



# NF PRODUCTS CATALOG

[www.nfcorp.co.jp/english/](http://www.nfcorp.co.jp/english/)

**MEASUREMENT  
INSTRUMENTS**

**POWER  
SUPPLIES**

**FUNCTION  
DEVICE**

**CUSTOMIZED  
PRODUCTS**

## NF Corporation

*(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches  
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: [tem@es-france.com](mailto:tem@es-france.com) - Site Web: [www.es-france.com](http://www.es-france.com)*

CONTENTS

FUNCTION GENERATORS ..... 3

IMPEDANCE MEASUREMENTS ..... 5

FREQUENCY RESPONSE ANALYZERS ..... 7

LOCK-IN AMPLIFIERS/PREAMPLIFIERS ..... 9

AC VOLTMETERS ..... 13

FILTERS ..... 14

MEASUREMENT SYSTEMS ..... 15

AC POWER SOURCES ..... 17

BIPOLAR AMPLIFIERS ..... 24

FUNCTION MODULES ..... 29

CUSTOMIZED PRODUCTS ..... 30

NOTES

- **Power line voltage**  
Some equipments are basically designed to operate on AC100 V, 50 Hz/60 Hz. The AC input can be modified to suit the requirements in your area. You can request to specify the voltage required when you place the order.
  - **Dimensions and weights**  
The dimensions of all the instruments shown are given in approximate value in order of Width, Height, and Depth. The weights are also approximate values. Handles, rubber legs and the like are not included in the dimensions and weights given in this catalog.
  - **Prices and quotations**  
No prices are given in this catalog. For quotations please contact us or our distributors in your area.
  - **For further information**  
More detailed specifications are available based upon your request.
- Specifications are subject to change without notice.**

WARRANTY

All NF products are warranted against defect in materials and workmanship for one year from the date of delivery to the original purchaser.

For repair or service under warranty, instruments must be returned to a distributor in your area.

# FUNCTION GENERATORS

## MULTIFUNCTION GENERATOR

WF1967/WF1968

An function generator equipped with features beyond high-performance and multi-functions

WAVE FACTORY



1ch, 200 MHz  
WF1967



2ch, 200 MHz  
WF1968

- Frequency range: 0.01  $\mu$ Hz to 200 MHz max.
- Amplitude resolution: approx. 16 bit
- Output voltage: max. 20 V<sub>p-p</sub>/open, resolution: 0.1 mV<sub>p-p</sub>
- Low jitter < 85 psrms ● Low distortion < 0.04%
- Output waveform: Sine, Square, Pulse, Ramp, Noise, DC, Arbitrary waveforms and pre-installed 25 types waveforms
- Arbitrary wave: 420 MS/s, 4 Mi\* words \*Mi: 2<sup>20</sup> = 1048576.
- Oscillation modes: Continuous, sweep, burst, sequence, internal/external modulation
- Functional sub-output works as a four-phase (WF1968) and a two-phase signal generator (WF1967).
- "Synclator" function, automatically synchronize with a signal input from an external source
- 2-channel operation (WF1968 only)

## SPECIFICATIONS

### Frequency and phase

Frequency range  
Sine: 0.01  $\mu$ Hz to 200 MHz, square: 0.01  $\mu$ Hz to 70 MHz, pulse: 0.01  $\mu$ Hz to 70 MHz, ramp: 0.01  $\mu$ Hz to 20 MHz, parameter-variable: 0.01  $\mu$ Hz to 20 MHz, noise: select from 100 M/30 M/10 M/3 M/1 M/300 k/100 kHz (equivalent bandwidth), DC: none, arbitrary: 0.01  $\mu$ Hz to 20 MHz  
Frequency setting resolution: 0.01  $\mu$ Hz (< 50 MHz), 0.1  $\mu$ Hz (50 MHz  $\leq$ )  
Frequency accuracy\*1:  $\pm$  (3 ppm of setting + 6 pHz)  
Phase setting range: -1800.000° to +1800.000° (resolution 0.001°)

### Output characteristics

Amplitude : 0 V<sub>p-p</sub> to 20 V<sub>p-p</sub>/open, 0 V<sub>p-p</sub> to 10 V<sub>p-p</sub>/50  $\Omega$ , resolution 4 digits or 0.1 mV<sub>p-p</sub>  
DC offset :  $\pm$ 10 V/open, resolution 4 digits or 0.1 mV<sub>p-p</sub>  
SYNC/SUB OUT:  
Synchronization, sub-waveform (sine, square, ramp (symmetry), rising ramp, falling ramp, noise and arbitrary), internal modulation signal, sweep X drive

### Signal characteristics

Sine Amplitude characteristics\*1:  $\pm$ 0.1 dB (up to 100 kHz)  
Total harmonic distortion\*1: 0.04% or less (20 Hz to 20 kHz)  
Square Duty variable: 0.0000% to 100.0000%  
Pulse Pulse width: 0.0001% to 99.9999% (duty), 6.88 ns to 99.999 Ms (time)  
Ramp Range of symmetry: 0.00% to 100.00%  
Parameter-variable waveform (25)  
Steady sine group, Transient sine group, Pulse waveform group, Transient response group, Surge group, Other group  
Arbitrary waveform  
Waveform length: 4Ki\* to 1Mi words, resolution: 16 bit  
Sampling rate: 420 MS/s, number of waveforms: 128 \*Ki=2<sup>10</sup>

### Modulation

Types : FM, FSK, PM, PSK, AM, DC offset modulation and PWM  
Source : Internal/External modulation (selectable)

### Sweep

Types : frequency, phase, amplitude, DC offset and duty  
Mode : Continuous, Single-shot, Gated single-shot

### Burst/Gate/Trigger

Burst mode : Auto burst, trigger burst, gate and triggered gate  
Trigger : Independent for each channel, manual trigger

\*1: Guaranteed numeric value. Other numeric values are nominal or typical (typ.) values.

### Synclator Function

Frequency range : 20 Hz to 10 MHz  
Target : External trigger input terminal

### Sequences

Control parameters: Step time, hold operation, jump destination, jump count, step stop phase, branch operation, step termination control and step synchronization code output  
Number of waveforms: 128, sequences: 10, steps max.: 255  
Step time: 0.1 ms to 1,000 s (resolution 4 digits or 0.01 ms)

### 2-Channel Ganged Operation (WF1968 only)

Two channels independent, 2-phases (same frequency), constant frequency difference, constant frequency ratio, differential output (reverse phase), differential output 2 (Only DC offset is reversed)

### Other Functions

External frequency reference input/output, External addition input, Multi-I/O, Phase synchronization, Synchronization of multiple units, User defined unit, Setting memory, Control and setting at power-on operation

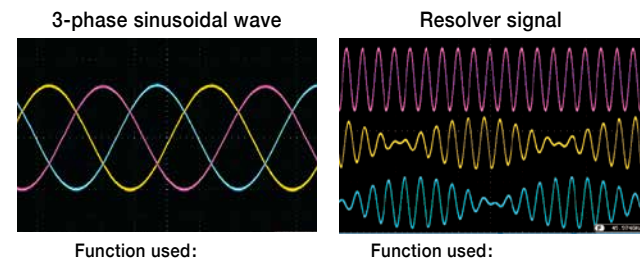
### General

Display: 4.3 inch TFT color LCD  
Interface: GPIB, USB, LAN (option)  
Power supply: AC100 V to 230 V  $\pm$ 10% (250 V or lower.) 50 Hz/60 Hz  $\pm$ 2 Hz  
Power consumption: WF1967: 65 VA or lower. WF1968: 85VA lower.  
Dimensions (mm) 216 (W) $\times$ 132.5 (H) $\times$ 332 (D) (not including protrusions)  
Weight: Approx. 3.0kg (main unit excluding accessories)

### Application software

Sequence editor: Sequence editing, display, transfer, device control  
Arbitrary waveform editor: Arbitrary waveform editing, display, transfer, device control

## WAVE SAMPLE



## MULTIFUNCTION GENERATOR

WF1947/WF1948/WF1973/WF1974

Effortless waveform generation through an intuitive graphical user interface

WAVE FACTORY

- Low noise ● Low Distortion ● 16 bit Resolution

- Useful programmable functions



1ch, 30 MHz  
WF1947



2ch, 30 MHz  
WF1948



1ch, 30 MHz  
WF1973



2ch, 30 MHz  
WF1974

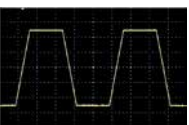
- Frequency range: 0.01  $\mu$ Hz to 30 MHz
- Waveform amplitude resolution: WF1947/WF1948: 16 bit WF1973/WF1974: 14 bit
- Various types of output waveform: Sine, Square (duty variable), Pulse, Ramp wave, Noise, DC, Arbitrary waveforms
- Pre-installed 25 types waveforms (WF1973/WF1974)
- Sequence function (WF1973/WF1974)  
Output parameters sequentially such as waveform, frequency, amplitude, DC offset, phase and square wave duty.
- Various oscillation modes: Continuous, sweep, burst (auto burst, trigger burst, gate, triggered gate), internal and external modulation.

- 2-channel operation (WF1948/WF1974)  
· Independent · 2-phase · Constant frequency difference  
· Constant frequency ratio · Differential output
- Various functions  
External 10 MHz frequency reference input, Synchronous operation of multiple units, External additional input, User-defined units, setting memory
- Other features  
Input/output signal ground insulated, Power input: 90 V AC to 250 V AC, QVGA TFT color LCD, USB/GPIB
- Control software bundled

## SAMPLE WAVEFORMS



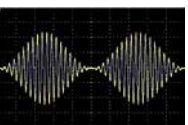
Sine wave



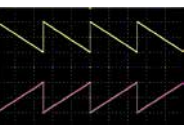
Pulse wave



Ramp wave



Amplitude modulation



Differential output



Arbitrary wave

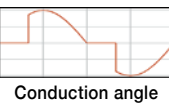
## Parameter Variable Waveforms (WF1973/WF1974)

The parameter-variable waveform offers an easy-order waveform system. The waveform based on your requests can be easily generated : just need to select a preprogrammed waveform and edit it using parameters specifically for your requirements. 25 types of waveforms including circuit-related, communication-related and machine-related waveforms are available.

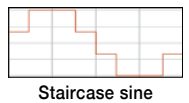
[Ex.]  
CF control sine  
Crest factor (1.41 to 10.00)



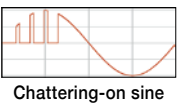
[Examples]



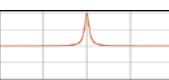
Conduction angle



Staircase sine



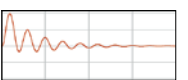
Chattering-on sine



Lorentz pulse



Sin(x)/x



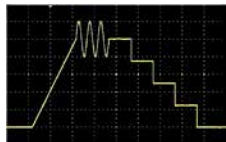
Oscillation surge

## DIGITAL FUNCTION GENERATOR

DF1906



- High accuracy:  $\pm$ 25 ppm
- Wide frequency range: 0.1 mHz to 2 MHz, Resolution: 0.1 mHz
- Sine, square, triangle, arbitrary waveform, DC
- Arbitrary waveform editor bundled
- Oscillation modes: continuous, trigger, gate and burst ● USB



Sequence editor



IMPEDANCE MEASUREMENTS

IMPEDANCE ANALYZER

ZA57630

From electronic parts and semi-conductor devices to material and substance characteristics assessments.



- Basic accuracy: ±0.08%
- Measurement frequency: 10 µHz to 36 MHz
- Measurement impedance range: 10 µΩ to 100 GΩ (Mode: IMPD-EXT)
- Measurement signal amplitude: 0.01 mVrms to 3 Vrms / 0.1 µArms to 60 mArms
- Measurement time: 0.5 ms/points
- Measurement parameters:  
Z, R, X, Y, G, B, Ls, Lp, Cs, Cp, Rs, Rp, θz, θy, D, De, Dμ, Q, V, I, εs, εs', εs'', μs, μs', μs'', FREQUENCY
- Four measurement modes
  - IMPD-3T (default measurement mode)
  - IMPD-2T (high-frequency measurement mode)
  - IMPD-EXT (expanded measurement mode)  
Allows external amplifiers, shunt resistors or other devices to be connected.
  - G-PH (gain/phase measurement mode)

SPECIFICATIONS

Measurement mode

| Mode                         | IMPD-3T (default measurement mode)   | IMPD-2T (high-frequency measurement mode) |
|------------------------------|--|---|
| Basic accuracy               | ±0.08%   | ±0.32%                                    |
| Measurement frequency        | 10 µHz to 10 MHz   | 10 MHz to 36 MHz                          |
| Measurement signal amplitude | Voltage: 0 to 3.00 Vrms, current: 0 to 60 mArms<br>Setting resolution: 3 digits or 10 µVrms (voltage), 100 nArms (current), whichever is the largest |   |
| DC bias                      | Voltage: -5.00 V to +5.00 V, current: -100 mA to +100 mA   |   |
| HV DC bias                   | Voltage: -40.00 V to +40.00 V (1 kHz or higher, no load)   |   |
| Range (Ω)                    | 10, 100, 1k, 10k, 100k, 1M, AUTO   | 1, 10, 100, 1k, AUTO                      |
| Measurement parameters       | Z, R, X, Y, G, B, Ls, Lp, Cs, Cp, Rs, Rp, θz, θy, D, De, Dμ, Q, V, I, εs, εs', εs'', μs, μs', μs'', FREQUENCY  |   |

| Mode                   | IMPD-EXT (expanded measurement mode)   | G-PH (gain/phase measurement mode)  |
|------------------------|--|---|
| Basic Accuracy         | ±0.12%   | Gain: ±0.01dB, Phase: ±0.06°  |
| Measurement frequency  | 10 µHz to 36 MHz   |   |
| OSC                    | AC signal amplitude setting range  | (0 to 3.0) ×  K  Vrms (K: DUT drive amplifier gain setting)   |
|                        | DC bias setting range  | -5.00 × K V to +5.00 × K V (K: DUT drive amplifier gain setting)  |
| PORT1/<br>PORT2        | Range (Vrms)   | 10m, 20m, 50m, 100m, 200m, 500m, 1, 2, 5, 7, AUTO   |
|                        | Over detection   | 0 to 7 Vrms   |
| Measurement parameters | Z, R, X, Y, G, B, Ls, Lp, Cs, Cp, Rs, Rp, θz, θy, D, De, Dμ, Qc, Ql, V1, V2, εs, εs', εs'', μs, μs', μs'', FREQUENCY | Gain: dBR (gain dB), R (absolute gain), a (real part of gain), b (imaginary part of gain), θ, GD (group delay), V1, V2, |

Measured signal control section (Sweep)

|         |  |
|---------|--|
| Item    | Frequency, measurement signal amplitude, DC bias, and time (zero span)   |
| Control | SWEEP UP: Sweeps in the direction of lower limit to upper limit.<br>SWEEP DOWN: Sweeps in the direction of upper limit to lower limit.<br>SPOT: Measures with fixed frequency<br>REPEAT: Repeats SWEEP or SPOT |
| Density | 3 to 2,000 steps/sweep   |
| Time    | Frequency: from 0.5 ms/point, Signal amplitude: from 2 ms/point  |

Measurement Processing Section

|   |   |
|---|---|
| Resonant frequency tracking function          | Automatically keeps the measurement frequency tracked to the resonance frequency of the DUT.                            |
| Equivalent circuit estimation function*1      | Estimate each constant of the equivalent circuits from the frequency sweep measured results.                            |
| Piezoelectric constant calculation function*1 | Calculates the piezoelectric related constants from the frequency sweep measurement results.                            |
| Sequence measurement function                 | Measurements according to the contents of setting memory (condition file).  |
| Comparator                                    | SPOT : measurement results Max. 14 bins<br>SWEEP: measurement results upper limit and lower limit comparison            |
| Error correction function                     | Open correction*1, Short correction*1, Load correction*1, Port extension*1, Equalizing*2, Self-calibration*3 and so on. |

\*1: excluding G-PH mode \*2: G-PH mode only \*3: IMPD-EXT, G-PH mode only

Other functions

|                 |  |
|-----------------|--|
| Display unit    | 8.4-inch color TFT-LCD (SVGA) with touch panel   |
| Graphs          | Bode plot, Nyquist plot, Cole-Cole plot  |
| Graph traces    | 9 traces of measurement data (MEAS) and reference data   |
| Marker display  | Markers are displayed on a graph, and the data at a marker position is displayed as a numerical value.   |
| Memory          | Conditions: 32 sets (per measurement mode)<br>Sweep measurement data up to 32 sets can be saved<br>REF data (up to 8 sets) that can be displayed on a graph together with measurement data (MEAS). |
| External memory | Connector: Front panel, USB-A connector<br>Saved items: Setting conditions, measurement data (MEAS) and reference data (REF 1 to 8)<br>File format: CSV and BMP                                    |
| Interface       | GPIB, USB, LAN, RS-232, External monitor (Analog VGA), (Reference clock input/output, Handler interface)   |

Generals

|                     |   |
|---------------------|---|
| Power input         | AC 100 V to 230 V ±10 %, however 250 V or less        |
| Power consumption   | Max. 100 VA   |
| External dimensions | 430 (W) × 177 (H) × 350 (D) mm (excluding protruding) |
| Weight              | Approx. 7.0 kg  |

LCR METER

ZM2371/ZM2372/ZM2376

High-speed, high-precision, stable measurement



ZM2376

- Basic accuracy: ±0.08%, display resolution of 6 digits (max.)
- Measurement speed: max. 2 ms at 1 kHz/1 MHz
- Frequency range:  
1 mHz to 100 kHz, 5-digit resolution (ZM2371/ZM2372)  
1 mHz to 5.5 MHz, 6-digit resolution (ZM2376)
- Measurement signal level: max. 5 Vrms, 3-digit resolution
- Measurements parameters: Lp, Ls, Cp, Cs, Rp, Rs, |Z|, |Y|, G, Q, D, θ, X, B, Rdc
- DC resistance measurement
- 4-terminal contact check function (ZM2372)
- Contact check and low capacitance check (ZM2376)

SPECIFICATIONS

|                           |  |                                   |   |
|---------------------------|--|-----------------------------------|---|
| Frequency range           | 1 mHz to 100 kHz<br>(5-digit resolution, ZM2371/ZM2372)<br>1 mHz to 5.5 MHz (6-digit resolution, ZM2376)   | Deviation display                 | Display deviation and deviation % from a preset reference value   |
| Measurement parameters    | Primary parameters:<br>Lp, Ls, Cp, Cs, Rp, Rs,  Z ,  Y  and G<br>(Automatically selectable)<br>Secondary parameters:<br>Q, D, θ, X, B, Rp, Rs, G, Lp and Rdc | Comparator                        | Primary parameters:<br>9 bins max. (ZM2371)<br>14 bins max. (ZM2372/ZM2376)<br>Original measured value / deviation / deviation % can be sorted.<br>Secondary parameter:<br>Upper limit and lower limit comparison<br>Original measured value / deviation / deviation % can be sorted. |
| Basic accuracy            | 0.08%  | Handler interface (ZM2372/ZM2376) | Signal isolation<br>Input signals: trigger, key lock, setting / correction value memory designation<br>Output signals: comparator results (BIN1 to BIN14)   |
| Measurement signal levels | 10 mVrms to 5.00 Vrms (3-digit resolution)<br>1 µArms to 200 mArms (3-digit resolution)  | Interface                         | USB, RS-232, GPIB (ZM2372/ZM2376)<br>LAN (Option for ZM2376)  |
| Internal DC bias          | 0 V to +2.5 V (ZM2371/ZM2372)<br>0 V to +5 V (ZM2376)  | Power                             | AC100 V to 230V ±10%, 250 V max.  |
| Trigger                   |  | Dimensions (mm)                   | 260 (W) × 88 (H) × 220 (D) (ZM2371/ZM2372)<br>260 (W) × 88 (H) × 280 (D) (ZM2376)   |
| Signal                    | INT (automatic continuous trigger), MAN (manual), EXT (handler interface), BUS (remote control)  | Weight                            | ZM2371 : approx. 2.0 kg, ZM2372: approx. 2.1 kg, ZM2376: approx. 2.4 kg   |
| Delay time                | 0.000 s to 999.999 s   |                                   |   |
| Triggered drive           | Drive only at measurement/continuous drive selectable  |                                   |   |
| Measurement speed         | RAP (rapid)/FAST/MED (medium)/SLOW / VSLO (very slow)<br>Switchable between 5 levels from 2 ms to 501 ms   |                                   |   |

TEST FIXTURES & TEST LEADS for LCR METERS

An assortment of test fixtures and test leads are available as jigs and tools for measuring components and materials with the LCR meter. Select the type that suits the target components.

