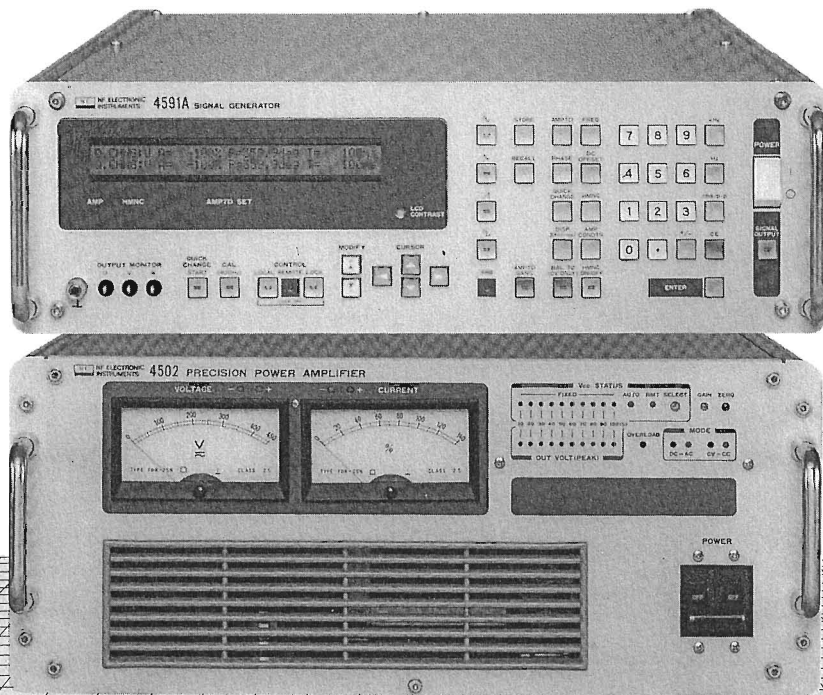
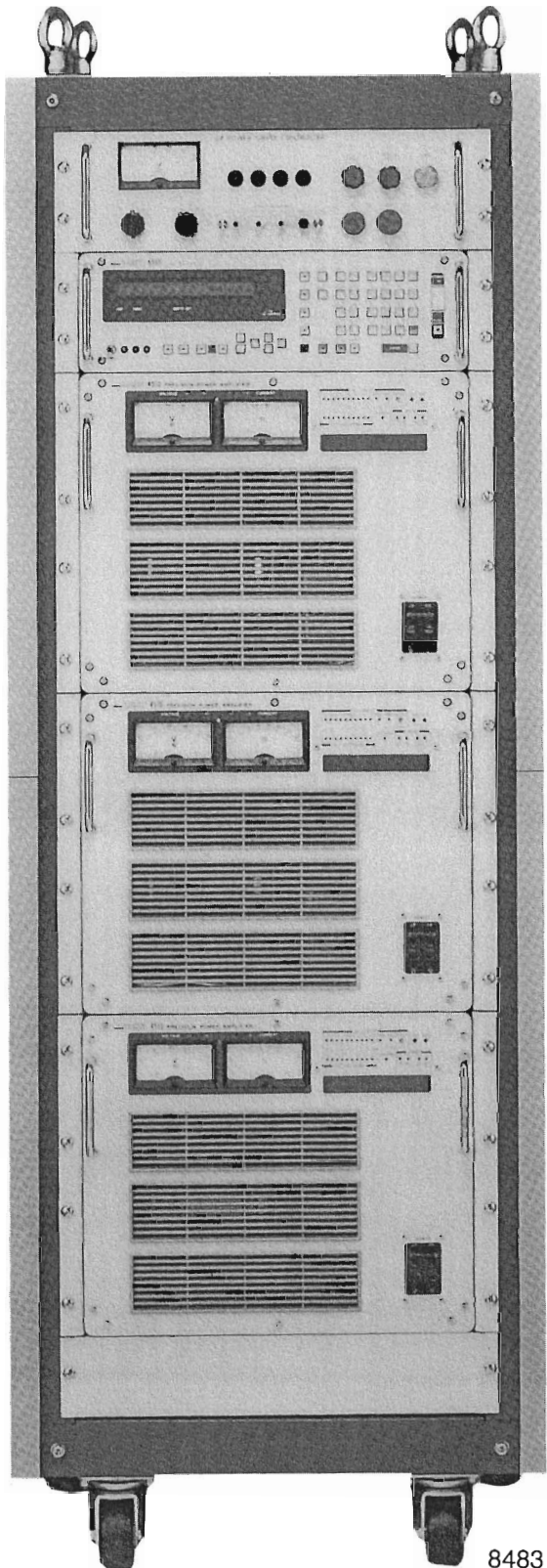


