a low noise DC power supply in the power supply section using our own unique technology.

Filter response speed (rise time) setting screen



Built-in System Features

Interfaces, input and output terminals

The standard-equipped USB and GPIB interfaces support remote control and integration of the CA5350 into an automatic measurement system.

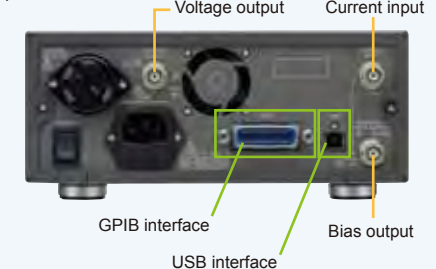
Since input and output terminals are provided on both the front and rear panels, you can choose the terminals depending on how you are connecting to sensors or other equipment.

In addition, the half-rack size makes the integration of multiple units easy.

Front panel



Rear panel



For system measurements that combine a variety of measurements.



The CA5350 programmable current amplifier can be combined with various other devices such as a lock-in amplifier, digital oscilloscope, and data acquisition system to support system measurements.

*Note: Optional single-unit and double-unit rack mount brackets are available.

Applications

- Beam position monitoring for storage rings and synchrotrons
- I-V characteristic measurement of organic thin film devices
- Gate leakage current measurement of devices such as field-effect transistors (FET) and insulated-gate bipolar transistors (IGBT)
- Detection of tunneling current of scanning tunneling microscopes (STM)
- Detection of conductive probe current for atomic force microscope (AFM) current measurement
- As a preamplifier for a lock-in amplifier

Depend on sensors and applications — Supporting research with a variety of functions

- Bias power supply -8 V to $+8$ V
Bias power supply for applying a bias voltage to a variety of sensors
- Display backlight brightness setting
3-level setting, including OFF
Enables use in light-sensitive experiments.
- Setting memory: 10 sets

■ Input section

Input type			DC coupling unbalanced input	
Input connectors			Isolated BNC receptacle. Input switchable between front panel and rear panel.	
Non-destructive maximum input current			±30 mA	
Gain setting (V/A)	Maximum rated input current		Input impedance (Supplementary value)	Input-referred noise current density ¹ (Supplementary value)
	Output amplifier gain setting			
	x1	x10		
10 G	±1 nA	±100 pA	30 kΩ (@100 Hz)	2.5 fA/√Hz (@55 Hz)
1 G	±10 nA	±1 nA	10 kΩ (@1 kHz)	6 fA/√Hz (@200 Hz)
100 M	±100 nA	±10 nA	3 kΩ (@1 kHz)	15 fA/√Hz (@200 Hz)
10 M	±1 μA	±100 nA	1 kΩ (@1 kHz)	45 fA/√Hz (@1 kHz)
1 M	±10 μA	±1 μA	400 Ω (@1 kHz)	150 fA/√Hz (@1 kHz)
100 k	±100 μA	±10 μA	300 Ω (@1 kHz)	750 fA/√Hz (@1 kHz)
10 k	±1 mA	±100 μA	10 Ω (@1 kHz)	6 pA/√Hz (@1 kHz)

*Note 1: When input: open, input: front, filter setting: 300 μs (10 G V/A), 30 μs (1 G V/A to 10 kV/A), with no additional input capacitance.

■ Current suppression section

Range	6 ranges (8 nA, 80 nA, 800 nA, 8 μA, 80 μA, 800 μA) or OFF	
Setting range	8 nA range	–8.000 nA to +8.000 nA setting resolution 1 pA
	80 nA range	–80.00 nA to +80.00 nA setting resolution 10 pA
	800 nA range	–800.0 nA to +800.0 nA setting resolution 100 pA
	8 μA range	–8.000 μA to +8.000 μA setting resolution 1 nA
	80 μA range	–80.00 μA to +80.00 μA setting resolution 10 nA
	800 μA range	–800.0 μA to +800.0 μA setting resolution 100 nA
Setting accuracy (Supplementary value)	8 nA range	± (3.0% of setting + 0.15% of range)
	80 nA range	± (1.5% of setting + 0.15% of range)
	800 nA range	± (0.8% of setting + 0.15% of range)
	8 μA range and higher	± (0.6% of setting + 0.15% of range)

*Note: Auto suppression function is available to automatically select and set the current suppression range and current value required to cancel the input current.