2324 Four-terminal alligator-clip test leads

Use these test leads with low-impedance four-terminal components, including those which have separate current supply terminals and voltage test terminals.



2325A (L/M) Kelvin-clip test leads

The two test lead clips enable four-terminal connections. The 2325A can be used to test large or unusually shaped components that cannot be easily inserted into the direct test fixture. Select between two types : the standard L type or the M type with smaller clips.



ZM2363 Test fixture

This text fixture is for measuring directly connected lead-ended components. The ZM2363 enables bend free measurement of both parallel-lead type and opposing-lead type components.



ZM2366/2326A Test lead for chip components

Features tweezer-type test leads for easy measurement of surface-mounted chip components, etc. The tip's measurement contact is removable.



ZM2391 Three-terminal alligator-clip test leads

A three-terminal type is also available for simple measurements.



ZM2392 Kelvin-clip test leads

The ZM2392 provides test leads for simpler measurements.



ZM2393/ZM2394/ZM2394H Chip test fixture

This text fixture for SMD and chip elements is directly connected to the panel surface for measuring. Its small floating capacitance makes for easier zero-point correction.



ZM2328/ZM2329 DC voltage bias adapter



FREQUENCY RESPONSE ANALYZERS

FREQUENCY RESPONSE ANALYZER

FRA51615



FRA51615 is a best fit for measuring frequency response for many industries from electronic circuits, electronic components, and materials for mechatronics and electrochemical applications. Equipped with high performance and high functionalities to support different industries, FRA51615 provides high reproducible measurement data and more efficient testing operations.

- Frequency range: 10 μHz to 15 MHz
- Measurement speed: 0.5 ms/point
- Basic accuracy: gain: ±0.01 dB, phase: ±0.06°
- Maximum measurement voltage: 600 Vrms
- Maximum input voltage: 600 V CAT II/300 V CAT III
- Isolation: 600 V CAT II/300 V CAT III
- Dynamic range: 140 dB
- Functions to ensure reliable and highly accurate measurements
- Impedance measurement: Z/R/X/Y/L/C/R/V/I/D/Q

APPLICATIONS

- Measurements of resonance characteristics of piezo element
- Measurements of characteristics of multi-layer ceramic capacitor to which voltage is applied
- Loop gain measurements of DC-DC converters
- Measurements of transmission efficiency on wireless charging
- Measurements of mechanical servo characteristics

SPECIFICATIONS

|                  |   |
|------------------|---|
| Oscillator       |   |
| Waveform         | Sinusoidal, square, or triangular   |
| Frequency range  | 10 μHz to 15 MHz, Res: 10 μHz   |
| AC amplitude     | 0 to 10 Vpk   |
| DC bias          | -10 V to 10 V, Res: 10 mV   |
| Output impedance | 50 Ω  |
| Output control   | QUICK, SLOW, Function for turning off at 0° phase, Function for changing the frequency at 0°phase |
| Sweep            | Sweep density 3 to 20,000 steps/sweep, linear/log   |
| Isolation        | 600 V CAT II or 300 V CAT III   |

|                             |   |
|-----------------------------|---|
| Inputs                      |   |
| Input channels              | 2   |
| Input impedance             | 1 MΩ  |
| Measurement range           | 30 mV to 600 V (rms), and AUTO. CH1 and CH2 can be set independently. |
| Isolation                   | 600 V CAT II or 300 V CAT III   |
| Frequency range             | 10 μHz to 15 MHz  |
| Maximum measurement voltage | 600 Vrms  |
| Over-level detection        | 0 to 600 Vrms   |
| Dynamic range               | 140 dB (10 Hz to 1 MHz), 80 dB (1 MHz to 15 MHz)                      |

|                        |   |
|------------------------|---|
| Measuring process      |   |
| Measurement operations | UP SWEEP, DOWN SWEEP, SPOT, REPEAT, SINGLE  |
| Functions              | Measurement delay function, Start delay function, Integration function, Automatic integration function, Amplitude compression, Automatic high density sweep (slow sweep), and Sequence measurement function |

|                   |   |
|-------------------|---|
| Analyzing process |   |
| Display unit      | Gain (ratio, unitless number) or impedance  |
| Basic accuracy    | (Fixed range) Gain: ±0.01 dB, Impedance: ±0.12%, Phase: ±0.06° (30 mV to 30 V range, 200 kHz or less)<br>(Auto range) Gain: ±0.02 dB, Impedance: ±0.24 %, Phase: ±0.12° (200 kHz or less) |

|  |  |
|--|--|
| Gain measurement   |  |
| Analysis modes   | Ratio CH1/CH2, CH2/CH1 Amplitude CH1, CH2  |
| Graph types  | Bode plot, Nyquist plot, Nichols plot  |
| Measurement parameters                                       | dBR (Gain dB), θ (phase), GD (group delay), R (absolute gain), a (real part of gain), b (imaginary part of gain)         |
| Error correction   | Equalizing   |
| Impedance measurement  |  |
| (Voltage is measured at CH1 and current is measured at CH2.) |  |
| Analysis modes   | Impedance CH1/CH2, Admittance CH2/CH1, Voltage CH1, Current CH2  |
| Graph types  | Bode plot, Nyquist plot, Cole-Cole plot  |
| Measurement parameters                                       | Z, R, X, Y, G, B, Ls, Lp, Cs, Cp, Rs, Rp, V(Voltage), I (current), θ (phase), D (dissipation factor), Q (quality factor) |
| Error correction   | Open / Short / Load correction, Port extension, Slope compensation   |

|                 |   |
|-----------------|---|
| General         |   |
| Memory          | Measurement data, Reference data, Error correction data |
| External memory | USB memory device                                       |
| Display unit    | 8.4-inch color TFT-LCD (SVGA) with touch screen         |
| Interface       | GPIO/USB/LAN/RS-232/VGA                                 |
| Reference clock | Input/output (10 MHz)                                   |
| Power           | Voltage AC100 V to 230 V, 250 V or less, 50 Hz/60 Hz    |
| Dimensions      | 430 mm (W) × 177 mm (H) × 350 mm (D)                    |
| Weight          | approx. 8.5 kg  |

GAIN-PHASE ANALYZER

FRA51602



APPLICATIONS

- Characteristic measurements of inverters and switching power supplies
- Measurements of transmission efficiency on wireless charging
- Measurements of mechanical servo characteristic

SPECIFICATIONS

|                  |   |
|------------------|---|
| Oscillator       |   |
| Waveform         | Sinusoidal, square, or triangular                 |
| Frequency range  | 10 μHz to 2 MHz, Res: 10 μHz                      |
| AC amplitude     | 0 to 10 Vpk                                       |
| Output impedance | 50 Ω  |
| Sweep            | Sweep density 3 to 20,000 steps/sweep, linear/log |
| Isolation        | 600 V CAT II or 300 V CAT III                     |

|                       |   |
|-----------------------|---|
| Inputs                |   |
| Input channels        | 2   |
| Input impedance       | 1 MΩ  |
| Measurement range     | 30 mV to 600 V (rms), and AUTO. CH1 and CH2 can be set independently. |
| Maximum input voltage | 600 V CAT II or 300 V CAT III   |
| Isolation             | 600 V CAT II or 300 V CAT III   |
| Dynamic range         | 140 dB (10 Hz to 1 MHz), 80 dB (1 MHz to 15 MHz)                      |

|                        |   |
|------------------------|---|
| Measuring process      |   |
| Measurement operations | UP SWEEP, DOWN SWEEP, SPOT, REPEAT, SINGLE  |
| Functions              | Measurement delay function, Start delay function, Integration function, Automatic integration function, Amplitude compression, Automatic high density sweep (slow sweep), and Sequence measurement function |

FRA51602 measures the loop gain frequency characteristics, such as inverters and switching power supplies by using frequency sweep. The two analysis inputs and oscillator outputs are independently isolated from the instrument enclosure (600 V CAT II/300 V CAT III).

- Frequency range: 10 μHz to 2 MHz
- Measurement speed: 0.5 ms/point
- Basic accuracy: gain: ±0.01 dB, phase: ±0.06°
- Maximum measurement voltage: 600 Vrms
- Maximum input voltage: 600 V CAT II/300 V CAT III
- Isolation: 600 V CAT II/300 V CAT III
- Dynamic range: 140 dB
- Auto ranging, automatic high density sweep, delay function, group delay, amplitude compression function and so on.

|                        |  |
|------------------------|--|
| Analyzing process      |  |
| Basic accuracy         |  |
| (fixed range)          | Gain: ±0.01 dB, Phase: ±0.06° (30 mV to 30 V range, 200 kHz or less)   |
| (auto range)           | Gain: ±0.02 dB, Phase: ±0.12° (200 kHz or less)  |
| Analysis modes         | Ratio CH1/CH2, CH2/CH1 Amplitude CH1, and CH2  |
| Graph types            | Bode plot, Nyquist plot, Nichols plot  |
| Measurement parameters | dBR (Gain dB), θ (phase), GD (group delay), R (absolute gain), a (real part of gain), b (imaginary part of gain) |
| Error correction       | Equalizing   |

|                 |   |
|-----------------|---|
| General         |   |
| Display unit    | 8.4-inch color TFT-LCD (SVGA) with touch screen         |
| Data memory     | Measurement data, Reference data, Error correction data |
| External memory | USB memory device                                       |
| Interface       | GPIO/USB/LAN/RS-232/VGA                                 |
| Reference clock | Input/output (10 MHz)                                   |
| Power           | AC100 V to 230 V, 250 V or less, 50 Hz/60 Hz            |
| Dimensions      | 430 mm (W) × 177 mm (H) × 350 mm (D)                    |
| Weight          | approx. 8.5 kg  |

FREQUENCY RESPONSE ANALYZER

FRA5022



- Accuracy: gain: ±0.05 dB, phase: ±0.3°
- Frequency range: 0.1 mHz to 100 kHz
- Dynamic range: 120 dB
- Isolation: 42 Vpk/30 Vrms
- Shortened measurement time for ultra-low frequencies
- Slim chassis (2U) optimal for a rack system
- Color display
- ◆ 4-ch model FRA5014 available

FRA OPTIONS & PERIPHERALS



PA-001-1840/PA-001-1841



PA-001-0368

- Signal injector probe 5055
- Impedance measuring adapter PA-001-0368
- Loop gain measuring adapter PA-001-0369
- High power measurement adapter PA-001-1840 (1 Ω)/PA-001-1841 (100 Ω)
- Test fixture adapter PA-001-1838 (1 Ω)/PA-001-1839 (100 Ω)
- Shunt resistor PA-001-0370



LOCK-IN AMPLIFIERS/PREAMPLIFIERS

DIGITAL LOCK-IN AMPLIFIER LI5660/LI5655/LI5650/LI5645

High-response,wide-band,high-stability



0.5 Hz to 11 MHz  
2 phases 2 Frequencies  
HF Input 10V Input

LI5660



0.5 Hz to 3 MHz  
2 phases 2 Frequencies

LI5655



1 mHz to 250 kHz  
2 phases 2 Frequencies

LI5650



1 mHz to 250 kHz  
2 phases 1 Frequencies

LI5645



APPLICATIONS

- Scanning probe microscope
- Ultrasonograph
- Light transmission
- Hall coefficient measurements
- Ceramic sensors
- Spintronics
- Terahertz spectroscopy
- Light absorption
- Gyroscope
- Semiconductor lasers

SPECIFICATIONS

|  | LI5660   | LI5655  | LI5650   | LI5645                                       |
|--|--|---|--|--|
| Frequency Range                          | 0.5 Hz to 11 MHz   | 0.5 Hz to 3 MHz   | 1 mHz to 250 kHz   |  |
| Signal Input                             | Voltage (A, A-B, C, HF), Current (I)   | Voltage (A, A-B), Current (I)   |  | Voltage (A, A-B)                             |
| 10 Vrms input                            | ○(C input, 0.5 Hz to 3 MHz)  | —   | —  | —  |
| HF input                                 | ○(HF input ,10 kHz to 11 MHz)  | —   | —  | —  |
| Sensitivity                              | A, A-B: 10 nV to 1 V F.S. (0.5 Hz to 3 MHz)<br>C : 1 mV to 10 V F.S. (0.5 Hz to 3 MHz)<br>HF : 1 mV to 1 V F.S. (10 kHz to 11 MHz)<br>I : 10 fA to 1 μA F.S. | A, A-B: 10 nV to 1 V F.S. (0.5 Hz to 3 MHz)<br>I : 10 fA to 1 μA F.S. | A, A-B: 10 nV to 1 V F.S. (1 mHz to 250 kHz)<br>I : 10 fA to 1 μA F.S. | A, A-B: 10 nV to 1 V F.S. (1 mHz to 250 kHz) |
| Voltage accuracy                         | A, A-B: ±0.5% (1 kHz, signal level ≥ 1 mV)<br>C : ±0.5% (≤ 20 kHz)<br>HF : ±3% (≤ 1 MHz)   | A, A-B: ±0.5% (1 kHz, signal level ≥ 1 mV)                            |  |  |
| Current accuracy                         | ±1% (nominal value)  |   |  | —  |
| Input Referred Noise Voltage             | 4.5 nV/√Hz (supplement value)  |   |  |  |
| PSD                                      | 2-phase, 2 frequencies   |   |  | 2-phase, 1 frequency                         |
| Dynamic Reserve                          | 100 dB   |   |  |  |
| Time Constant                            | 1 μs to 50 ks  |   | 5 μs to 50 ks  |  |
| Reference signal                         | External   | A, A-B, C, I: 0.3 Hz to 3.2 MHz<br>HF : 0.3 Hz to 11.5 MHz            | 0.3 mHz to 3.2 MHz   | 0.5 mHz to 260 kHz                           |
|  | Internal   | A, A-B, C, I: 0.3 Hz to 3.2 MHz<br>HF : 8 kHz to 11.5 MHz             | 0.3 mHz to 3.2 MHz   | 0.5 mHz to 260 kHz                           |
| Analog Output Max. Update Rate           | Approx. 1.5 M samples/s  |   | Approx. 780 k samples/s  |  |
| Fractional Harmonic Measurement          | (1 to 63)/(1 to 63) of fundamental wave  |   |  |  |
| Dual Frequency Simultaneous Measurements | ○  | ○   | ○  | —  |
| External 10 MHz Synchronous Input        | ○  | ○   | ○  | ○  |
| Measurement Parameter                    | X, Y, R, θ, DC, NOISE  |   |  |  |
| Automatic setting                        | Measurement, Time constant, Sensitivity, Phase, Offset   |   |  |  |
| Remote Control Interface                 | USB, GPIB, RS-232, LAN   |   |  |  |
| Display                                  | 4.3-inch WQVGA, color LCD  |   |  |  |
| Power supply                             | AC 100 V/120 V/230 V   |   |  |  |
| Dimensions (mm)                          | 430 (W) × 88 (H) × 400 (D)   |   |  |  |
| Weight                                   | Approx. 7.5 kg   |   |  |  |

- Frequency range  
LI5660: 0.5 Hz to 11 MHz\* \* HF input used  
LI5655: 0.5 Hz to 3 MHz, LI5650/LI5645: 1 mHz to 250 kHz
- Voltage measurement  
LI5660: 10 nV to 10 V\* F.S. \* C input used  
LI5655/LI5650/LI5645 : 10 nV to 1 V F.S.
- Current measurement  
LI5660/LI5655/LI5650: 10 fA to 1 μA F.S.
- Minimum time constant  
LI5660/LI5655: 1 μs, LI5650/LI5645: 5 μs
- Analog output update rate  
LI5660/LI5655: approx. 1.5 M samples/s  
LI5650/LI5645: approx. 700 k samples/s
- Simultaneous 2-frequency measurements (LI5660/LI5655/LI5650)  
Dual 2-phase sensitive detectors for simultaneous measuring for two frequency components
- Fractional harmonic measurements  
Measurements at fractional times frequencies of the fundamental wave (1 to 63)/(1 to 63)
- External reference 10 MHz synchronous input  
Can be synchronized with the reference frequency of other devices by using an external reference frequency
- Measurement parameters X, Y, R, θ, DC, NOISE
- Thin 2U size (88 mm)

- LIGHT CHOPPER 5584A (optional)  
Frequency range: 4 Hz to 400 Hz/40 Hz to 4 kHz  
Aperture: 29 mm×10 mm (4 Hz to 400 Hz)/5 mm×10 mm (40 Hz to 4 kHz)

LOW NOISE AMPLIFIER

SA-200/SA-400 SERIES

Extremely, low noise measurements with high accuracy for very small signals



SA-251F6



SA-440F5

SA-200/SA-400 series pre-amplifiers are used for detecting sub micro-Volt signals, and can achieve a ultra low noise level. Eleven models are available for meeting various requirements, such as frequency range, input type, and input impedance. SA-200/SA-400 series pre-amplifiers are best for various types of sensors.