POWER-LINE ENVIRONMENT TEST SYSTEM

Precision Power Amplifiers / Signal Generator



Now Momentary Interruptions Can Be Predicted. High-Precision Power-line Environment Test System Capable of Simulating Virtually any AC Line Problem



8483

Development of today's advanced products assumes the ability to withstand AC-line problems such as momentary interruptions.

The commercial power mains we use daily without problem are actually subject to frequent waveform abnormalities and momentary interruptions, or drops, in voltage. With electronic equipment requiring ever-increasing accuracies, focus has been drawn on the problems caused by such power-line abnormalities.

For example, power-line problems can completely disable an unmanned robot-run factory, can completely destroy a document stored in a word processor, can cause costly and dangerous runaway of numerical control equipment, and can have disastrous effects on air-control radar. The list of potential problems is literally endless.

The key solution is to predict the unpredictable, using a power-line test system from NF Corporation.

Imagine that an unforeseen momentary interruption occurs. Do you know for sure what your newly developed product will do in response? And what countermeasures should be taken in such cases? By simulating AC power-line abnormalities, often a blind spot in maintaining trouble-free operation, the advantages of higher reliability can be accrued to both user and designer.

Power-line environment test systems from NF Corporation are designed-from-the-ground-up systems capable of performing high-precision simulations of all varieties of AC power-line abnormalities. While power-line protection is often a costly investment, the use of these systems can provide an optimum and economic solution to the many requirements in this area, using capabilities designed to meet the tough challenges of today's high-precision electronic equipment.

4500 Series Precision Power Amplifiers Team Up with the New 4591A Signal Generator.

(1) Precision Simulation Capabilities

By combining the broad bandwidth and high output power of the 4500 Series precision amplifiers with the versatile 4591A Signal Generator, it is possible to achieve a high level of simulation repeatability and reliability. In addition, the 4500 Series provides load regulation and line regulation of 0.1% or better. This provides stable and powerful load-drive capabilities, and represents a power-line abnormality simulation system that has no rival. This team of workhorses has sufficient bandwidth reserve to easily provide the DC component required in generating half-cycle interruptions, as well.

(2) Generation of any Type of Interruption

The ability to arbitrarily set the depth of momentary interruptions (both positive and negative directions), the interruption phase, and the interruption duration enables simulation of virtually any type of momentary interruption problem. Setting of interruption duration can be made from 0.1 milliseconds, enabling power-line abnormality testing with extremely high precision.

(3) Distorted-Waveform and Arbitrary-Waveform Output

By using a harmonic-superimposition function (optional), it is possible to superimpose up to five harmonics of arbitrary phases and levels in the range 2nd to 64th harmonic. A GPIB capability (optional) can be used to generate user-defined signals such as voltage-clipped waveforms. This enables investigations using waveforms heretofore impossible to generate, greatly contributing to the reliability of final products.