■ Amplification section

Gain and accuracy (DC)			
Setting (V/A)	Output amplifier gain setting x1	Output amplifier gain setting x10	
10 G	1×10 ¹⁰ ±1.0%	1×10 ¹¹ ±1.0%	
1 G	1×10 ⁹ ±1.0%	1×10 ¹⁰ ±1.0%	
100 M	1×10 ⁸ ±0.5%	1×10 ⁹ ±0.5%	
10 M	1×10 ⁷ ±0.3%	1×10 ⁸ ±0.3%	
1 M	1×10 ⁶ ±0.25%	1×10 ⁷ ±0.25%	
100 k	1×10 ⁵ ±0.25%	1×10 ⁶ ±0.25%	
10 k	1×10 ⁴ ±0.25%	1×10 ⁵ ±0.25%	
Frequency characteristics (When output amplifier gain: x1, filter: OFF, with no additional input capacitance)			
Setting (V/A)	within +0.5 dB / –3 dB	Response speed ² (Supplementary value)	Reference frequency
10 G	DC to 14 kHz	25 μs	10 Hz
1 G	DC to 70 kHz	5 μs	
100 M	DC to 175 kHz	2 μs	
10 M	DC to 350 kHz	1 μs	
1 M			
100 k	DC to 500 kHz	0.7 μs	
10 k			
Output amplifier gain		Switchable between x1 and x10, gain of the converted current-voltage	
Filter	Setting range	Response speed (rise time): 1 μs to 300 ms, 1 to 3 sequences, or OFF	
	Setting accuracy	Within ±20% of set time (10% to 90% of rise time) (Supplementary value)	
	Filter characteristics	Low-pass filter (LPF), linear phase type	
	Attenuation slope	12 dB/oct	
Input/output phase		Reverse phase (When current flows into the input connector, output has negative potential.)	

*Note 2: Rise time of the square wave output waveform (10% to 90%).

■ Output section

Output type	DC coupling unbalanced output
Output connectors	Provided on front and rear panels. Same signal is output to isolated BNC receptacle connectors on front and rear panels.
Maximum output voltage	±10 V (When no load)
Maximum output current	±10 mA, Total current of front and rear connectors.
Output impedance	50 Ω (Supplementary value)
Output offset voltage	within ±30 mV (Gain setting: 10 G V/A) within ±20 mV (Gain setting: 10 k to 1 G V/A) (When input: open, current suppression: OFF, output amplifier gain: ×1)

■ DC bias voltage output section

Output type	DC coupling unbalanced output
Output connectors	Provided on front and rear panels. Same signal is output to isolated BNC receptacle connectors on front and rear panels.
Setting range	–8.000 V to +8.000 V, setting resolution: 0.001 V
Setting accuracy	± (1.0% of setting + 20 mV) (When no load)
Maximum output current	±2 mA, Total current of the front and rear connectors.
Output impedance	50 Ω (Supplementary value)

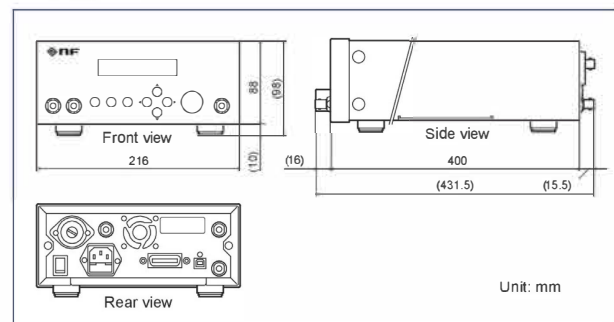
*Note: DC bias voltage polarity is reversed when output.

Example: With a +1.000 V setting, the DC bias voltage output at the BNC connector is –1.000 V.