\*CE certified: SA-240F5, SA-250F6, SA-251F6, SA-410F3, SA-440F5

APPLICATIONS

- Electromagnetic sensor for NMR/MRI systems
- High speed temperature sensor
- High precision strain gauge sensor
- Superconducting SQUID sensor for micro-magnetic detection
- High-temperature superconducting Josephson device for microwave detection
- Superconducting device in quantum computers

SPECIFICATIONS

| Single-end  | SA-200F3  | SA-220F5  | SA-240F5                         | SA-230F5  | SA-250F6                            | SA-251F6  |
|---|---|---|----------------------------------|---|-------------------------------------|---|
| Bandwidth   | DC to 800 kHz   | 1 kHz to 80 MHz   | DC to 20 MHz                     | 1 kHz to 100 MHz  | 100 Hz to 250 MHz                   | 1 kHz to 500 MHz  |
| Input type  | DC coupling   | AC coupling   | DC coupling                      | AC coupling   | AC coupling                         | AC coupling   |
| Input impedance   | 1 k/10 k/100 kΩ ±5%<br>//150 pF or less typ.          | 1 MΩ ±5%<br>//57 pF typ.  | 1 MΩ/100 MΩ/open<br>//60 pF typ. | 50 Ω ±5%  | 50 Ω                                | 50 Ω  |
| Equivalent input noise voltage density (Input terminal short circuit) | 0.7 nV/√Hz or less (1 kHz)<br>0.5 nV/√Hz typ. (1 kHz) | 0.7 nV/√Hz or less (100 kHz)<br>0.5 nV/√Hz typ. (10 kHz to 1 MHz) | 1.2 nV/√Hz (1 kHz)               | 0.35 nV/√Hz or less (100 kHz)<br>0.25 nV/√Hz typ. (10 kHz to 1 MHz) | 0.25 nV/√Hz or less (1 MHz)         | 0.25 nV/√Hz or less (1 MHz)                             |
| Equivalent input noise current density                                | 2.2 pA/√Hz typ. (10 kHz)                              | 200 fA/√Hz typ. (100 kHz)   | 5 fA/√Hz typ. (10 Hz)            | 5.0 pA/√Hz typ. (100 kHz)   | 5 pA/√Hz typ. (1 MHz)               | 8 pA/√Hz typ. (1 MHz)                                   |
| Noise figure (50 Ω system)  | —   | —   | —                                | 0.6 dB typ. (10 MHz)<br>0.8 dB typ. (100 MHz)                       | 0.6 dB (10 MHz)<br>1.0 dB (250 MHz) | 0.9 dB (10 MHz)<br>1.2 dB (250 MHz)<br>1.8 dB (500 MHz) |
| Maximum output voltage  | ±10 V, 1 kΩ   | 2.0 Vp-p, 50 Ω  | ±10 V, 1 kΩ                      | 1.8 Vp-p, 50 Ω  | 2.0 Vp-p                            | 2.0 Vp-p  |
| Output impedance  | 50 Ω ±5%  | 50 Ω ±5%  | 50 Ω                             | 50 Ω ±5%  | 50 Ω                                | 50 Ω  |
| Voltage gain  | 40±0.5 dB, 1 MΩ (1 kHz)                               | 46 ±0.5 dB, 50 Ω (1 MHz)  | 40 dB ±0.1 dB or less (1 kHz)    | 46 ±0.5 dB, 50 Ω (20 MHz)   | 40 ±0.5 dB (1 MHz)                  | 40 ±0.5 dB (1 MHz)                                      |
| Total harmonic distortion   | 0.009% typ.   | —   | 0.004% typ.                      | —   | —                                   | —   |
| Power Supply  | Through feed-through capacitor                        | Through feed-through capacitor                                    | HR10-7R-4P (73) connector        | Through feed-through capacitor                                      | HR10-7R-4P (73) connector           | HR10-7R-4P (73) connector                               |
| Operating supply voltage range  | ±15 V ±5%   | ±15 V ±5%   | ±15 V ±1 V                       | +15 V ±5%   | +15 V ±1 V                          | +15 V ±1 V  |
| Dimensions (W×D×H)  | 68 × 43 × 17.6 mm                                     | 68 × 43 × 28 mm   | 76 × 50 × 25 mm                  | 68 × 43 × 17.6 mm   | 76 × 50 × 25 mm                     | 76 × 50 × 25 mm   |
| Weight (approx.)  | 90 g  | 130 g   | 105 g                            | 90 g  | 140 g                               | 140 g   |

| Differential  | SA-410F3                                       | SA-420F5  | SA-421F5  | SA-440F5   | SA-430F5  |
|---|--|---|---|--|---|
| Bandwidth   | DC to 1 MHz                                    | 1 kHz to 70 MHz   | 30 Hz to 30 MHz   | DC to 20 MHz                                     | 1 kHz to 100 MHz  |
| Input type  | DC coupling                                    | AC coupling   | AC coupling   | DC coupling                                      | AC coupling   |
| Input impedance   | 1 k/10 k/100 kΩ ±5% or less<br>//100 pF typ.   | 1 MΩ ±5%<br>//15 pF typ.  | 1 MΩ ±5%<br>//85 pF typ.  | 1 MΩ/100 MΩ/open<br>//60 pF typ.                 | 50 Ω ±5%  |
| CMRR (Equivalent input)   | 110 dB or more (55 Hz)<br>80 dB typ. (100 kHz) | 55 dB or more (1 kHz to 10 MHz)                                     | 46 dB or more (1 kHz to 10 MHz)                                     | 90 dB or more (10 Hz to 10 kHz)<br>60 dB (1 MHz) | 80 dB or more (100 kHz),<br>90 dB typ. (100 kHz)<br>80 dB typ. (10 MHz)                 |
| Equivalent input noise voltage density (Input terminal short circuit) | 0.75 nV/√Hz typ. (1 kHz)                       | 1.2 nV/√Hz or less (100 kHz)<br>0.9 nV/√Hz typ. (100 kHz to 10 MHz) | 0.7 nV/√Hz or less (100 kHz)<br>0.5 nV/√Hz typ. (100 kHz to 10 MHz) | 1.8 nV/√Hz (1 kHz)                               | 0.45 nV/√Hz or less (100 kHz)<br>0.35 nV/√Hz typ. (10 kHz to 1 MHz)                     |
| Equivalent input noise current density                                | 4.5 pA/√Hz typ. (10 kHz)                       | 100 fA/√Hz typ. (1 kHz)   | 100 fA/√Hz typ. (100 Hz)  | 25 fA/√Hz typ. (100 Hz)                          | 7.0 pA/√Hz typ. (100 Hz)  |
| Noise figure (50 Ω system)  | —  | —   | —   | —  | 1.25 dB or less,<br>1.10 dB typ. (10 MHz)<br>1.75 dB or less,<br>1.40 dB typ. (100 MHz) |
| Maximum output voltage  | ±10 V, 1 kΩ                                    | 2.0 Vp-p, 50 Ω  | 2.0 Vp-p, 50 Ω  | ±10 V, 1 kΩ                                      | 2.0 Vp-p, 50 Ω  |
| Output impedance  | 50 Ω ±5%                                       | 50 Ω ±5%  | 50 Ω ±5%  | 50 Ω   | 50 Ω ±5%  |
| Voltage gain  | 40±0.2 dB, 1 MΩ (1 kHz)                        | 46±0.5 dB, 50 Ω (1 MHz)   | 46±0.5 dB, 50 Ω (1 MHz)   | 40 dB ±0.1 dB (1 kHz)                            | 46±0.5 dB, 50 Ω (100 kHz)   |
| Total harmonic distortion   | 0.004% typ.                                    | —   | —   | 0.006% typ.                                      | —   |
| Power Supply  | HR10-7R-4P (73) connector                      | Through feed-through capacitor                                      | Through feed-through capacitor                                      | HR10-7R-4P (73) connector                        | Through feed-through capacitor  |
| Operating supply voltage range  | ±15 V ±1 V                                     | ±15 V ±5%   | ±15 V ±5%   | ±15 V ±1 V                                       | ±15 V ±5%   |
| Dimensions (W×D×H)  | 76 × 50 × 21.1 mm                              | 68 × 43 × 28 mm   | 68 × 43 × 28 mm   | 76 × 50 × 25 mm                                  | 68 × 43 × 28 mm   |
| Weight (approx.)  | 105 g  | 100 g   | 100 g   | 120 g  | 130 g   |

## WIDEBAND CURRENT AMPLIFIER

## SA-600 SERIES

High gain and wide bandwidth



\*All model CE certified

SA-600 series are used for detecting small signals to achieve high gain and wide bandwidth.

## APPLICATIONS

- Photomultiplier tube, photodiode and other photodetectors
- Monitor of particle accelerator beam
- Scanning tunneling microscope
- Ion detector

## SPECIFICATIONS

|   | SA-604F2  | SA-605F2                                       | SA-606F2                                     | SA-607F2                                    | SA-608F2                                     | New SA-609F2                                    |
|---|---|--|--|---|--|---|
|   | DC to 500 kHz,<br>10 M (V/A)                    | DC to 250 kHz,<br>100 M (V/A)                  | DC to 100 kHz,<br>1 G (V/A)                  | DC to 20 kHz,<br>10 G (V/A)                 | DC to 2 kHz,<br>100 G (V/A)                  | DC to 300 Hz,<br>1 T (V/A)                      |
| Maximum input current                         | ±1 µA   | ±100 nA  | ±10 nA                                       | ±1 nA                                       | ±100 pA                                      | ±10 pA  |
| Equivalent input current noise density (typ.) | 45 fA/√Hz                                       | 15 fA/√Hz                                      | 6 fA/√Hz                                     | 2.5 fA/√Hz                                  | 0.6 fA/√Hz                                   | 0.4 fA/√Hz                                      |
| Gain  | 1×10 <sup>7</sup> (10 M) V/A ±1%                | 1×10 <sup>8</sup> (100 M) V/A ±1%              | 1×10 <sup>9</sup> (1 G) V/A ±1%              | 1×10 <sup>10</sup> (10 G) V/A ±1%           | 1×10 <sup>11</sup> (100 G) ±3%               | 1×10 <sup>12</sup> (1 T) ±1%                    |
| LPF output<br>(Cut-off frequency setting)     | 30 kHz/100 kHz/<br>300 kHz/<br>THRU, selectable | 10 kHz/30 kHz/<br>100 kHz/<br>THRU, selectable | 3 kHz/10 kHz/<br>30 kHz/<br>THRU, selectable | 1 kHz/3 kHz/<br>10 kHz/<br>THRU, selectable | 100 Hz/300 Hz/<br>1 kHz/<br>THRU, selectable | 30 Hz/3 Hz/0.3 Hz/<br>THRU, selectable          |
| Operating power supply voltage                | ±15 V ±1 V                                      |  |  |   |  |   |
| External dimensions /Weight                   | 76 (W) × 50 (D) × 21.1 (H) mm / approx. 135 g   |  |  |   |  | 100 (W) × 50 (D) ×<br>25 (H) mm / approx. 140 g |

## PROGRAMMABLE CURRENT AMPLIFIER

## CA5351

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



- High gain: 10<sup>3</sup> V/A to 10<sup>10</sup> V/A (8ranges, 10-times step)
- Wide bandwidth: DC to 500kHz (10<sup>8</sup> V/A), DC to 70kHz (10<sup>9</sup> V/A)
- Low noise: 2.5 fA/√Hz (10<sup>10</sup> V/A, 55Hz)
- Fast response: 0.7 µs (10<sup>8</sup> V/A)
- Current suppression: ±8nA to ±8mA (7ranges)
- LAN, USB, GPIB

## APPLICATIONS

- 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

The CA5351 programmable current amplifier is a variable gain type, current-input, voltage-output amplifier. Various applications from beam position monitoring in synchrotron radiation to quantum electronics, semiconductor, MEMES and Biochemistry research.

## PROGRAMMABLE CURRENT AMPLIFIER

## CA5350

Supports a variety of small current measurements using various optical sensors



- High gain: 10<sup>4</sup> V/A to 10<sup>10</sup> V/A (7ranges), 10<sup>11</sup> V/A max.
- Wide bandwidth: DC to 500kHz (10<sup>8</sup> V/A), DC to 70kHz (10<sup>9</sup> V/A)
- Low noise: 2.5 fA/√Hz (10<sup>10</sup> V/A, 55Hz)
- Fast response: 0.7 µs (10<sup>8</sup> V/A)
- Current suppression: ±8 nA to 800 µA (6ranges)
- USB, GPIB

## APPLICATIONS

- Beam position monitoring for storage rings and synchrotrons
- I-V characteristic measurement of organic thin film device
- Gate leakage current measurement of devices such as FET and IGBT
- Detection of tunneling current of scanning tunneling microscopes (STM)
- Detection of conductive probe current for AFM measurement

The CA5350 programmable current amplifier is a variable gain type, current-input, voltage-output amplifier. With its unique circuitry, high gain and broad bandwidth, as well as stable operation with additional input capacitance.

## LOW NOISE PREAMPLIFIER

## LI-75A



- Input type: Single-Ended/Differential
- Input impedance: 100 MΩ/50 pF
- CMRR: 120 dB (DC to 100 Hz)
- Input referred noise: 2 nV/√Hz (1 kHz)
- Voltage gain: 40 dB
- Frequency response: DC to 1 MHz (DC), 0.2 Hz to 1 MHz (AC)
- Power: Provided by PS-70A (dedicated DC power supply)
- Dimensions (mm): 120 (W)×55 (H)×200 (D)
- Weight: approx. 1.15 kg

## DIFFERENTIAL AMPLIFIER

## 5307



- Frequency response: DC to 10 MHz
- High gain: ×10 to ×1000
- Differential input (single-ended input selectable)
- High CMRR: 120 dB or higher
- Low noise: 4 nV/√Hz typ. (1 kHz)
- Input impedance: 1 MΩ or 100 MΩ selectable

## LOW NOISE PREAMPLIFIER

## CA5360



CA5360 is good solution for improving sensitivity of lock-in amplifiers or removal of noise.

- Voltage gain: ×100 (40 dB)
- Input impedance: 100 MΩ
- Input referred noise voltage: 5 nV/√Hz
- CMRR: 100 dB or more (DC to 100 Hz)
- DC to 1 MHz

## LOW NOISE DC POWER SUPPLY

## LP5394/LP5393

Low noise and low drift



LP5394



LP5393

Ultra low noise DC power supply LP series are the best fit for low noise precision measurement applications, such as sensor pre-amps power supplies and DC bias power supplies that are widely used in advanced devices research, analyzing devices, and medical equipment.

- Output noise: 10 µVrms or lower (typ.) (10 Hz to 20 MHz bandwidth)
- Output voltage stability: ±10 ppm/°C (typ.) (LP5394)  
±20 ppm/°C (typ.) (LP5393)
- Output voltage: 0 to ±15 V (LP5394), ±12 V to ±15 V (LP5393)
- Output current: ±0.1 A max.



## LOW NOISE DC VOLTAGE SOURCE

LP6016-01/LP6016-01P

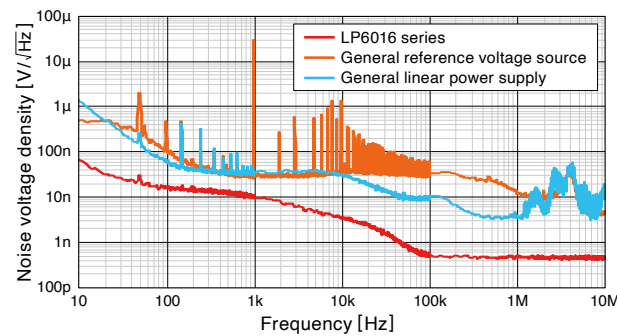
Low noise DC voltage output can be set with a fine resolution of 500  $\mu$ V steps.