(4) Up to Six Phases of Output

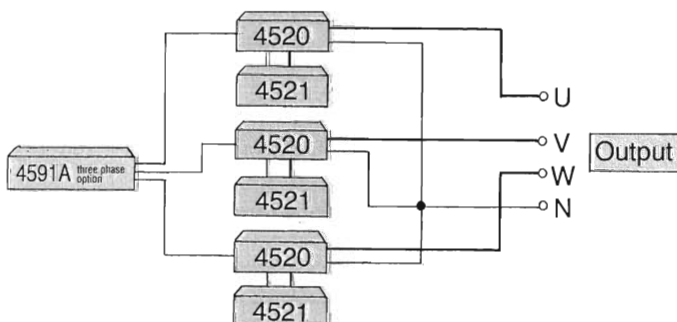
- Multiple 4500 Series units can be configured for up to 10kVA for 100V nominal systems ($\pm 200V$), and up to 20kVA for 200V nominal systems ($\pm 400V$), enabling easy testing of even large 200V systems.
- A single 4591A Signal Generator can provide two or three-phases of signal output with variable phases. By using a pair of these generators, output of up to six phases is possible.

System Output Power

	Single phase	Two phase	Three phase	Four phase	Six phase
100V nominal ($\pm 200V$)	250 VA to 10 kVA	500 VA to 20 kVA	750 VA to 30 kVA	1 kVA to 40 kVA	1.5 kVA to 60 kVA
200V nominal ($\pm 400V$)	500 VA to 20 kVA	—	—	—	—

* Powers are the sums of each phase, and voltages are the phase voltage.

System Configuration Example (three phase, 12 kVA system)



(5) Simple Automated System Configuration

Using the GPIB capability of these systems, it is a simple task to automate the power-line environment test, enabling highly accurate and fast testing under precise computer control.

(6) The Good Combination

The 4500 Series can be paired with the 4591A Signal Generator to form the good combination. Connection in an automated system is extremely simple, as are system modifications and expansions. The level setting can be made at the amplifier output voltage (and automatic calculation and setting are made even if the amplifier is connected directly). Line-to-line voltage specification is possible for three phase connection (balance three phase mode), as well as smooth phase matching found on no other system, making this combination extremely convenient and easily configurable for your application.

NF Corporation can provide a total system solution, including a dedicated rack and control/monitor panels. Consult us for details.

Momentary Interruption Simulation Example

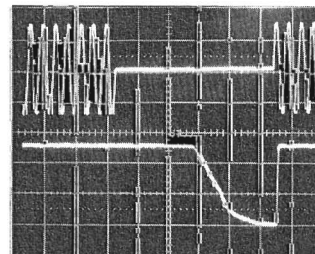


Photo (1)

Top: Line voltage waveform (100V/DIV)
Bottom: Output voltage waveform (2V/DIV)
50ms/DIV

- Photo (1) shows the results of testing a commercially available switching regulator for the effects of a momentary interruption. It can be seen that, with an interruption duration of 135ms or longer, the output voltage drops suddenly.



Photo (2)

Normal display screen

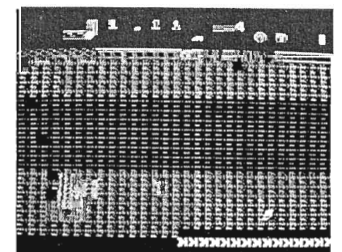


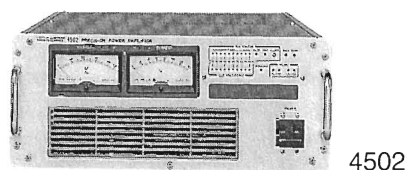
Photo (3)

Disturbed screen

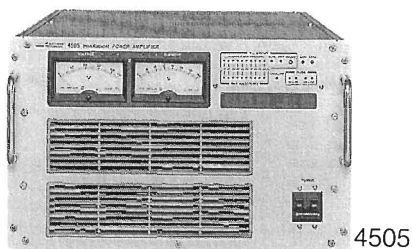
- Photos (2) and (3) are examples of momentary interruption testing of a personal computer, indicating the normal display screen and the screen disturbance when a momentary interruption occurs.