■ General

Display	Monochrome LCD, with 3-level backlight brightness setting (including OFF)
Setting memory	10 sets (1 set is fixed for use by factory default settings)
Input and output ground	Input (CURRENT INPUT), output (INVERTING OUTPUT), bias output (INVERTING BIAS OUTPUT) signal grounds are insulated from the chassis. (Signal grounds are common.) Breakdown voltage between signal ground and chassis: 42 Vpk maximum (DC + AC peak)
External control	GPIB: IEEE488.1 USB: USB 1.1 full speed, device class CDC *Note: USB driver can be downloaded from our website.
Power supply	100, 120, 220, 240 VAC ±10% (250 V or less) 50 Hz/60 Hz ±2 Hz, Power consumption: 40 VA or less Overvoltage category: II
Temperature and humidity range	Rated performance: 23°C ± 5°C, 5% to 85% RH (Absolute humidity: 1 to 25 g/m ³ , non-condensing) Operation: 0°C to +40°C, 5% to 85% RH (Absolute humidity: 1 to 25 g/m ³ , non-condensing) Storage: –10°C to +50°C, 5% to 95% RH (Absolute humidity: 1 to 29 g/m ³ , non-condensing)
Dimensions	216 (W) × 88 (H) × 400 (D) mm (excluding protrusions)
Weight	Approx. 5.0 kg (excluding accessories)
Accessories	Power cord: 1, fuse: 1, instruction manual: 1

■ Dimensions



■ Option

- Rack mount brackets (Single-unit, inch)
- Rack mount brackets (Double-unit, inch)
- Rack mount brackets (Single-unit, metric)
- Rack mount brackets (Double-unit, metric)

- Product appearance and specifications are subject to change without notice.
- Before purchase, contact us to confirm the latest specifications, price and delivery date.



Input	
Coupling	AC, DC
Connector	BNC-R
Input mode	A-B (balance) A (FLOAT) (unbalance), A (GND) (unbalance)
Impedance	100 M Ω (nominal value), ≤ 50 pF in parallel (A and B) 0.015 μ F (nominal value) at AC coupling
Common mode voltage	± 5 V (DC to 100 Hz)
CMRR	≥ 100 dB (DC to 100 Hz)
Input referred noise	≤ 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 μ V/ $^{\circ}$ C (supplementary value)
Nondestructive maximum voltage	± 12 V at DC coupling DC ± 40 V, AC 12 Vpk at AC coupling
Output	
Connector	BNC-R (unbalance)
Maximum Voltage	± 5 V (load ≥ 2 k Ω , DC to 500 kHz)
Maximum Current	± 2.5 mA
Impedance	50 Ω (nominal value) (400 Hz)
Input-output Characteristic (output voltage = 1 Vrms)	
Gain	$\times 100$ (40 dB) ± 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	≤ 0.03 % (at 1 kHz)

Power Supply and Generals	
Input voltage	± 15 V / ± 20 V / ± 24 V ± 5 %
Input current	± 50 mA
Connector	HR10-7R-4P (Hirose Electric Co., Ltd. equivalent)
Power indicator	Possible to turn off the lights.
Operating temperature and humidity	0 to +40 $^{\circ}$ C, 5 to 85 %RH, absolute humidity 1 g/m 3 to 25 g/m 3 , non-condensing
Safety	EN 61010-1 : 2010 EN 61010-2-030 : 2010
EMC	EN 61326-1 : 2013 (Group 1, Class A)
RoHS	Directive 2011/65/EU
Warm-up time	30 minutes
Dimensions(mm)	100(W) $\times$ 48(H) $\times$ 80(D) (excluding protrusions)
Weight	Approx. 250 g, except for accessories
Accessories	Coaxial cable (BNC-BNC 1 m)
Option	Instruction manual DC cable 2m (PA-001-2372) DC cable 2m (PA-001-2791)

DC Cable (2 m)



Accessory PA-001-2372

for LI5645, LI5650, LI5655, LI5660,
LP5391, LP5392, LP5393, LP5394



Option PA-001-2791

for LI5630, LI5640, PS-70A

**COSINUS Messtechnik - Ihr Partner für Messlösungen
in allen elektrischen und physikalischen Anwendungen**

COSINUS Messtechnik GmbH

Rotwandweg 4

82024 Taufkirchen

Tel.: 089 / 66 55 94 - 0

Fax: 089 / 66 55 94 -30

**office@cosinus.de
www.cosinus.de**