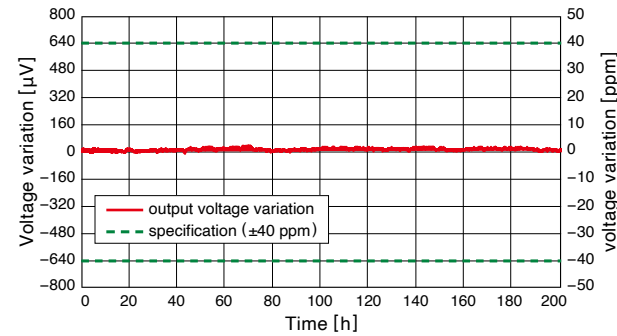
\*Both model are CE certified

- Output noise: 10  $\mu$ Vrms or lower (typ.) (10 Hz to 20 MHz bandwidth)
- Output voltage stability :  $\pm 10$  ppm/ $^{\circ}$ C (typ.)
- Output voltage:  
LP6016-01: 0 to +16.1 V (+) / 0 to -16.1 V (-)  
LP6016-01P: 0 to +16.1 V (Dual outputs, V1, V2)  
Setting resolution: 500  $\mu$ V  
Setting accuracy:  $\pm(0.03\% + 250 \mu$ V)
- Output current :  $\pm 100$  mA max. ● USB, RS-232, LAN

### ■ Output Noise Voltage Density ( $\pm 16.1000$ V, 100 mA)



### ■ Long-term Stability ( $\pm 16.1000$ V, 100 mA)



## AC VOLTMETERS

### TRUE R.M.S. AC VOLTMETER

M2170A



#### SPECIFICATIONS

|  |   |
|--|---|
| Voltage measurement range                  | 1 mV to 100 Vrms/F.S.   |
| Frequency range                            | 5 Hz to 20 MHz  |
| Input impedance                            | approx. 1 M $\Omega$ 25 pF max.   |
| Max. input voltage                         | 1 V to 100 V range: AC $\pm$ DC peak value $\pm 250$ V<br>Frequency[Hz] $\times$ Voltage[V]=10 <sup>8</sup><br>1 mV to 300 mV range : AC $\pm 10$ V peak,<br>AC $\pm$ DC peak value $\pm 250$ V |
| Indication accuracy<br>(reference to F.S.) | 30 Hz to 1 MHz: $\pm 3\%$ , 10 Hz to 10 MHz: $\pm 5\%$<br>5 Hz to 20 MHz: $\pm 10\%$  |
| AC/DC output                               | 1 V (F.S., no load), output impedance: approx. 50 $\Omega$ typ.   |
| Power                                      | AC100 V, 120 V, 230 V switchable  |
| Dimensions (mm) / Weight                   | 144 (W) $\times$ 177 (H) $\times$ 300 (D) / approx. 3.7 kg  |

- Wide frequency range 5 Hz to 20 MHz
- Indication of true rms values
- AC and DC output ● dB linear scale (optional)

### AC VOLTMETER/NOISE METER

M2174A/M2177A



M2174A



M2177A

#### SPECIFICATIONS

|   |   |
|---|---|
| Voltage measurement range                                       | M2174A: 10 $\mu$ V to 100 Vrms/F.S.<br>M2177A: 30 $\mu$ V to 100 Vrms/F.S.  |
| Frequency range   | 5 Hz to 500 kHz   |
| Input impedance   | approx. 1 M $\Omega$ 20 pF max.   |
| Max. input voltage  | 30 mV to 100 V range: AC+DC peak value $\pm 250$ V<br>10 $\mu$ V to 10 mV range: AC+5 V peak,<br>AC+DC peak value $\pm 250$ V   |
| Indication accuracy<br>(average response,<br>reference to F.S.) | 10 $\mu$ V range: 10 Hz to 30 kHz $\pm 10\%$ (M2174 only)<br>30 $\mu$ V range: 10 Hz to 30 kHz $\pm 5\%$<br>100 $\mu$ V range: 10 Hz to 100 kHz $\pm 5\%$<br>300 $\mu$ V to 100 V range: 5 Hz to 500 kHz $\pm 10\%$ |
| AC/DC output  | 1 V (F.S., no load), output impedance: approx. 50 $\Omega$ typ.   |
| Weighting network   | Built-in 4 types filter, Possible to add another 2 filters<br>as option   |
| Power   | AC100 V, 120 V, 230 V, switchable   |
| Dimensions (mm) / Weight  | 144 (W) $\times$ 177 (H) $\times$ 300 (D) / approx. 3.6 kg  |

- 10  $\mu$ Vrms fullscale (M2174A) / 30  $\mu$ Vrms fullscale (M2177A)
- Automatic range selection (M2177A)
- Maximum six types of filters can be built-in
- Indication response: true rms, average and quasi peak
- AC and DC output ● dB linear scale (optional)

## FILTERS

### DUAL CHANNEL PROGRAMMABLE FILTER

3624/3625/3627/3628



3628

0.01 Hz to 159.9 kHz / 1 Hz to 1.59 MHz

- Dual channels
- 4 models
- Selectable cutoff frequency (3-1/2 digit resolution)
- Power: AC100, 120, 200 or 240 V  $\pm 10\%$ , selectable (max. 250 V)
- Dimensions (mm): 434 (W) $\times$ 132.5 (H) $\times$ 400 (D)

| Model            | 3624  | 3625      | 3627             | 3628      |
|------------------|---|-----------|------------------|-----------|
| No. of channel   | 2 (CH-A and CH-B)   |           |                  |           |
| Cutoff frequency | 0.01 Hz to 159.9 kHz  |           | 1 Hz to 1.59 MHz |           |
| Roll-off         | 24 dB/oct   | 48 dB/oct | 24 dB/oct        | 48 dB/oct |
| Function         | THRU, LP-MF (max. flat<Butterworth>), LP-PL (phase linear <Bessel>), HPE, BPF and BEF       |           |                  |           |
| Mode             | SEPARATE (independent operating CH-A and CH-B), CASCADE (cassaded CH-A and CH-B)            |           |                  |           |
| Passband gain    | $\times 1$ , $\times 2$ , $\times 5$ selectable respectively on input and output amplifiers |           |                  |           |
| Power supply     | AC100, 120, 200 or 240 V $\pm 10\%$ , selectable (Max. 250 V)                               |           |                  |           |
| Dimensions       | 434 (W) $\times$ 132.5 (H) $\times$ 400 (D) mm excluding protusions                         |           |                  |           |
| Weight (approx.) | 10.0 kg   | 10.5 kg   | 10.0 kg          | 10.5 kg   |

### MULTIFUNCTION FILTER

3611



0.1 Hz to 21.8 kHz

- 2-digit setting of cutoff frequency, 24 dB/oct
- Filter mode: LPF (max. flatness/phase-linear), HPF, BPF (1/3 oct), BPE or THRU
- Gain setting: 0 to 20 dB ( $\pm 0.5$  dB)
- Power: AC100, 120, 220 or 240 V  $\pm 10\%$ , selectable
- Dimensions (mm): 216 (W) $\times$ 132.5 (H) $\times$ 290 (D)
- Weight: approx. 2.6 kg

### WIDE RANGE DECADE FILTER

FV-628B



1 Hz to 10 MHz

- Cutoff frequency range: LPF 1 Hz to 10 MHz, HPF 1 Hz to 3 MHz, Rolloff: 24 dB/oct
- Filter mode: LPF (max. flatness/phase linear), HPF, BPF or THRU
- Passband gain: 0  $\pm 0.7$  dB
- S/N ratio: 60 dB or greater (at 100 MHz or less)
- Power: AC100, 120, 200 or 240 V  $\pm 10\%$ , switchable
- Dimensions (mm) : 429 (W) $\times$ 99 (H) $\times$ 350 (D)
- Weight: approx. 8.5 kg

### APPLICATIONS FOR PROGRAMMABLE FILTERS

- High frequency noise removal of sensor signal
- Unnecessary frequency removal of displacement meter output signal
- Unnecessary band removal during sound measurement
- Noise and vibration frequency removal by 1/3 octave filter
- Ultrasonic sound field measurement
- Filtering of signal in overcurrent inspection
- Video signal filtering
- Noise removal of discharge pulse signal
- Noise removal for digital signals

### MULTI CHANNEL FILTER

3314/3315/3316/3334/3344/DV-04



3315

These filter chassis are capable of inserting multiple filter module as a desktop type fixed frequency filter.

| Model           | 3314                                    | 3315  | 3316                                    | 3334                                    | 3344   | DV-04                                  |
|-----------------|---|---|---|---|--|--|
| Modules         | HR series<br>Resistor<br>tunable filter | SR/SRA series<br>Resistor<br>tunable filter | RT series<br>Resistor<br>tunable filter | VT series<br>Resistor<br>tunable filter | DT-5FL/DT-6FL<br>series<br>Programmable filter | DV/CF series<br>Programmable<br>filter |
| No. of channels | 4                                       | 8   | 8                                       | 2                                       | 8  | 4                                      |



MEASUREMENT SYSTEMS

MEASUREMENT SYSTEM

MS-500 SERIES



The MS series is suitable for pre-processing analog signals. The plug-in units, such as filters, differential amplifiers, and isolation amplifiers can be installed into the frames. (16 channels at maximum/the JIS rack size)

24dB/oct FILTER · 48dB/oct FILTER

P-81/P-82/P-83/P-84



P-81 P-82 P-83 P-84

- Four filters : lowpass (maximum flatness and phase-linear), highpass and THRU
- 16 selectable points for high-resolution control of cutoff frequency
- Cascade mode enables simple cascade connection to neighboring units
- Input ground line is floatable, enabling the elimination of induced noise caused by ground loops

SPECIFICATIONS

| Model            | P-81              | P-82           | P-83              | P-84           |
|------------------|-------------------|----------------|-------------------|----------------|
| Cutoff frequency | 0.1 Hz to 1.6 kHz | 1 Hz to 16 kHz | 0.1 Hz to 1.6 kHz | 1 Hz to 16 kHz |
| Roll-off         | 24 dB/oct         |                | 48 dB/oct         |                |

|  |  |
|--|--|
| Mode                                       | Lowpass (ML, PL), Highpass and THRU  |
| Cutoff frequency setting                   | 1, 2, ..., 15, 16 (16 points), plus multipliers  |
| Input type                                 | CASCADE (The output of left-side unit is connected.), FLOAT, GND (single-ended input)              |
| Input impedance                            | 100 kΩ//40 pF  |
| CMRR                                       | 60 dB or greater (DC to 1 kHz)   |
| Output voltage                             | ±10 V  |
| Phase matching between the same type units | P-81: ±1°typ., P-82: ±1.2°typ., P-83: ±1°typ., P-84: ±2.2°typ. (LP, DC to 2fc, purchased together) |

48dB/oct FILTER

P-85



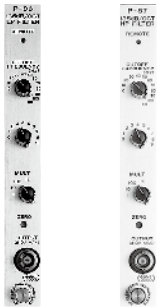
- Wide cutoff frequency range: 0.1 Hz to 119.9 kHz
- High resolution: 3-digits
- Filters: lowpass (maximum flatness and phase-linear), highpass and THRU

SPECIFICATIONS

|  |   |
|--|---|
| Cutoff frequency range                     | 0.1 Hz to 111.9 kHz   |
| Roll-off                                   | 48 dB   |
| Mode                                       | Lowpass (ML, PL), Highpass and THRU   |
| Cutoff frequency setting                   | 0.1, 0.2, 0.3, ..., 111.9 (1119 points) plus multipliers                              |
| Input type                                 | CASCADE (The output of left-side unit is connected.), FLOAT, GND (single-ended input) |
| Input impedance                            | 100 kΩ//40 pF   |
| CMRR                                       | 60 dB or greater (DC to 1 kHz)  |
| Output voltage                             | ±10 V   |
| Phase matching between the same type units | ±5.5° typ. (LP, DC to fc, purchased together)   |

135dB/oct FILTER

P-86/P-87



P-86 P-87

- Sharp rolloff equivalent to 135 dB/oct
- P-86 and P-87 can be combined as a bandpass filter

SPECIFICATIONS

|  |   |
|--|---|
| Cutoff frequency range                     | P-86: 1 Hz to 119 kHz, P-87: 1 Hz to 20 kHz   |
| Roll-off                                   | Equivalent to 135 dB/oct (8-pole Elliptic)  |
| Mode                                       | P-86: Lowpass/P-87: Highpass  |
| Cutoff frequency setting                   | 1, 2, 3, ..., 119 (119 points) plus multipliers                                       |
| Input type                                 | CASCADE (The output of left-side unit is connected.), FLOAT, GND (single-ended input) |
| Input impedance                            | 100 kΩ//40 pF   |
| CMRR                                       | 60 dB or greater (DC to 1 kHz)  |
| Output voltage                             | ±10 V   |
| Phase matching between the same type units | ±2° typ. (P-86) (DC to 0.2fc, ±100 kHz, purchased together)                           |

DIFFERENTIAL AMPLIFIER

P-61



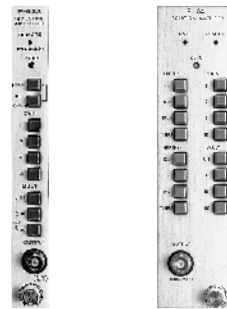
- Wide bandwidth
- High gain
- High CMRR

SPECIFICATIONS

|                    |   |
|--------------------|---|
| Input type         | Balanced differential input                             |
| Input impedance    | 100 MΩ  |
| Gain               | ×1 to ×1000, 1-2-5 steps                                |
| Gain accuracy      | ±0.2% at 400 Hz (no load, 25°C)                         |
| Non-linearity      | ±0.02% or better (DC, no load)                          |
| CMRR               | 120 dB or greater (DC to 120 Hz)                        |
| DC offset          | ±2 μV/°C(input-referred value)                          |
| Frequency response | ±0.1 dB (DC to 10 kHz)<br>+0.5 to -3 dB (DC to 100 kHz) |

ISOLATION AMPLIFIER

P-62A/P-64



P-62A P-64

- High withstanding voltage
- Wide bandwidth enabling excellent transfer characteristics

SPECIFICATIONS

| Model              | P-62A   | P-64   |
|--------------------|---|--|
| Isolation voltage  | ±1000 VDC continuous, 1500 Vrms (1 minute, 48 to 62 Hz) | ±1000 VDC continuous, 2000 Vpeak (1 minute, 48 to 62 Hz) |
| IMRR               | 150 dB or more (DC to 60 Hz)                            |  |
| Gain               | ×0.1 to ×1000, 1-2-5 sequence                           |  |
| Input type         | Single-ended  |  |
| Input impedance    | 1 MΩ//50 pF   | 1 MΩ//60 pF  |
| Frequency response | DC to 100 kHz (-3 dB)                                   | DC to 1 MHz (+1 dB, -3 dB)                               |
| Filter             | —   | LPF and HPF  |
| Output voltage     | ±10 V   |  |

GPIO UNIT

P-42A



- A maximum of 16 channels may be controlled by using this units
  - Built-in multiplexer
- \* This unit cannot be used with MS-521.

SPECIFICATIONS

|                |   |
|----------------|---|
| GPIO function  | SH1, AH1, T6, L4, SR1, RL2, PP0, DC1, DT1, C0 |
| Other function | Multiplexer output, Status monitor            |

MAIN FRAME

MS-521/MS-523/MS-525



MS-523  
(filled with 8 plug-in units)

The MS-521/MS-523/MS-525 are the chassis with built-in power supply used to hold the MS-500 series plug-in units.

SPECIFICATIONS

| Model                                    | MS-521                              | MS-523 <sup>*2</sup>                | MS-525                             |
|--|-------------------------------------|-------------------------------------|------------------------------------|
| No. of amplifier and filter units        | 4                                   | 8                                   | 16                                 |
| Power supply                             | AC100, 120, 220, 240 V              | DC11 to 15 V, or AC100 V            | AC100, 120, 220, 240 V             |
| Control or GPIO unit                     | —                                   | P-42A                               | P-42A                              |
| Dimensions (mm) and Weight <sup>*1</sup> | 119.5 (W)×199 (H)×400 (D)<br>5.0 kg | 283.5 (W)×199 (H)×400 (D)<br>6.1 kg | 480 (W)×199 (H)×400 (D)<br>12.2 kg |

\*1: Weight of mainframe only, approximately  
\*2: Can combine P-85, P-86 or P-87 up to 7 units. Max. 6 units in conjunction with P-42A

AC POWER SOURCES

PROGRAMMABLE AC POWER SOURCE

DP SERIES (1.5 kVA to 36 kVA)



A powerful and reliable AC power source

DP series incorporates new ideas while pursuing the high-quality, stable supply of power that is the fundamental role of any AC power source.

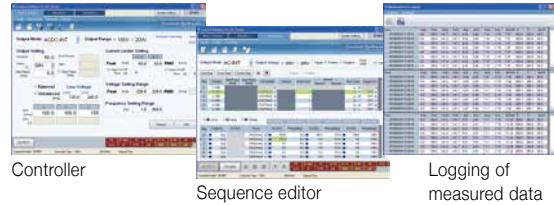
- Highly robustness, low distortion. both capacitive and inductive loads are driven stably.
- Flexible load protection equipped. It protect load and works with stable waveform even using current limiter
- Low noise for both conduction and radiation, which mean best solution for EMC testing.
- Abundant line-up: from 1.5kVA to three-phase 144kVA.

\* DP240S and DP360S are not CE-certified.