Precision Power Amplifiers

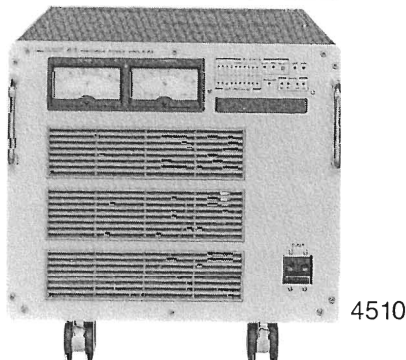
4502/4505/4510/4520/4521



4502



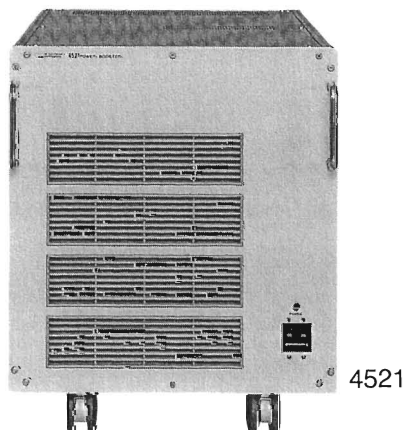
4505



4510



4520



4521

This series consists of power amplifiers/regulated AC power supplies that provide an output of up to $\pm 200V$ from DC to 20 kHz. Four types are available, ranging 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.

DC to 20 kHz Coverage

This series covers the wide range of DC to 20 kHz, enabling output of not only sinewave signals, but trouble free output of signals with harmonic or DC components, such as half-wave interrupted waveforms or voltage-clipped waveforms.

Expandable Capabilities

By connecting two units in series a two-fold increase in output voltage (up to $\pm 400V$) is possible. Also, up to four 4521 Power Booster (2 kVA) can be connected to each 4520 (2 kVA), providing a power expansion of up to 20 kVA.

Constant-Current Output

In addition to constant-voltage (CV) output, constant-current (CC) output is possible as well, a convenience in driving such low-impedance devices as solenoids. In the constant-current mode, parallel-connecting several units can provide a power increase.

Remote Sensing

The 4500 Series provides 0.1% or better load regulation and distortion of just 0.05% or less, placing these amplifiers in the state-of-the-art class for use as amplifiers or AC power supplies. In addition, for applications in which the voltage drop between the amplifier output and the load cannot be ignored, remote sensing terminals have been provided.

V_{cc} Control

Internal control of the DC supply voltage (V_{cc}) increases the supply efficiency, ensuring a constant large output current.

Output Transformer

An optional output transformer can be connected. Using this transformer it is possible to use these amplifiers as AC amplifiers or power supplies, providing a single phase output of 282 Vrms. This transformer is built into the 4502, 4505, and 4510 and housed in a separate case for the 4520 and 4521.

Dedicated Signal Source

The 4500 Series of amplifiers can use an RC oscillator, function generator, or function synthesizer as a signal source. For power-line environment testing involving momentary interruptions or signals with superimposed harmonics, and for three phase supply system configurations, NF's dedicated signal generator (4591A) is a convenient choice. For details, refer to "Signal Generator 4591" in this catalog.

■ Standalone Specifications

▽ Input (CV: Constant-voltage mode, CC: Constant-current mode)

Frequency range	DC to 20 kHz
Maximum allowable input voltage	±50 V (AC + DC)
Gain	CV: 100 V/V CC: 1.5 A/V (4502) 3.0 A/V (4505) 6.0 A/V (4505) 12.0 A/V (4510)
Gain-adjustment range	Approx. ±10% (by means of panel trimmers)
Gain stability	±100 ppm/°C (typical) ±100 ppm/8h (typical) (CV: DC to 1 kHz)
Input impedance	100 kΩ, unbalanced
Input connector type	Binding posts (rear panel)

▽ Output

Model		4502	4505	4510	4520
Rated output power (with a load power factor of 0.7 or greater)		250 VA	500 VA	1 kVA	2 kVA
Maximum output power with respect to product* 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	±15.0 A
	AC mode* ² (rms)	2.1 A	4.2 A	8.3 A	16.7 A
Peak current* ¹		Approx. 2.5×rated value (rms)			

*1: With respect to a capacitor-input rectifier circuit having a crest factor (I_{peak}/I_{rms}) of 2, in the CV mode.

*2: Rms value for a sine wave current (at the rated output voltage, with V_{cc}=100% in AUTO mode, 45 Hz to 20 kHz)

Rated output voltage	120 V _{rm} (±170 V) sine wave
Maximum output voltage	141 V _{rms} (±200 V) sine wave The maximum allowable output current, I, when the output voltage exceeds the rated value is given as I=P/V. (P: rated output power, V: output voltage.)
Output offset voltage (current)	Adjustable to zero (DC mode) using a ZERO panel trimmer.
Output offset voltage drift (CV mode)	DC mode: ±1 mV/°C (typical) AC mode: ±20 μV/°C (typical)
Load regulation (DC mode)	CV mode: ±0.1% (DC to 1 kHz) ±2% (1 k to 20 kHz with local sensing) CC mode: ±2% (DC to 1 kHz) ±20% (1 k to 20 kHz) (Values apply for one/off switching of a purely resistive load.)
Line regulation (DC mode)	CV mode: ±0.1% (DC to 1 kHz) ±1% (1 k to 20 kHz) CC mode: ±0.2% (DC to 1 kHz) ±2% (1 k to 20 kHz) (Values apply for a purely resistive load, at the rated output power, and with the line voltage varied ±10%.)
Output voltage (current) distortion factor	CV mode: 0.05% max. (10 Hz to 1 kHz) 1% max. (10 kHz) 2.5% max. (20 kHz) CC mode: 0.5% max. (10 Hz to 1 kHz) 2.5% max. (20 kHz) (Values apply for a purely resistive load, at the rated output power.)
Frequency response	DC (45 Hz) to 5 kHz +0.2/-0.5 dB 5 k to 20 kHz +0/-3 dB (With respect to 400 Hz reference for CV and CC modes.) (45 Hz figure in parenthesis is refers to AC mode, applies for a purely resistive rated load at the rated output power.)
Output noise level	20 mV _{rms} max. (CV mode, V _{cc} =100%)
Remote sensing	Possible in the CV and DC modes (DC to 1 kHz) (With an output cable length of 10 m max., and an assumed output cable voltage drop of 2 V _{rms} or smaller (sine wave).)
Output configuration	Balanced output, one side can be grounded.

Output modes

Constant voltage (CV)/
Constant current (CC)
DC/AC
(Switch selectable from the rear panel.)
Voltmeter: 450 V full scale
Ammeter: 140% full scale (rms responding, rms value indicating, 2.5% accuracy)
(The ammeter reads 100% for the rated AC current.)

Output meters

Internal DC supply (V_{cc}) control modes

- ① Fixed: V_{cc} fixable at any of ten points in the range 10 to 100%.
 - ② AUTO: V_{cc} tracks the output voltage
 - In addition to panel selector switches, setting is possible using an external remote signal
 - The status is indicated by LEDs.
- The following LED status indicators are provided.
- ① Output voltage peak value (10 points from 10 to 100%)
 - ② Overload
 - ③ DC/AC mode
 - ④ CV/CC mode
 - ⑤ V_{cc} mode

▽ Protective Circuitry

The 4500 features the following protective circuitry.
(Note: Item marked Δ depends upon the type of overload.)

	Output limiting	Power shut off
Output overcurrent protection	○	Δ
Power transistor damage protection	○	
Power transistor area of stable operation protection	○	
Power transistor temperature rise protection		○
DC supply (V_{cc}) overvoltage protection		○
Power supply input overcurrent protection		○

▽ Power Supply

Model	4502	4505	4510	4520
Voltage	AC 100/120/200/220/240V		AC 200/220/240V	
Frequency	48 to 62Hz			
Power consumption	600W	1kW	2kW	4kW
Reactive power	1.1 kVA	2kVA	4kVA	8kVA

● Values apply for a purely resistive rated load and at rated output power.