SPECIFICATIONS

|  |                        |  | Single-phase (1P2W)  |           |   |           |                     |           |                     |
|--|------------------------|--|--|-----------|---|-----------|---------------------|-----------|---------------------|
|  |                        |  | DP015S   | DP030S    | DP045S  | DP060S    | DP075S              | DP090S    | DP105S              |
| Output power*1                           |                        |  | 1.5 kVA  | 3 kVA     | 4.5 kVA   | 6 kVA     | 7.5 kVA             | 9 kVA     | 10.5 kVA            |
| Polyphase system                         |                        |  | A polyphase system can be configured by connecting multiple units of the same single-phase model.<br>Single-phase three-wire system: 3 kVA, 6 kVA, 9 kVA, 12 kVA, 15 kVA, 18 kVA, 21kVA, 24 kVA, 48 kVA, 72 kVA<br>Three-phase system: 4.5 kVA, 9 kVA, 13.5 kVA, 18 kVA, 22.5 kVA, 27 kVA, 31.5 kVA, 36 kVA, 72 kVA, 108 kVA   |           |   |           |                     |           |                     |
| AC/DC mode                               |                        |  | AC, ACDC, DC   |           |   |           |                     |           |                     |
| AC output*2                              | Voltage setting range  | Phase voltage  | 0.0 V to 160.0 V/0.0 V to 320.0 V,<br>0.0 Vp-p to 454.0 Vp-p / 0.0 Vp-p to 908.0 Vp-p (arbitrary waveform)   |           |   |           |                     |           |                     |
|  |                        | Line to line voltage   | —  |           |   |           |                     |           |                     |
|  | resolution             | 0.1 V  |  |           |   |           |                     |           |                     |
|  | Max. current*3 *4      | 15 A/7.5 A   |  | 30 A/15 A | 45 A/22.5 A   | 60 A/30 A | 75 A/37.5 A         | 90 A/45 A | 105 A/52.5 A        |
|  | Max. peak current*3 *5 | 4 times value of maximum current.  |  |           |   |           |                     |           |                     |
| Load power factor range                  |                        |  | 0 to 1 (lead or lag, at 45 Hz to 65 Hz)  |           |   |           |                     |           |                     |
| Frequency setting range, output waveform |                        |  | 40.00 Hz to 550.00 Hz (AC mode), 1.00 Hz to 550.00 Hz (ACDC mode), resolution: 0.01 Hz, waveform: sine, arbitrary (16 types),  |           |   |           |                     |           |                     |
| Output voltage stability                 |                        |  | Line regulation: within ±0.15%, load regulation: within ±0.15 V/±0.3 V (45 Hz to 65 Hz), within ±0.5 V/±1.0 V (40 Hz to 550 Hz)  |           |   |           |                     |           |                     |
| Output voltage distortion factor         |                        |  | 0.5% or less (40 Hz to 550 Hz, 50% or more of rated output voltage, maximum output current or below, AC mode or ACDC mode)   |           |   |           |                     |           |                     |
| DC output                                | Output power*1         |  | 1.5 kW   | 3 kW      | 4.5 kW  | 6 kW      | 7.5 kW              | 9 kW      | 10.5 kW             |
|  | Voltage setting range  |  | -227 V to +227 V/-454 V to +454 V, resolution: 0.1 V   |           |   |           |                     |           |                     |
|  | Max. current*4         |  | 15 A/7.5 A   | 30 A/15 A | 45 A/22.5 A   | 60 A/30 A | 75 A/37.5 A         | 90 A/45 A | 105 A/52.5 A        |
| Measurement function                     | Voltage                | RMS value (rms), DC average (avg) (only single-phase models), peak value (pk)  |  |           |   |           |                     |           |                     |
|  | Current                | RMS value (rms), DC average (avg) (only single-phase models), peak value (pk), peak hold value                                 |  |           |   |           |                     |           |                     |
|  | Power                  | Effective (W), apparent (VA), reactive (var)   |  |           |   |           |                     |           |                     |
|  | Others                 | Load power factor, load crest factor, synchronization frequency, harmonic current, CO2 emissions (excluding 24 kVA and 36 kVA) |  |           |   |           |                     |           |                     |
| Current limiter                          |                        |  | Setting: peak limiter (positive current and negative current), RMS limiter, limit operations: automatic recovery or output turn off  |           |   |           |                     |           |                     |
| Power unit energization setting          |                        |  | The power section is modularized in 1.5 kVA or 2 kVA units. Power units can be set ON or OFF to suit the load capacity.  |           |   |           |                     |           |                     |
| Sequence function                        |                        |  | Parameters such as frequency, voltage and time can be programmed and sequentially output. Number of steps: 255 max (for start phase, stop phase, phase angle, step termination, jump count (1 to 9999, or ∞), specification of the jump-to step,   |           |   |           |                     |           |                     |
| AC line simulation                       |                        |  | Simulates a problem in the power supply line such as power failure, voltage rise, voltage drop, sudden phase changes, or sudden parameters: output range, ACV (phase voltage), frequency, waveform, start phase, stop phase, synchronous step output (2 bit),  |           |   |           |                     |           |                     |
| Other functions                          |                        |  | Setting limitation: voltage and frequency, remote sensing/AGC /Autocal, memory function, external signal input, interface (RS232C,   |           |   |           |                     |           |                     |
| Power input (specified on order)         |                        |  | AC100 V to 230 V ±10%<br>50 Hz/60 Hz ±2 Hz   |           | AC100 V to 230 V ±10%, 3P3W AC200 V to 220 V ±15% or 3P4W AC380 V ±15%<br>50 Hz/60 Hz ±2 Hz |           |                     |           |                     |
| Efficiency                               |                        |  | 77% or more (typ., at AC200 V input)   |           |   |           |                     |           |                     |
| Power consumption (maximum)              |                        |  | 2.25 kVA   | 4.5 kVA   | 6.75 kVA  | 9 kVA     | 11.25 kVA           | 13.5 kVA  | 15.8 kVA            |
| Weight (approx.)                         |                        |  | 38 kg  | 50 kg     | 70 kg   | 82 kg     | 110 kg              | 125 kg    | 140 kg              |
| Dimensions (W×H×D)                       |                        |  | 430 × 398 × 562 mm   |           | 430 × 665 × 562 mm  |           | 430 × 1021 × 562 mm |           | 430 × 1287 × 562 mm |
| Reference                                |                        |  | Note: When two values are indicated with a slash [ / ], the value before the slash is specification for 100 V range , the value after the slash is specification for 200 V range.<br>*1: With models of 6 kW or more, output capacity is limited, if input voltage is AC170 V or less.<br>*2: When [V] = Vrms, [A] = Arms, and power input voltage is 200 V, unless otherwise specified.<br>*3: Values for single-phase 3-wire and three-phase are for phase current.<br>*4: If at or above the rated output voltage, this is limited (reduced) to be at or below the power capacity.<br>If there is DC superimposition, the RMS current value of AC+DC<br>*5: For capacitor input type rectifier load (crest factor=4), rated output voltage, 45 Hz to 65 Hz. |           |   |           |                     |           |                     |

- Single-phase, single-phase three-wire, three-phase and multi-phase models are in one housing. also polyphase systems by combining single-phase models.
- High-performance current limiter (set with peak value and RMS value)
- Measurement functions : voltage, current, power, crest factor, power factor, frequency, harmonic current and so on.
- Sequence and AC line simulation
- Power unit energization settings
- RS-232, USB, GPIB or LAN (specified on order)
- Power input selectable
- Simple operation
- Control software bundled



LINEUP

| Output power (kVA)    | 1.5 | 3 | 4.5 | 6 | 7.5 | 9 | 10.5 | 12 | 16 | 18 | 24 | 36 | 42 | 48 |
|-----------------------|-----|---|-----|---|-----|---|------|----|----|----|----|----|----|----|
| Single-phase          | ●   | ● | ●   | ● | ●   | ● | ●    | ●  | ●  | —  | ●  | ●  | ●  | ●  |
| Single-phase 3-wire*1 | —   | ● | —   | ● | —   | ● | —    | —  | —  | —  | —  | —  | —  | —  |
| Three-phase*2         | —   | — | ●   | — | —   | ● | —    | —  | —  | —  | —  | —  | —  | —  |
| Multi-phase*3         | —   | — | ●   | ● | —   | ● | —    | ●  | —  | ●  | ●  | —  | —  | —  |

\*1: Single-phase model x2 units  
\*2: Single-phase model x3 units, max. 108 kVA  
\*3: Multi-phase model (P. 19) and high power model (P. 20) are also available.

Options

- Remote controller DP008
- System cable (for single phase 3-wire)
- System cable (for 3-phase)
- Power input cable / Cable holder



| Single-phase (1P2W)   |   |                         | Single-phase three-wire (1P3W)  |   |                        |                        | Three-phase (3P4W)                |                        |
|---|---|-------------------------|---|---|------------------------|------------------------|-----------------------------------|------------------------|
| DP120S  | DP240S*   | DP360S*                 | DP030D  | DP060D  | DP090D*                | DP120D*                | DP045T                            | DP090T                 |
| 12 kVA  | 24 kVA  | 36 kVA                  | 3 kVA   | 6 kVA   | 9 kVA                  | 12 kVA                 | 4.5 kVA                           | 9 kVA                  |
|   |   |                         | —   |   |                        |                        |                                   |                        |
|   |   |                         | AC, ACDC  |   |                        |                        |                                   |                        |
|   |   |                         | 0.0 V to 160.0 V/0.0 V to 320.0 V,<br>0.0 Vp-p to 454.0 Vp-p / 0.0 Vp-p to 908.0 Vp-p (arbitrary waveform)<br>All-phase common setting for balanced mode. Each phase setting for unbalanced mode. |   |                        |                        |                                   |                        |
|   |   |                         | 0.0 V to 320.0 V/0.0 V to 640.0 V   |   |                        |                        | 0.0 V to 277.2 V/0.0 V to 554.2 V |                        |
|   |   |                         | Only for balanced mode and sine wave.<br>Phase voltage: 0.1 V, line to line: 0.2 V  |   |                        |                        |                                   |                        |
| 120 A/60 A  | 240 A/120 A   | 360 A/180 A             | 15 A/7.5 A  | 30 A/15 A   | 45 A/22.5 A            | 60 A/30 A              | 15 A/7.5 A                        | 30 A/15 A              |
|   |   |                         |   |   |                        |                        |                                   |                        |
| clipped Sine (3 types)  |   |                         |   |   |                        |                        |                                   |                        |
| (phase voltage)   |   |                         |   |   |                        |                        |                                   |                        |
| (phase voltage)   |   |                         |   |   |                        |                        |                                   |                        |
| 12 kW   | 24 kW   | 36 kW                   | —   |   |                        |                        |                                   |                        |
| 120 A/60 A  | 240 A/120 A   | 360 A/180 A             |   |   |                        |                        |                                   |                        |
|   |   |                         |   |   |                        |                        |                                   |                        |
|   |   |                         |   |   |                        |                        |                                   |                        |
| model)  |   |                         |   |   |                        |                        |                                   |                        |
| when the limit state has continued for the designated time.   |   |                         |   |   |                        |                        |                                   |                        |
|   |   |                         |   |   |                        |                        |                                   |                        |
| 1 sequence), step time setting range: 0.0010 s to 999.9999 s, parameters: output range ,AC/DC mode, AC phase voltage, frequency, waveform, DC voltage, synchronous step output (2 bit), specification of the branch step, trigger output, number of memories: 5 |   |                         |   |   |                        |                        |                                   |                        |
| frequency change. Number of steps: 6 (initial, normal 1, transition 1, abnormal, transition 2, normal 2), step time setting range : 0.0010 s to 999.9999 s, trigger output, repeat count (1-9999 times or ∞)  |   |                         |   |   |                        |                        |                                   |                        |
| USB, GPIB /LAN [specified on order]], external control I/O, output relay control, output waveform monitor   |   |                         |   |   |                        |                        |                                   |                        |
|   | 3P3W AC200 V to 220 V ±15%<br>or 3P4W AC380 V ±15%<br>50 Hz/60 Hz ±2 Hz |                         | Same as<br><b>DP030S</b>  | AC100 V to 230 V ±10%, 3P3W AC200 V to 220 V ±15% or 3P4W AC380 V ±15%<br>50 Hz/60 Hz ±2 Hz |                        |                        |                                   |                        |
|   |   |                         |   |   |                        |                        |                                   |                        |
| 18 kVA  | 36 kVA  | 54 kVA                  | 4.5 kVA   | 9 kVA   | 13.5 kVA               | 18 kVA                 | 6.75 kVA                          | 13.5 kVA               |
| 155 kg  | 345 kg  | 510 kg                  | 50 kg   | 82 kg   | 125 kg                 | 155 kg                 | 70 kg                             | 125 kg                 |
|   | 860 × 1463 ×<br>649 mm  | 1290 × 1463 ×<br>649 mm | 430 × 398 ×<br>562 mm   | 430 × 665 ×<br>562 mm   | 430 × 1021 ×<br>562 mm | 430 × 1287 ×<br>562 mm | 430 × 665 ×<br>562 mm             | 430 × 1021 ×<br>562 mm |

DP-G Series  
This series doesn't have the function of arbitrary waveform and external signal Input.  
DP Series Type K  
CPCS-CCC outlet. Only Single-phase models are available, not for polyphase system.



Multiple outputs for multiple uses switch between single-phase, single-phase three-wire, and three-phase



DP240LM

LINEUP

| Model | DP045M  | DP090M | DP060LM | DP120LM | DP180LM | DP240LM | DP360LM |
|-------|---------|--------|---------|---------|---------|---------|---------|
| 1P2W  | 4.5 kVA | 9 kVA  | 6 kVA   | 12 kVA  | 18 kVA  | 24 kVA  | 36 kVA  |
| 1P3W  | 3 kVA   | 6 kVA  | 4 kVA   | 8 kVA   | 12 kVA  | 16 kVA  | 24 kVA  |
| 3P4W  | 4.5 kVA | 9 kVA  | 9 kVA   | 12 kVA  | 18 kVA  | 24 kVA  | 36 kVA  |

- Highly robust, low distortion
- Low noise
- Short reverse power flow (100%, ≤ 20 ms)
- Load protection: variable current limiter function
- Single space-saving cabinet
- Lineup: 4.5 kVA to 36 kVA
- Single-phase and polyphase output terminal equipped separately

\* DP045M and DP090M are CE certified

SPECIFICATIONS

| Model  |  |  | DP045M   | DP090M          | DP060LM  | DP0120LM  | DP0180LM        | DP0240LM  | DP0360LM      |
|--|--|--|--|-----------------|--|---|-----------------|---|---------------|
| Output power* <sup>1</sup>                                       |  |  | 4.5 kVA  | 9 kVA           | 6 kVA  | 12 kVA  | 18 kVA          | 24 kVA  | 36 kVA        |
| AC output* <sup>2</sup>  | Voltage setting range                      | Phase voltage  | 0.0 V to 160.0 V / 0.0 V to 320.0 V, arbitrary wave: 0.0 V <sub>p-p</sub> to 454.0 V <sub>p-p</sub> / 0.0 V <sub>p-p</sub> to 908.0 V <sub>p-p</sub> , setting resolution: 0.1 V                                 |                 |  |   |                 |   |               |
|  |  | Line voltage   | 1P3W: 0.0 V to 320.0 V / 0.0 V to 640.0 V (balanced mode and sine wave only) setting resolution: 0.2 V<br>3P4W: 0.0 V to 277.2 V / 0.0 V to 554.2 V (balanced mode and sine wave only) setting resolution: 0.2 V |                 |  |   |                 |   |               |
|  | Max. current* <sup>3</sup>                 | single-phase   | 45 A / 22.5 A  | 90 A / 45 A     | 60 A / 30 A  | 120 A / 60 A  | 180 A / 90 A    | 240 A / 120 A   | 360 A / 180 A |
|  |  | polyphase  | 15 A / 7.5 A   | 30 A / 15 A     | 20 A / 10 A  | 40 A / 20 A   | 60 A / 30 A     | 80 A / 40 A   | 120 A / 60 A  |
|  | Max. peak current* <sup>4</sup>            |  | Peak value (Apk) which is four times of the max. current   |                 |  |   |                 | Peak value (Apk) which is three times of the max. current |               |
|  | Short reverse power flow                   |  | —  |                 |  | 100% or less of max. current (RMS)<br>(reverse power flow time ≤ 20 ms, discontinuous, 40°C or lower) |                 |   |               |
| Load power factor  |  | 0 to 1 (phase lead or phase lag, 45 Hz to 65 Hz, external power injection and regeneration are not available.)   |  |                 |  |   |                 |   |               |
| Frequency setting range  |  | 40.00 Hz to 550.00 Hz (AC mode), 1.00 Hz to 550.00 Hz (ACDC mode), setting resolution: 0.01 Hz   |  |                 |  |   |                 |   |               |
| Output waveform  |  | Sine wave, arbitrary wave (16 types), clipped sine wave (3 types)  |  |                 |  |   |                 |   |               |
| DC output* <sup>5</sup>  | Output power* <sup>1</sup>                 | 4.5 kW   | 9 kW   | 6 kW            | 12 kW  | 18 kW   | 24 kW           | 36 kW   |               |
|  | Voltage setting range                      | -227 V to +227 V / -454 V to +454 V, setting resolution: 0.1 V   |  |                 |  |   |                 |   |               |
|  | Max. source current* <sup>3</sup>          | 45 A / 22.5 A  | 90 A / 45 A  | 60 A / 30 A     | 120 A / 60 A   | 180 A / 90 A  | 240 A / 120 A   | 360 A / 180 A   |               |
|  | Short sink current                         | —  |  |                 | 100% or less of max. source current<br>(reverse power flow time ≤ 20 ms, discontinuous, 40°C or lower) |   |                 |   |               |
| Stability and distortion (phase voltage)                         | Output voltage stability                   | Fluctuation with input voltage: within ±0.15%<br>Fluctuation with output current: DC (only single-phase output) within ±0.15 V / ±0.30 V, 45 Hz to 65 Hz within ±0.15 V / ±0.30 V, 40 Hz to 550 Hz within ±0.5 V / ±1.0 V  |  |                 |  |   |                 |   |               |
|  | Distortion                                 | 0.5% or lower  |  |                 |  |   |                 |   |               |
| Power input  | Voltage* <sup>1</sup> (specified on order) |  | Overvoltage category II  |                 |  |   |                 |   |               |
|  | 1P2W input<br>3P3W input<br>3P4W input     | 100 V to 230 V ±10%  | 200 V to 230 V ±15%  |                 |  | —   |                 |   |               |
|  |  | 200 V to 220 V ±15%  |  |                 |  |   |                 |   |               |
|  |  | 380 V ±15%   |  |                 |  |   |                 |   |               |
| Frequency, power factor* <sup>6</sup> , efficiency* <sup>6</sup> |  | 50 Hz / 60 Hz ±2 Hz, 0.90 or higher (typ., AC200 V input), 77% or higher (typ.)  |  |                 |  |   |                 |   |               |
| Max. power consumption   |  | 6.75 kVA or lower  | 13.5 kVA or lower  | 9 kVA or lower  | 18 kVA or lower  | 27 kVA or lower   | 36 kVA or lower | 54 kVA or lower   |               |
| Measurement function   |  | Voltage (RMS value, DC average value, peak value), current (RMS value, DC average value, peak value, peak hold value), power (active, apparent, reactive), load power factor, load crest factor, synchronization frequency, harmonic current, CO <sub>2</sub> emissions  |  |                 |  |   |                 |   |               |
| Current limiter  |  | Setting: peak limiter (positive current and negative current), RMS limiter,<br>Limit operations: automatic recovery or output turn off when the limit state has continued for the designated time.   |  |                 |  |   |                 |   |               |
| Sequence function  |  | Parameters such as frequency, voltage and time can be programmed and sequentially output.<br>Number of steps: max. 255 (in 1 sequence), setting items: step time, output range, AC/DC mode, DC voltage, AC voltage, frequency, waveform, start phase, stop phase, phase angle, step termination, jump count and so on.                               |  |                 |  |   |                 |   |               |
| Simulation   |  | Simulates a problem in the power supply line such as power failure, voltage rise, voltage drop, sudden phase changes, or sudden frequency change.  |  |                 |  |   |                 |   |               |
| Control software   |  | Remote control, status monitor, logging, editing the arbitrary waveform data, editing performing sequence / simulation   |  |                 |  |   |                 |   |               |
| Other functions  |  | Voltage / Frequency setting limitation, remote sensing / AGC / Autocal, clipped sine wave, arbitrary wave, external signal input (SYNC, VCA, EXT* <sup>5</sup> , ADD* <sup>5</sup> ), memory function, protections, external control I/O, interface (USB, RS-232, GPIB / LAN [specified on order]), output relay control, waveform monitor and so on |  |                 |  |   |                 |   |               |
| Dimensions (W × H × D) (mm)                                      |  | 430 × 665 × 562  | 430 × 1287 × 562   | 455 × 887 × 803 | 455 × 1407 × 803   | 910 × 1580 × 803  |                 | 1365 × 1580 × 803   |               |
| Weight   |  | approx. 75 kg  | approx. 130 kg   | approx. 125 kg  | approx. 200 kg   | approx. 350 kg  | approx. 400 kg  | approx. 570 kg  |               |

Note: When two values are indicated with a slash [ / ], the value before the slash is specification for 100 V range, the value after the slash is specification for 200 V range.

\*1: Excluding 4.5 kVA models, output power is limited, if input voltage is AC170 V or less. \*2: [V]=Vrms, [A]=Arms, and power input voltage is 200 V, unless otherwise specified.

\*3: If the output voltage is higher than the rated value, this is limited (lowered) to satisfy the output power.

\*4: For the capacitor input type rectified load (crest factor=4 or 3), the rated output voltage, and 45 Hz to 65 Hz. \*5: Single-phase only, [V]=Vdc, [A]=Adc

\*6: In the case of AC-INT, the rated output voltage, the resistance load at the maximum current, 45 Hz to 65 Hz output.

High efficiency / Large capacity



DP420LS / DP480LS (single-phase)



Three phase 144 kVA

- Highly robust, low distortion
- Low noise
- High efficiency 77% or more
- Superior transient stability
- Current limiter function
- Reverse power flow (100%, ≤ 20 ms)
- Simple wiring
- Low audible noise

SPECIFICATIONS

|                              |           |   |  |                  |                                  |  |   |  |
|------------------------------|-----------|---|--|------------------|----------------------------------|--|---|--|
| Output power                 |           | DP160LS: single-phase 16 kVA<br>DP420LS: single-phase 42 kVA<br>DP480LS: single-phase 48 kVA<br><br>Poly-phase system:<br>Configure single-phase three-wire by two units,<br>Configure three-phase four-wire by three units |  |                  | Power Input (specified on order) |  | Overvoltage category II<br>3P3W AC200 V to 220 V ±15% or<br>3P4W AC380 V ±15%, 50 Hz / 60 Hz ±2 Hz,<br>power factor 0.90 or higher (typ.), efficiency 77% or higher (typ.), max. power consumption<br>DP160LS: 24 kVA or lower, DP420LS: 63 kVA or lower,<br>DP480LS: 72 kVA or lower |  |
| AC/DC mode                   |           | AC, ACDC, DC (single-phase only)  |  |                  | Measurement function             |  | RMS / peak / average values of the output voltage / current, current peak-hold values, active / apparent / reactive power, the power factor, the crest factor, and harmonic current (40th max.), synchronization frequency  |  |
| Output voltage and frequency |           |   |  |                  | Variable current limiter         |  | Effective value, positive / negative peak value   |  |
| AC                           | Voltage   | 100 V range   |  | 200 V range      | Resolution                       |  | Remote sensing, AGC (automatic gain control), Autocal (output voltage compensation)   |  |
|                              | Frequency | 0 V to 160 V  |  | 0 V to 320 V     | 0.1 V                            |  | Sequence function, voltage fluctuation testing function, clipped sine wave, arbitrary waveform  |  |
|                              | Frequency | AC: 40.00 Hz to 550.00 Hz<br>ACDC: 1.00 Hz to 550.00 Hz   |  |                  | 0.01 Hz                          |  | Power unit energization setting   |  |
| DC                           | Voltage   | -227 V to +227 V  |  | -454 V to +454 V | 0.1 V                            |  | External control I/O  |  |

|   |   |
|---|---|
| Max. current (100 V range / 200 V range)                    | DP160LS: 160 A / 80 A, DP420LS: 420 A / 210 A<br>DP480LS: 480 A / 240 A   |
| Max. peak current   | DP160LS: Four times of the max. current<br>DP420LS, DP480LS: Three times of the max. current  |
| Short reverse power flow                                    | Less than 100% of max. current (RMS)<br>(reverse power flow time ≤ 20 ms, discontinuous, less than 40°C)                                |
| Fluctuation with output current (100 V range / 200 V range) | Within ±0.15 V / ±0.30 V<br>(In the case that the output current is changed from 0% to 100% of the max. current. DC or 45 Hz to 65 Hz.) |
| Distortion of output voltage waveform                       | 0.5% or lower (40 Hz to 550 Hz)   |

Lineup for High Power Applications



DP240S



DP360S

DP240S: single-phase 24 kVA  
DP360S: single-phase 36 kVA

A three-phase model can be configured by connecting 3 units.

\* Contact us for detailed specifications.



3-phase 72 kVA System

## PROGRAMMABLE AC/DC POWER SOURCE

## KP3000S/KP3000GS



KP3000S

(Foot type, Optional outlets are equipped.)



For production lines manufacturing household electrical appliances in ever larger sizes, for mixed lines composed of both AC and DC equipment, and for testing of DC-DC converters, this unit provides 3 kVA/3 kW power.

- AC single-phase 3 kVA/DC 3 kW
- KP3000S : configurable of polyphase system  
single-phase three-wire 6 kVA (2 cabinets)  
three-phase 9 kVA (3 cabinets)

KP3000GS: multifunctional single-phase model  
includes sequence and simulation function,  
and external signal inputs

- Measurement functions  
Voltage (rms value, average DC value, peak value), current (rms value, average DC value, peak value, peak hold value), power (active power, apparent power, reactive power), load power factor, crest factor, sync frequency, harmonic current (up to 40th order), CO<sub>2</sub> emissions
- Current limiter: peak value and RMS value
- Remote sensing, AGC, Auto Cal
- Sequence function and simulation function
- RS-232, USB, GPIB/LAN (specified on order), external control I/O

## SPECIFICATIONS

## Power Output

|                 |                 | 100 V range                                | 200 V range      | Resolution |
|-----------------|-----------------|--|------------------|------------|
| AC              | Output voltage  | 0 V to 155 V                               | 0 V to 310 V     | 0.1 V      |
|                 | Maximum current | 30 A                                       | 15 A             | —          |
|                 | Frequency       | AC: 40 Hz to 550 Hz, AC+DC: 1 Hz to 550 Hz | —                | 0.1 Hz     |
| DC              | Output voltage  | -220 V to +220 V                           | -440 V to +440 V | 0.1 V      |
|                 | Maximum current | 30 A                                       | 15 A             | —          |
| Output waveform |                 | Sine, arbitrary, clipped sine              |                  |            |

## PROGRAMMABLE AC/DC POWER SOURCE

## ES SERIES



- Single-phase 2 kVA to 20 kVA, three-phase 6 kVA to 90 kVA.
- AC output voltage: 0 V to 150 V/0 V to 300 V, frequency: 5 Hz to 1100 Hz, DC output voltage: 0 V to +203 V/0 V to +406 V
- Component style allows expansion after being introduced.  
Cabinet style is compact and requires small installation space.
- Voltage dips, voltage variations, simultaneous sweeping of frequency and voltage.
- Measurement function, protection function, remote sensing, AGC function and external input.
- Handle reverse power flow
- Peripherals for low frequency immunity test of IEC standard is available.

## APPLICATIONS

- Voltage dips, short interruptions and voltage variations tests (for IEC 61000-4-11)
- Harmonic current measurement and flicker measurement (for IEC 61000-3-2 / IEC 61000-3-3)
- Grid connection test for inverter
- As CVCF for anechoic chambers and for production lines

## LINEUP

ES2000S 2 kVA single-phase master   ES2000U 2 kVA three-phase master   ES2000P 2 kVA three-phase slave   ES2000B 2 kVA booster

## ■ Single-phase

|                 |                | 2 kVA | 4 kVA | 6 kVA   | 8 kVA   | 10 kVA   | 12 kVA   | 14 kVA | 16 kVA | 18 kVA   | 20 kVA |
|-----------------|----------------|-------|-------|---------|---------|----------|----------|--------|--------|----------|--------|
| Component style | ES2000S        | 1     | 1     | 1       | 1       | 1        | 1        | 1      | 1      | 1        | 1      |
|                 | ES2000B        | —     | 1     | 2       | 3       | 4        | 5        | 6      | 7      | 8        | 9      |
| Cabinet style   | Model          |       |       | ES6000S | ES8000S | ES10000S | ES12000S |        |        | ES18000S | —      |
|                 | S type cabinet | —     |       | 1       | 1       | —        | —        | —      |        | 1        |        |
|                 | L type cabinet |       |       | —       | —       | 1        | 1        |        |        | 1        |        |

## ■ Three-phase

|                 |                | 6 kVA | 12 kVA | 18 kVA   | 24 kVA | 30 kVA   | 36 kVA | 42 kVA | 48 kVA | 54 kVA | 60 kVA |
|-----------------|----------------|-------|--------|----------|--------|----------|--------|--------|--------|--------|--------|
| Component style | ES2000U        | 1     | 1      | 1        | 1      | 1        | 1      | 1      | 1      | 1      | 1      |
|                 | ES2000P        | 2     | 2      | 2        | 2      | 2        | 2      | 2      | 2      | 2      | 2      |
|                 | ES2000B        | —     | 3      | 6        | 9      | 12       | 15     | 18     | 21     | 24     | 27     |
| Cabinet style   | Model          |       |        | ES24000T |        | ES36000T |        |        |        |        |        |
|                 | S type cabinet | —     |        | 3        |        | —        |        | —      |        |        |        |
|                 | L type cabinet |       |        | —        |        | 3        |        |        |        |        |        |

## ■ Three-phase / single-phase switchable

|                 |                | 6 kVA * | 12 kVA   | 18 kVA   |
|-----------------|----------------|---------|----------|----------|
| Component style | ES2000U        | 1       |          |          |
|                 | ES2000P        | 2       |          |          |
| Cabinet style   | Model          | ES6000W | ES12000W | ES18000W |
|                 | S type cabinet | 1       | —        | 1        |
|                 | L type cabinet | —       | 1        | 1        |

\* Distribution unit ES4439 is required.

## SPECIFICATIONS

## ■ ES2000S Single phase master

The following conditions apply unless otherwise specified.

- The units of voltage and current are rms with rated load (pure resistance load) that obtains rated power at rated output voltage.
- AGC: Off, Remote sensing: Internal

## AC output

|   |   |
|---|---|
| Output type                             | Single-phase two-wire system  |
| Output voltage setting range            | 100 V range: 0 V to 150 V<br>200 V range: 0 V to 300 V<br>(resolution of 0.1 V)   |
| Maximum output current*1                | 100 V range: 20 A / 200 V range: 10 A   |
| Maximum output current (peak)*2         | Precision mode: 3.5 times of maximum output current (rms value)<br>High stability mode: 2.7 times of maximum output current (rms value) |
| Load regulation*3                       | Precision mode: within $\pm 0.5\%$<br>High stability mode: within $\pm 1.0\%$   |
| Line regulation                         | Within $\pm 0.2\%$ to the change in power input voltage of 170 V to 250 V   |
| Load power factor range                 | 0 to 1 (lead or lag)  |
| Output frequency                        | 5 Hz to 1100 Hz (resolution of 0.01 Hz)   |
| Output voltage waveform distortion rate | 0.3% or less (40 Hz to 100 Hz, rated output voltage, typ.), 0.5% or less (rated output voltage)   |
| Output voltage stability                | $\pm 100$ ppm/°C (typ.) (rated output voltage, no load, more than one hour after turning on power)                                      |
| Output noise level                      | 300 mVrms or lower (output voltage setting: 0 V, 20 Hz to 100 kHz)  |
| Output offset voltage                   | Within $\pm 15$ mV (DC)   |

## DC output\*4

|                          |  |
|--------------------------|--|
| Voltage setting range    | 100 V range: 0 V to +203 V<br>200 V range: 0 V to +406 V (resolution 0.1 V)                        |
| Maximum output current*5 | 100 V range: 9 A / 200 V range: 4.5 A  |
| Output voltage stability | $\pm 500$ ppm/°C (typ.) (rated output voltage, no load, more than one hour after turning on power) |
| Power capacity           | 1.27 kVA   |
| Output offset voltage    | Within $\pm 500$ mV (DC), adjustable   |

## ■ Option

|         |                        |
|---------|------------------------|
| ES0406D | Immunity test software |
| ES4439  | Distribution unit      |
| ES4474A | Remote terminal        |
| 4481    | Power inlet unit       |
| 4482    | Outlet unit            |

ES0406D▶



ES4474A



ES4152



ES4153

## ■ Peripherals

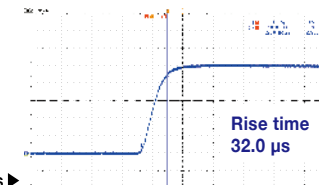
|                |   |
|----------------|---|
| ES4152         | Reference impedance network (single-phase)        |
| ES4153         | Reference impedance network (three-/single-phase) |
| As-517A/As-537 | Voltage dips simulator                            |

## ■ Rise time

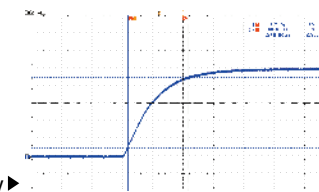
Since the rise time is shorter than a general AC power supply, it is possible to output waveforms with fast change with high reproducibility.

- X-axis: 40  $\mu$ s/div.
- Y-axis: 20 V/div.

ES series▶



Generic AC power supply▶

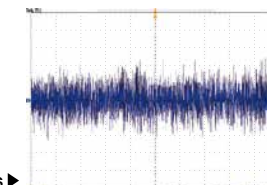


## ■ Output noise

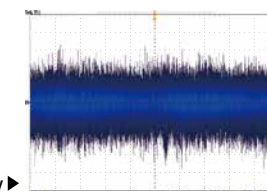
It has less output noise than a general AC power supply, and it is adopted as CVCF for anechoic chamber.

- X-axis: 2.00 ms/div.
- Y-axis: 100 mV/div.

ES series▶



Generic AC power supply▶





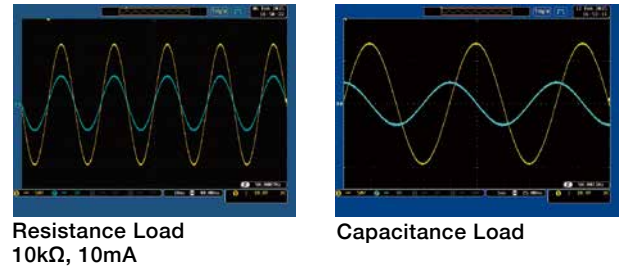
Stable Output in Various Load Conditions

The EC750SA and EC1000SA provide not only a stable power supply, but also the necessary functions for power supply testing, such as measurement, current limiter, , and sequence functions.



- Full power, AC as well as DC (750 VA/750 W, 1 kVA/1 kW)
- Max. output voltage: 310 V
- Peak current output of up to 4 times as large as the max. current (RMS value) at the rated output voltage
- Measurement, sequence, current limiter and protection function
- USB/RS-232, control I/O
- Control software bundled

Output waveform



SPECIFICATIONS

AC/DC mode, signal source

|               |  |
|---------------|--|
| AC/DC mode    | AC, AC+DC  |
| Signal source | INT (Internal), EXT (External), ADD (Internal and external), SYNC (External synchronization) |

AC output

|                           |   |
|---------------------------|---|
| Output power              | EC750SA: 750 VA<br>EC1000SA: 1000VA (when the input is from AC180 V to 250 V, referred to as “AC 200 V input system”)<br><br>When the input is from AC 100 V to 180V (referred to as “AC 100 V input system”), output power is limited to 750 VA. |
| Rated output voltage      | 100 Vrms/200 Vrms   |
| Output range              | 100 V range/200 V range   |
| Voltage setting range*1   | 0.0 to 155.0 Vrms/0.0 to 310.0 Vrms (resolution 0.1 Vrms)   |
| Max. current*2 *3 *4      | 10 Arms/5 Arms  |
| Max. peak current*3 *5    | EC750SA: 30 Apk/15 Apk, EC1000SA: 40 Apk/20 Apk   |
| Frequency setting range*6 | 1.0 Hz to 550.0 Hz (resolution 0.1 Hz)  |
| Output waveform*6         | Sine wave, square wave,arbitrary wave (16 types)  |

DC output

|                         |   |
|-------------------------|---|
| Output power            | EC750SA: 750 W<br>EC1000SA: 1000W (AC 200V input system) (for the AC 100 V input, output power is limited to 750 W) |
| Rated output voltage    | 100 V/200 V   |
| Voltage setting range*1 | −220.0 V to +220.0 V/−440.0 V to +440.0 V (resolution 0.1 Vrms)   |
| Max. current*2 *3       | 10 A/5 A  |
| Max. peak current*2     | EC750SA: 30 Apk/15 Apk, EC1000SA: 40 Apk/20 Apk   |

Output voltage stability

|                                 |  |
|---------------------------------|--|
| Fluctuation with output current | 45 Hz to 65 Hz: Within ±0.15%,<br>DC and 40 Hz to 550 Hz: Within ±0.5%       |
| Fluctuation with input voltage  | Within 0.2% (power input voltage: 100 V/120 V /230 V, no load, rated output) |

Output voltage distortion factor

0.5% or lower (50 Hz/60 Hz, 50% or higher of rated output voltage)

Power input

|                        |   |
|------------------------|---|
| Voltage                | AC100 V to 230 V ±10% (max. voltage 250 V),<br>overvoltage category II  |
| Frequency              | 50 Hz/60 Hz ±2 Hz (single-phase)  |
| Power factor (typ.)    | 0.95 or higher (at AC100 V input),<br>0.90 or higher (at AC200 V input) |
| Max. power consumption | EC750SA: 1.2 kVA or lower<br>EC1000SA: 1.4 kVA or lower                 |

Measurement functions

Output voltage, output current, output power, load power factor, load crest factor, output harmonic current, external synchronization frequency

Sequence functions (internal signal source only.)

|                       |  |
|-----------------------|--|
| Number of sequences   | One sequence per AC/DC mode at both 100 V and 200 V range.                         |
| Number of steps       | Up to 255 (within one sequence)  |
| Step time             | 0.1 ms to 999.9999 s (resolution:0.1 ms)   |
| Operation within step | Constant, keep or linear sweep   |
| Parameters            | DC voltage, AC voltage, frequency, waveform, step synchronization output of 2 bits |
| Number of jumps       | 1 to 999 or continuous   |
| Sequence control      | Start, stop, hold and branch   |

Control software

Remote control, logging, arbitrary waveform, sequence

Other functions

Setting range limit function\*6, arbitrary wave, external signal input, memory function, protections, external control I/O, USB Interface, LCD display

Generals

|                 |   |
|-----------------|---|
| Dimensions (mm) | 258 (W)×176(H)×440(D) (not including protrusions) |
| Weight          | approx. 9.7 kg                                    |

\*1: Signal source: INT, SYNC or ADD, no load  
\*2: The limit on max. output power may cause a reduction in max. output current and max. peak current (EC1000SA for power input AC100 V)  
\*3: For at or above the rated output voltage, the limit on max. output power reduces max. output current. (EC1000SA only).  
\*4: The RMS current of AC+DC is max. output current  
\*5: For a capacitor input type rectifier circuit (crest factor = 4)  
\*6: Signal source: INT, SYNC or ADD

BIPOLAR AMPLIFIERS

HIGH SPEED BIPOLAR AMPLIFIER

HSA SERIES

High Speed, Broad Bandwidth, High Voltage Output

In the test of electronic components and devices such as capacitors and coils, it can stably drives the DUT that cannot be driven by other amplifiers. Used in advanced research fields such as medicine and biotechnology.