* Your are requested to designate the voltage required when you order.

▽ General Specifications

Installation resistance 10 MΩ min. (measured using 500 VDC)

Withstand voltage 1500 VAC for 1 minute

● The above values apply between line input, output and chassis.

Ambient operating temperature 0 to 40°C, 10 to 99% RH and humidity

Model	4502	4505	4510	4520
Weight	27 kg 59.5 lb	40 kg 88.1 lb	70 kg 154.2 lb	93 kg 205 lb

▽ Options

Output transformer	In the AC mode, the rated output voltage can be switch-selected as 100, 120, 200 or 240 V (rms), (Standalone transformer for the 4520) Load regulation when using a transformer is as follows:		
	Mode	45 Hz to 1 kHz	1 k to 20 kHz
	CV	±5%	±10%
	CC	±5%	±20%

■ Specifications when Combined with a Booster

▽ Separate Specifications

Configura- tion	4520	1	1	1	1
	4521	1	2	3	4
Rated output power		4 kVA	6 kVA	8 kVA	10 kVA
Maximum power delivered to equipment		5 kVA	7.5 kVA	10 kVA	12.5 kVA
Rated output current	DC mode	±30.0 A	±45.0 A	±60.0 A	±75.0 A
	AC mode (rms)	33.3 A	50.0 A	66.7 A	83.3 A
Gain (CC mode)		24 A/V	36 A/V	48 A/V	60 A/V
		Variable approx. ±10% using a panel trimmer 100 V/V in the CV mode.			
Output voltage (current) versus frequency characteristics		DC to 10 kHz	DC to 7 kHz	DC to 5 kHz	DC to 4 kHz
		+0.2/ -1.0 dB in the above frequency ranges with respect to a 400 Hz reference, for a purely resistive rated load, and at rated output power (for both CV and CC modes).			

▽ Common Specifications

Load regulation
(DC mode, DC to 1 kHz)

Line regulation
(DC mode, DC to 1 kHz)

Output voltage (current) distortion
(DC mode, 10 Hz to 1 kHz)

Supply on/off switching

Power supply (4521 alone)

Weight (4521 alone)

▽ Options

Output transformers

CV mode: ±0.1%

CC mode: ±1%

For purely resistive rated load on/off switching

CV mode: ±0.1%

CC mode: ±0.2%

For a purely resistive rated load, at the rated power output, and with the line input varied ±10%.

CV mode: 0.05% max.

CC mode: 0.5% max.

Booster (4521) supply is switched on/off from the master (4520) power switch.

Voltage: 200V single phase ±10%,
48 to 62 Hz

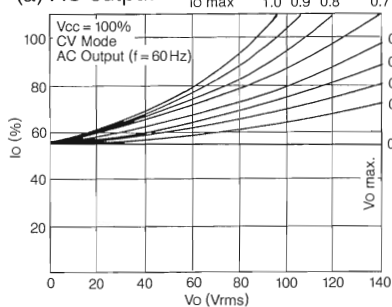
Power consumption: 4 kW, 8 kVA
92 kg, 203 lb

The rated output voltage in the AC mode can be selected as 100, 120, 200, or 240 Vrms. Using a transformer, the CV mode load regulation is 5% (45 Hz to 1 kHz).

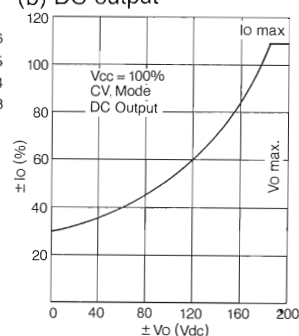
* Other specifications are the same as the 4500 Series.