LINE UP

|          | Frequency     | Voltage  | Current   | Slew Rate |
|----------|---------------|----------|-----------|-----------|
| HSA42011 | DC to 1 MHz   | 150 Vp-p | 3 Ap-p    | 475 V/μs  |
| HSA42012 | DC to 1 MHz   | 150 Vp-p | 6 Ap-p    | 475 V/μs  |
| HSA42014 | DC to 1 MHz   | 150 Vp-p | 12 Ap-p   | 475 V/μs  |
| HSA42052 | DC to 500 kHz | 300 Vp-p | 5.66 Ap-p | 450 V/μs  |

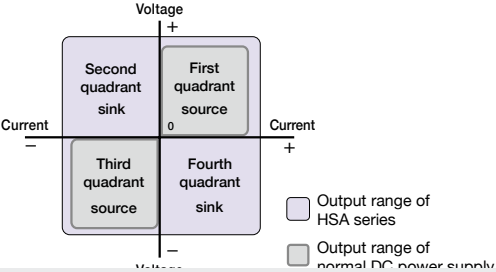
APPLICATIONS

- Driving multilayer ceramic capacitors (MLCC)
- Drive test of ultrasonic motor in combination with signal generator
- B-H curve measurement of magnetic materials such as magnetic powder core and ferrite
- Drive of piezoelectric element and measurement of resonance characteristics
- Reproduction of malfunction due to power supply noise of smartphone / touch panel
- Power fluctuation test of in-vehicle electrical components

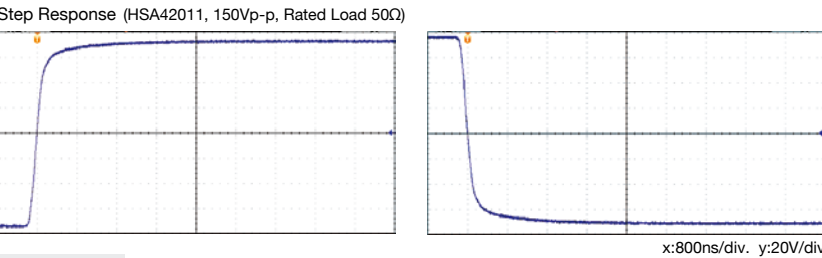
SPECIFICATIONS

| Model  | HSA42011   | HSA42012  | HSA42014  | New HSA42052  |   |
|--------|--|---|---|---|---|
| Output | Maximum Output Voltage   | RL: 50 Ω 53 Vrms (40 Hz to 1 MHz)<br>45 Vrms (20 Hz to 40 Hz)<br>RL: 75 Ω ±75 V (DC to 1 MHz)   | RL: 25 Ω 53 Vrms (40 Hz to 1 MHz)<br>45 Vrms (20 Hz to 40 Hz)<br>RL: 37.5 Ω ±75 V (DC to 1 MHz) | RL: 12.5 Ω 53 Vrms (40 Hz to 1 MHz)<br>45 Vrms (20 Hz to 40 Hz)<br>RL: 18.8 Ω ±75 V (DC to 1 MHz) | DC mode RL: 50 Ω 100 Vrms (40 Hz to 200 kHz)<br>40 Vrms (20 Hz to 500 kHz)<br>RL: 75 Ω ±150 V (DC to 50 kHz)<br>±140 V (50 kHz to 200 kHz)<br>±55 V (200 kHz to 500 kHz)<br>AC mode RL: 50 Ω 100 Vrms (40 Hz to 200 kHz)<br>40 Vrms (20 Hz to 500 kHz)<br>RL: 75 Ω ±150 V (10 Hz to 50 kHz)<br>±140 V (50 kHz to 200 kHz)<br>±55 V (200 kHz to 500 kHz) |
|        | Maximum Output Current(AC)   | 1.06 Arms, 3 Ap-p (40 Hz to 1 MHz)  | 2.12 Arms, 6 Ap-p (40 Hz to 1 MHz)  | 4.24 Arms, 12 Ap-p (40 Hz to 1 MHz)   | 2 Arms, 5.66 Ap-p (40 Hz to 200 kHz)  |
|        | Maximum Output Current(DC)   | ±1 A  | ±2 A  | ±4 A  | ±2 A  |
|        | Low Amplitude Frequency response   | DC to 100 kHz −1 dB to +1 dB<br>100 kHz to 1 MHz −3 dB to +1 dB   |   |   | DC mode DC to 100 kHz : -0.3 dB to +0.3 dB<br>100 kHz to 300 kHz : -1 dB to +0.5 dB<br>300 kHz to 500 kHz : -3 dB to +0.5 dB<br>AC mode 10 Hz to 100 kHz : -0.3 dB to +0.3 dB<br>100 kHz to 300 kHz : -1 dB to +0.5 dB<br>300 kHz to 500 kHz : -3 dB to +0.5 dB   |
|        | Gain Accuracy  | ±5% (Fixed Gain:×1, ×10,×20, and ×50, Variable Gain: CAL, at 400 Hz)  |   |   | ±5% (Fixed Gain:×1, ×20,×40, and ×100, Variable Gain: CAL, at 400 Hz)   |
|        | Slew Rate  | 475 V/μs or above   |   |   | 450 V/μs or above   |
|        | Output DC Offset   | ±0.5 V or above   |   |   | DC: ±1 V or above, AC: ±1 mV  |
|        | Output DC Bias   | ±75 V or above  |   |   | ±150 V or above   |
|        | Harmonic Distortion Rate   | 0.1% or less (40 Hz to 1 kHz, output 40 Vrms)   |   |   | 0.1% or less (40 Hz to 1 kHz, output 80 Vrms)   |
|        | Output Impedance   | [0.19+0.0155√fx(1+j)] Ω or less (typ.) [0.19+0.00803√fx(1+j)] Ω or less (typ.) [0.19+0.00460√fx(1+j)] Ω or less (typ.)                        |   |   | [0.19+0.0084√fx(1+j)] Ω or less (typ.)  |
| Input  | Input A, Input B or addition of input A and input B (When two inputs are on, the maximum input voltage is within ±10 V in total) |   |   |   |   |
|        | Input Format   |   |   |   |   |
|        | Input Impedance  | 50 Ω±5%/10 kΩ±5% switchable (Unbalanced, switch between two inputs A and B at once)   |   |   |   |
|        | Power Input  | AC100 V to 230 V±10% (Maximum voltage 250 V), Overvoltage category II<br>50 Hz ±2 Hz or 60 Hz ±2 Hz (Single-phase), Power factor 0.95 or more |   |   |   |
|        | Power Consumption  | 290 VA or less  | 580 VA or less  | 1050 VA or less   |   |
|        | Dimensions   | 220(W)×132.5(H)×450(D)mm  | 290(W)×132.5(H)×450(D)mm  | 350(W)×177(H)×450(D)mm  |   |
|        | Weigh  | approx. 9kg   | approx.11kg   | approx.16kg   |   |

Four-quadrant operation



Fast response, wide frequency bandwidth, DC to 1MHz



HIGH SPEED BIPOLAR AMPLIFIER

BA4825



BA4825

- **Broadband:** DC to 2 MHz
- **High-power output:** 100 Vrms (300 Vp-p), 0.5 Arms
- **High slew rate:** 500 V/μs
- **Low output impedance**
- **Bipolar output**  
Four-quadrant operation that enables positive and negative voltage and current to be supplied (source) and absorbed (sink).
- **Multiple functions**  
Output polarity switching, output range shift, output monitoring, external output on/off control, DC bias addition, and DC offset adjustment

APPLICATIONS

- Driving and evaluation of piezoelectric elements
- Test and evaluation of display devices
- Power amplifier for signal or pulse generators
- Measurement of magnetizing characteristics (B-H curves)

- Driving of elastic surface wave ultrasonic motors and comb tooth-shaped electrodes in the field of nanotechnology and MEMS
- High-frequency ripple tests of capacitors

SPECIFICATIONS

Frequency

Frequency band
DC to 2 MHz

Output

Maximum output voltage

- ±150 V range (rated resistance load 200 Ω)  
100 Vrms or greater (40 Hz to 500 kHz)  
70 Vrms or greater (500 kHz to 1 MHz)  
40 Vrms or greater (1 MHz to 2 MHz)
- ±150 V range (rated resistance load 450 Ω)  
±150 V (300 Vp-p) (DC to 500 kHz)  
±100 V (200 Vp-p) (500 kHz to 1 MHz)  
±56 V (112 Vp-p) (1 MHz to 2 MHz)
- +250 V range (rated resistance load 1,250 Ω)  
−50 V to +250 V (DC to 500 kHz)  
+40 V to +240 V (500 kHz to 1 MHz)  
+80 V to +200 V (1 MHz to 2 MHz)
- −250 V range (rated resistance load 1,250 Ω)  
−250 V to +50 V (DC to 500 kHz)  
−240 V to −40 V (500 kHz to 1 MHz)  
−200 V to −80 V (1 MHz to 2 MHz)

Rated output current

0.5 Arms  
(±150 V range, rated resistance load 200 Ω)

Output power

50 W (rated condition), 150 W max.

Operation mode

Constant voltage (CV)

Output polarity

In-phase or reversed phase  
(toggled with the panel switch)

Characteristics of small amplitude frequency

DC to 100 kHz, ±0.5 dB  
100 kHz to 2 MHz, +1, −3 dB  
Conditions: Output amplitude 20 Vrms, reference 1 kHz

Gain setting

Fixed: ×1, ×10, ×20, ×50  
Variable: ×1 (CAL) to ×3, consecutive  
The set gain equals to (Fixed × Variable).

Slew rate

500 V/μs

Output DC offset

Adjustment range: ±0.5 V or more  
(input terminal short circuit)

Output DC bias

±200 V or more  
Allows turning on/off by the front panel switch.

Output impedance

0.5 Ω+1.5 μH or less (typ.)

Output terminal

BNC connector (front panel),  
Lo side grounded to the cabinet

Monitor output

1/100 of output voltage, in-phase

Output on/off

Front panel switch or external control input

Input

Maximum input voltage

±10 V

Number of terminals

2 (A input: Front panel, B input: Rear panel)  
(Input type may be A input, B input, or both A input and B input.)

Input terminals

BNC connector, Lo side grounded to the cabinet

Input impedance

50 Ω and 10 kΩ, switchable

Miscellaneous

Protection function

Output overcurrent, output overvoltage, power section failure, abnormal internal temperature

External control input/output

Output on/off and other uses

Settings at power-on

Settings power-on made by dip switches on the rear panel (10 settings for BA4825)

Power input

AC100 V to 230 V ±10% (at 250 V or less),  
50 Hz/60 Hz ±2 Hz

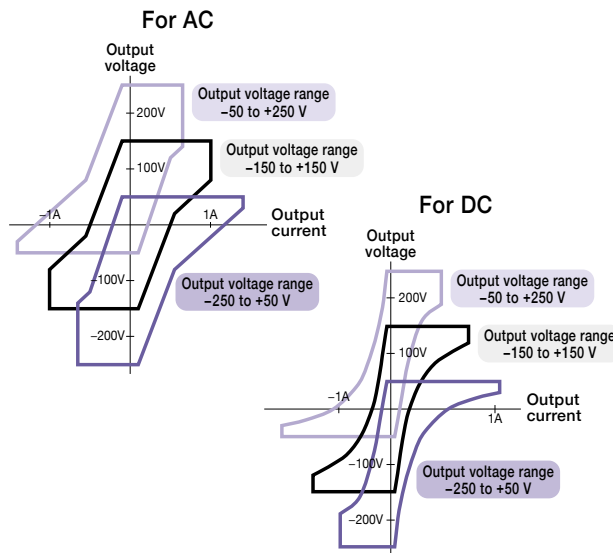
Power consumption

350 VA or less

Dimensions (mm)/Weight

258 (W) × 132.5 (H) × 390 (D) (not including protrusions)/approx. 7kg

Output voltage and current range



PRECISION POWER AMPLIFIER

4500 SERIES



4502



4520A

This series consists of power supplies that provide an output of up to ±200 V from DC to 20 kHz. Four type are available, range from 250 VA to 2 kVA in output power.

In addition, by combining boosters with the 2 kVA amplifier, power output of up to 10 kVA (in 2 kVA/booster) is possible.

- **Wide rage:** DC to 20 kHz
- **High output voltage:** ±200 V
- **Four modes of DC (CV/CC) and AC (CV/CC)**
- **Output voltage can be boosted up by serial connection.**
- **The 4521A Power Booster combined with the 4520A enable power expansion.**

POWER BOOSTER 4521A

The 4521A boosts the output power (current) of the 4520A.

Up to four 4521A units can be connected to a single 4520A.

SPECIFICATIONS

| Model   | 4502   | 4505            | 4510   | 4520A             |
|---|--|-----------------|--|-------------------|
| Rated output power                              | 250 VA   | 500 VA          | 1 kVA  | 2 kVA             |
| Maximum output power with respect to products*1 | 313 VA   | 625 VA          | 1.25 kVA   | 2.5 kVA           |
| Rated output current                            | DC mode  | ±1.9 A          | ±3.8 A   | ±7.5 A            |
|   | AC mode (rms)*2  | 2.1 Arms        | 4.2 Arms   | 8.3 Arms          |
| Peak current                                    | 2.5 × rated value (rms)  |                 |  |                   |
| Rated output voltage                            | 120 Vrms (±170 V) sine wave  |                 |  |                   |
| Maximum output voltage                          | 141 Vrms (±200 V) sine wave  |                 |  |                   |
| Gain  | CC   | 100 V/V         |  |                   |
|   | CV   | 1.5 A/V         | 3 A/V  | 6 A/V             |
| Gain stability                                  | ±100 ppm (typ.), ±100 ppm/8 h (typ.) (CV, DC to 1 kHz)   |                 |  |                   |
| Output mode                                     | CV, CC, DC and AC  |                 |  |                   |
| Load regulation (DC mode)                       | CV mode: Within ±0.1% (DC to 1 kHz), ±2% max. (1 kHz to 20 kHz)  |                 |  |                   |
|   | CC mode: Within ±2% (DC to 1 kHz), ±20% max. (1 kHz to 20 kHz)   |                 |  |                   |
| Line regulation (DC mode)                       | CV mode: Within ±0.1% (DC to 1 kHz), ±1% max. (1 kHz to 20 kHz)  |                 |  |                   |
|   | CC mode: Within ±0.2% (DC to 1 kHz), ±2% max. (1 kHz to 20 kHz)  |                 |  |                   |
| Frequency response                              | +0.2, −0.5 dB: DC to 5 kHz (45 Hz to 5 kHz for AC mode), +0, −3 dB: 5 kHz to 20 kHz  |                 |  |                   |
| Harmonic distortion (DC mode)                   | CV mode: 0.05% or less (10 Hz to 1 kHz), 1% or less (10 kHz), 2.5% or less (20 kHz)<br>CC mode: 0.5% or less (10 Hz to 1 kHz), 2.5% or less (20 kHz)   |                 |  |                   |
| Output offset voltage/current                   | Adjustable to zero   |                 |  |                   |
| Remote sensing                                  | Possible in the CV and DC mode (DC to 1 kHz)   |                 |  |                   |
| Output type                                     | Balanced, single-ended possibly, isolated between input and output   |                 |  |                   |
| Power input                                     | AC100 V ±10%<br>(120, 200, 220 or 240 V is available as option.)<br>48 Hz to 62 Hz   |                 | AC200 V ±10%<br>(220 or 240 V is available as option.)<br>48 Hz to 62 Hz |                   |
|   |  |                 |  |                   |
| Dimensions (H×W×D) (mm)                         | 430 × 176 × 598  | 430 × 265 × 598 | 430 × 353.5 × 600  | 430 × 442.5 × 600 |
| Weight  | approx. 27 kg  | approx. 40 kg   | approx. 70 kg  | approx. 93 kg     |
| Remarks   | *1: with respect to a capacitor-input rectifier circuit having a crest factor (Ipeak/Irms) of 2, in the CV mode<br>*2: rms value for a sine wave current (at the rated output voltage, with Vcc=100% in AUTO mode) |                 |  |                   |

HIGH SPEED BIPOLAR AMPLIFIER for Vehicle Electrical and Electronic Component

As-161 SERIES



As-161-30/60



As-161-60/60

As-161 conducts various EMC tests and power simulation tests on vehicle electrical and electronic components when connected to a testing waveform generator.

- **High speed and broadband:** DC to 150 kHz
- **High output voltage:** −15 V to +60 V/−10 V to +30 V
- **High current:** 30Apeak/60Apeak/120Apeak/240Apeak
- **Low output impedance**
- **Stable constant voltage output for capacitive load**
- **Adjustable slew rate of 5 levels.**



BIPOLAR DC POWER SUPPLY

BP SERIES

Voltage  $\pm 60$  V, Current  $\pm 100$  A max., Constant voltage and Constant current  
Wide output range, Variety of Application

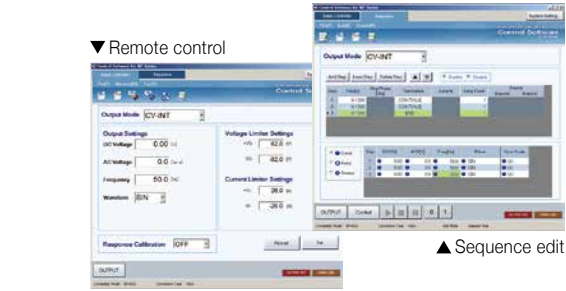


\*BP4610 and BP4620 are CE certified

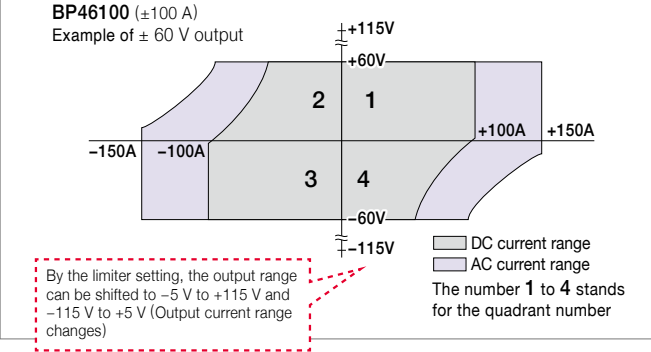
SPECIFICATIONS

| Model                     |   |                 |   | BP4610  | BP4620                                   | BP4630           | BP4640           |            |
|---------------------------|---|-----------------|---|---|--|------------------|------------------|------------|
| Output                    | Maximum output voltage*1<br>CV mode         |                 | DC  | -115 V to +115 V  |  |                  |                  |            |
|                           |   |                 | DC to 0.5 kHz   |   | RL = 23 Ω                                | RL = 12 Ω        | RL = 7.7 Ω       | RL = 5.8 Ω |
|                           |   |                 | 0.5 kHz to 40 kHz   |   | ±60 V                                    |                  |                  |            |
|                           |   |                 | 40 kHz to 150 kHz   |   | RL = 6 Ω                                 | RL = 3 Ω         | RL = 2 Ω         | RL = 1.5 Ω |
|                           |   |                 |   |   | ±60 V                                    |                  |                  |            |
|                           | Maximum output current*1<br>CC mode         |                 | DC to 0.5 kHz   | RL = 4 Ω  | RL = 2 Ω                                 | RL = 1.3 Ω       | RL = 1 Ω         |            |
|                           |   |                 | 0.5 kHz to 30 kHz   | ±50 V   |  |                  |                  |            |
|                           |   |                 | 30 kHz to 70 kHz  | RL = 6 Ω  | RL = 3 Ω                                 | RL = 2 Ω         | RL = 1.5 Ω       |            |
|                           | Small amplitude frequency characteristics*1 |                 |   | CV mode: DC to 200 kHz (amplitude 12 Vp-p, 500 Hz reference), CC mode: DC to 70 kHz (amplitude 12 Vp-p, 500 Hz reference)   |  |                  |                  |            |
|                           | Response calibration function               |                 |   | Response characteristic can be adjusted with knobs on the front panel (Time constant: T, Voltage: V, and  |  |                  |                  |            |
| Rise / Fall time          |   |                 | CV: 2.5 μs*1 (square ±60 V), CC: 4 μs*1 (square, for the following current)                           |   |  |                  |                  |            |
| Output Impedance*1        |   |                 | CV mode   | ±10 A   | ±20 A                                    | ±30 A            | ±40 A            |            |
|                           |   |                 | CC mode   | 7 mΩ + 1.3 μH   | 3.5 mΩ + 0.65 μH                         | 2.3 mΩ + 0.43 μH | 1.8 mΩ + 0.33 μH |            |
|                           |   |                 |   | 10 kΩ// 0.45 μF   | 5 kΩ// 0.90 μF                           | 3.3 kΩ// 1.35 μF | 2.5 kΩ// 1.8 μF  |            |
| Signal sources*2          | Internal signal source                      | CV mode         | DC voltage setting range  | -115 to +115 V (resolution 0.01 V)  |  |                  |                  |            |
|                           |   |                 | AC voltage  | Amplitude range   | 0 Vp-p to 120 Vp-p (resolution 0.1 Vp-p) |                  |                  |            |
|                           |   |                 |   | Waveform  | Sine, square, arbitrary (16 types)       |                  |                  |            |
|                           |   | Frequency range | 1 Hz to 100 kHz (resolution 0.1 Hz)   |   |  |                  |                  |            |
|                           | CC mode                                     | DC current      | Setting range   | -10A to +10A  | -20A to +20A                             | -30A to +30A     | -40A to +40A     |            |
|                           |   |                 | Resolution  | 0.01 A  |  |                  |                  |            |
|                           |   | AC current      | Amplitude range   | 0 to 30 Ap-p  | 0 to 60 Ap-p                             | 0 to 90 Ap-p     | 0 to 120 Ap-p    |            |
|                           |   |                 | Resolution  | 0.001 Ap-p  |  |                  | 0.1 Ap-p         |            |
|                           |   |                 | Waveform  | Sine, Square, Arbitrary (16 types)  |  |                  |                  |            |
|                           |   |                 | Frequency range   | 1 Hz to 100 kHz (resolution 0.1 Hz)   |  |                  |                  |            |
|                           | External signal input                       |                 |   | Phase: In phase, Input impedance: 10 kΩ, Non-destructive max. input voltage: ±5 V, Frequency range: DC to 200 kHz (amplitude 12 Vp-p, 500 Hz reference), CC mode: DC to 70 kHz (amplitude 12 Vp-p, 500 Hz reference)  |  |                  |                  |            |
|                           | Sequence functions                          |                 |   | Number of sequences: 1 sequence for each of the CV and CC, number of steps: 1 to 255 (within 1 sequence) frequency, waveform, step sync output 2 bits, jump count: 1 to 999, or continuous, sequence control: start / |  |                  |                  |            |
|                           | Monitor output                              |                 |   | Output voltage, output current  |  |                  |                  |            |
| Measurement functions     |   |                 | DC output voltage, DC output current, AC output voltage, AC output current                            |   |  |                  |                  |            |
| Arbitrary waveform memory |   |                 | 16 (1024 words, 16 bit.) write is performed via the USB interface.                                    |   |  |                  |                  |            |
| Store / Recall memory     |   |                 | The basic settings can be saved to memories No.1 to No.30   |   |  |                  |                  |            |
| Other functions           |   |                 | Protection functions, external control input / output, key lock, beep, reset, self-diagnosis function |   |  |                  |                  |            |
| Generals                  | Interface                                   |                 |   | USB Interface (USBTMC/USB1.1)   |  |                  |                  |            |
|                           | Power Input                                 |                 | Voltage   | 90 V to 250 V   |  | 180 V to 250 V   |                  |            |
|                           |   |                 | Frequency   | 50 Hz/60 Hz ±2 Hz   |  |                  |                  |            |
|                           |   |                 | Power consumption   | 1.2 kVA max.  | 2.4 kVA max.                             | 3.6 kVA max.     | 4.8 kVA max.     |            |
|                           | Dimensions (W × H × D) (mm)                 |                 |   | 430 × 176 × 551   | 430 × 354 × 551                          | 430 × 710 × 686  | 505 × 1150 × 700 |            |
| Weight (approx.)          |   |                 | 26 kg   | 57 kg   | 97 kg                                    | 165 kg           |                  |            |
| Remarks                   |   |                 |   | *1: Adjusted characteristics *2: Selectable from among internal source, external signal, and internal source + external signal.   |  |                  |                  |            |

- Wide range voltage output  $\pm 60$  V (possible to shift the range)
- 10 Models,  $\pm 10$  A to  $\pm 100$  A
- Two mode selectable, constant voltage/constant current
- High speed, DC to 150 kHz (CV, Adjusted)
- Up to 255 Steps sequence function
- DC, sine wave, square wave, and arbitrary wave
- Response calibration function
- USB/External control IO
- Analog input as power amplifier
- Control software bundled



Wide operation area



APPLICATIONS

- Power supply for voltage fluctuation test on 12 V/24 V/48 V vehicle electrical and electronic components
- Constant current power supply for generating magnetic field
- Constant current power supply for capacitor ripple test
- Constant current power supply for plating

| BP4650  | BP4660  | BP4670             | BP4680             | BP4690             | BP46100          |
|---|---|--------------------|--------------------|--------------------|------------------|
| RL = 4.6 Ω  | RL = 3.8 Ω  | RL = 3.3 Ω         | RL = 2.9 Ω         | RL = 2.6 Ω         | RL = 2.3 Ω       |
| RL = 1.2 Ω  | RL = 1 Ω  | RL = 0.86 Ω        | RL = 0.75 Ω        | RL = 0.67 Ω        | RL = 0.6 Ω       |
| RL = 0.8 Ω  | RL = 0.67 Ω   | RL = 0.57 Ω        | RL = 0.50 Ω        | RL = 0.44 Ω        | RL = 0.4 Ω       |
| RL = 1.2 Ω  | RL = 1 Ω  | RL = 0.86 Ω        | RL = 0.75 Ω        | RL = 0.67 Ω        | RL = 0.6 Ω       |
| ±50A/RL = 1.2 Ω   | ±60A/RL = 1 Ω   | ±70A/RL = 0.86 Ω   | ±80A/RL = 0.75 Ω   | ±90A/RL = 0.67 Ω   | ±100A/RL = 0.6 Ω |
| ±75A/RL = 0.8 Ω   | ±90A/RL = 0.67 Ω  | ±105A/RL = 0.57 Ω  | ±120A/RL = 0.5 Ω   | ±135A/RL = 0.44 Ω  | ±150A/RL = 0.4 Ω |
| ±41.5A/RL = 1.2 Ω   | ±49.8A/RL = 1 Ω   | ±58.1A/RL = 0.86 Ω | ±66.4A/RL = 0.75 Ω | ±74.7A/RL = 0.67 Ω | ±83A/RL = 0.6 Ω  |
| 500 Hz reference)   | CV mode: DC to 170 kHz (amplitude 12 Vp-p, 500 Hz reference), CC mode: DC to 70 kHz (amplitude 12 Vp-p, 500 Hz reference) |                    |                    |                    |                  |
| Current: I)   | CV: 2.7 μs*1 (square ±60 V), CC: 4.2 μs*1 (square, for the following current)   |                    |                    |                    |                  |
| ±50 A   | ±60 A   | ±70 A              | ±80 A              | ±90 A              | ±100 A           |
| 1.4 mΩ + 0.31 μH  | 1.2 mΩ + 0.3 μH   | 1 mΩ + 0.29 μH     | 0.9 mΩ + 0.27 μH   | 0.8 mΩ + 0.26 μH   | 0.7 mΩ + 0.24 μH |
| 2 kΩ // 2.25 μF   | 1.7 kΩ // 2.7 μF  | 1.4 kΩ // 3.15 μF  | 1.3 kΩ // 3.6 μF   | 1.1 kΩ // 4.05 μF  | 1 kΩ // 4.5 μF   |
| -50A to +50A  | -60A to +60A  | -70A to +70A       | -80A to +80A       | -90A to +90A       | -100A to +100A   |
| 0 to 150 Ap-p   | 0 to 180 Ap-p   | 0 to 210 Ap-p      | 0 to 240 Ap-p      | 0 to 270 Ap-p      | 0 to 300 Ap-p    |
| 200 kHz   |   |                    |                    |                    |                  |
| step time: 0.1 ms to 999.999 s (res 0.1 ms), parameters: DC voltage (CV), DC current (CC), superimposed AC voltage (CV), superimposed AC current (CC), stop/hold/branch |   |                    |                    |                    |                  |
| three-wire or 323 V to 433 V, three-phase, four-wire (specified on order)   |   |                    |                    |                    |                  |
| 6 kVA max.  | 7.2 kVA max.  | 8.4 kVA max.       | 9.6 kVA max.       | 10.8 kVA max.      | 12 kVA max.      |
| 180 kg  | 260 kg  | 280 kg             | 300 kg             | 320 kg             | 340 kg           |

## FUNCTION MODULES

Advanced circuit and various types of electronic equipment combined with advanced technology and reliable mounting technology.

### FILTER

Filters for noise removal and anti-aliasing are modularized. The characteristics you need are available from a wide range selection of models.

#### ● Resistor tunable filter

Filter module that sets the cutoff (center) frequency with external resistors.

#### ● Programmable filter

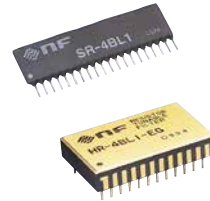
Filter module that sets the cutoff (center) frequency with logic signals.

#### ● Voltage tunable filter

Filter module that sets the cutoff (center) frequency with external DC voltages.

#### ● Fixed frequency filter

A semi-custom-made filter module that the customers can select the filter characteristics and designate necessary items, such as cutoff frequency, and create it.



### AMPLIFIER

Amplifier modules having low noise and excellent frequency characteristics. A highly accurate amplifier circuit can be realized with a few external components.

#### ● Low noise amplifier

It is an amplifier module with extremely low internal noise. While achieving low noise, it has excellent DC and frequency characteristics. Thus, it is possible to achieve both high-precision signal processing and high-density mounting.

#### ● Transconductance amplifier

It outputs and applies a weak current of  $\mu\text{A}$  level. It is a voltage to current conversion module that can supply bipolar output current.

#### ● Transimpedance amplifier

High gain, broadband, low noise. Current amplifiers that realize the world's highest performance with original circuit design technology.

#### ● Piezo driver

It is a linear amplifier that outputs 150 Vpp. This amplifier is optimum for driving various piezoelectric actuator.



### OSCILLATOR

Lineup for low distortion sine-wave oscillator modules that can set the oscillation frequencies with external resistors.

#### ● Resistor tunable oscillator

Oscillator module that sets the frequency with external resistor.

#### ● Random binary generator

Oscillator which can be output binary signals from a random timing. It is possible to make white noise combination with lowpass filter.



### PHASE DETECTOR

A phase detector module is used to detect signals that are buried in noise as well as signals extremely minor levels.

#### ● Phase detector

A phase detector module can detect small level signals and signals that are buried in noise.

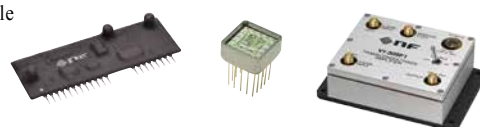
#### ● Vector detector

It detects the quadrature phase using phase detector module. The amplitude and the phase of the input signal synchronous with a reference signal are calculated by a DSP.



### CUSTOM DEVICE

Based on customer's requests, we can do circuits design, sample prototypings, and mass productions. Designing and manufacturing include small quantity lot and board mounting, also support highly reliable products, such as hermetic seals.



## CUSTOMIZED PRODUCTS

### RIPPLE CURRENT TESTER



A device that tests the reliability of a capacitor and coil by applying a DC bias and superimposing a sinusoidal ripple current. Meets the needs of reliability tests, deterioration tests, and noise tests of capacitors and coils.

#### ■ For electrolytic capacitors

- Frequency range: 120 Hz to 100 kHz
- Ripple current: 100 A
- Waveform: sine wave
- Multi channels

#### ■ For power inductor

- Frequency range: 10 kHz to 150 kHz
- Ripple current:  $\pm 30\text{ A}$
- Inductance: 10  $\mu\text{H}$  to 500  $\mu\text{H}$

### BIDIRECTIONAL DC POWER SUPPLY / BATTERY SIMULATION POWER SUPPLY



For evaluation of secondary batteries and various simulated power supplies

- Output range: 0 to 400 V /  $\pm 50\text{ A}$  /  $\pm 20\text{ kW}$
- 800 V in 2 series,  $\pm 500\text{ A}$  in 10 parallel
- Constant voltage / constant current / constant power output, switchable
- Limiter function, load protection function, measurement function, remote sensing
- A maximum of 10 units lithium ion battery simulated power sources can be combined and controlled together with the controller
- Supports solar cell simulation

### MULTICHANNEL LOW NOISE AMPLIFICATION SYSTEM

Sensors, from low resistance to high resistance  
Highly accurate signal processing



- Low Noise
  - Bipolar Input: 1.3  $\text{nV}/\sqrt{\text{Hz}}$
  - FET Input: 2.5  $\text{nV}/\sqrt{\text{Hz}}$
- Multifunction
  - Input-coupling: DC / AC
  - Input-mode: differential / single-ended / GND
  - LPF: THRU (OFF) / LPF (ON,  $f_c = 1\text{ MHz}$ )
  - Equivalent input offset voltage adjustment range:  $\pm 100\text{ }\mu\text{V}$
  - Amplifier GND: FLOAT / EXTERNAL

## NF Corporation

- Head Office: Yokohama, Japan
- Establishment: April 1959
- Business Description:  
Development, Manufacture and Sales of Measurement Instruments, Power Supplies, Device Modules and Customized Products
- Production Sites: Yokohama and Yamaguchi (2 sites)
- Overseas Office: Ohio, USA and Shanghai, CHINA



Head Office



Note: The contents of this catalog are current as of January 24th, 2023  
• Products appearance and specifications are subject to change without notice.  
• Before purchase contact us to confirm the latest specifications, price and delivery date.

# NF Corporation

## Head Office

6-3-20 Tsunashima Higashi, Kohoku-ku, Yokohama 223-8508, Japan

[www.nfcorp.co.jp/english/](http://www.nfcorp.co.jp/english/)

## NF Techno Commerce Co., Ltd. International Sales Division

6-3-14 Tsunashima Higashi, Kohoku-ku, Yokohama 223-0052, Japan  
Phone : +81-45-777-7604 Fax : +81-45-777-7605

*(ES) Equipements Scientifiques SA - Département Tests & Mesures - 127 rue de Buzenval BP 26 - 92380 Garches  
Tél. 01 47 95 99 45 - Fax. 01 47 01 16 22 - e-mail: [tem@es-france.com](mailto:tem@es-france.com) - Site Web: [www.es-france.com](http://www.es-france.com)*