Allowable output when Vcc = 100%

(a) AC output

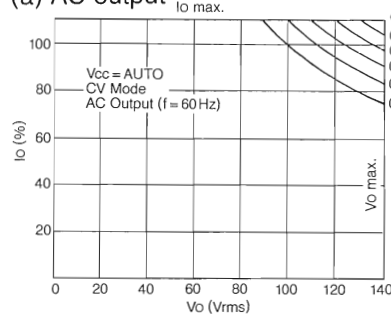


(b) DC output

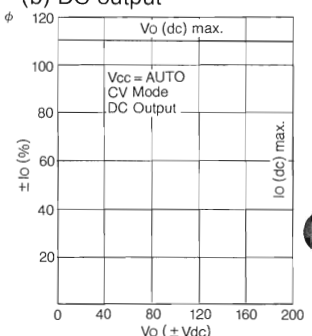


Allowable output when Vcc = AUTO

(a) AC output

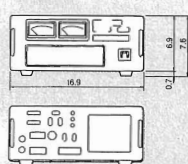


(b) DC output

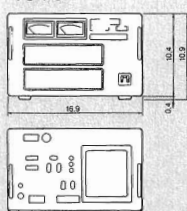


■ Outer Dimensions

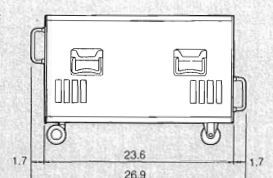
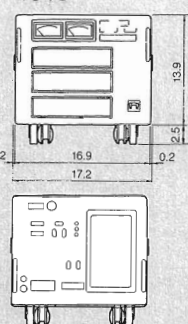
4502



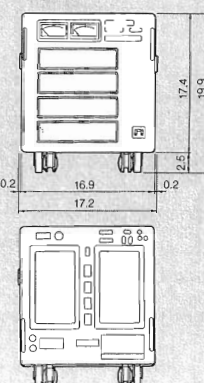
4505



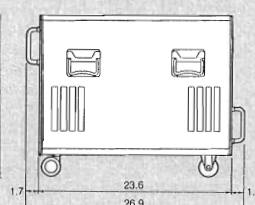
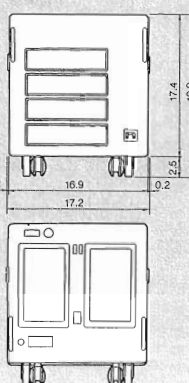
4510



4520

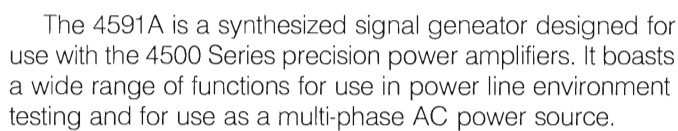


4521



4502	16.9(W) × 6.9(H) × 23.6(D) inch
4505	16.9(W) × 10.4(H) × 23.6(D) inch
4510	16.9(W) × 13.9(H) × 23.6(D) inch
4520	16.9(W) × 17.4(H) × 23.6(D) inch
4521	16.9(W) × 17.4(H) × 23.6(D) inch

GP◀▶IB



The ability to arbitrarily set the depth of momentary interruption (both positive and negative directions); the interruption phase and the interruption duration enables simulation of virtually any type of momentary interruption phenomenon.

By using a harmonic-superimposition function (optional), it is possible to superimpose up to five harmonics of arbitrary phases and levels in the range 2nd to 64th harmonic. A GPIB capability (optional) can be used to generate user-defined waveforms such as voltage-clipped waveforms.

In addition to such high performance as a frequency accuracy of 5×10^{-5} and output voltage setting resolution of 0.001 Vrms (peak-to-peak setting also possible), combined with the 4500 Series Precision Power Amplifiers, the 4591 provides settable output voltage and current, as well as settable line-to-line voltages for three phase power, and other enhanced features to utilize the full capabilities of these power amplifiers.

Technical drawing of the 16.9 inch LCD monitor showing front, top, and side views with dimensions.

Front View: The monitor has a width of 16.9 inches and a height of 5.2 inches. The bezel is 0.1 inches thick. The screen area is 16.9 inches wide and 4.7 inches high. The bottom bezel is 1.7 inches high. The top bezel is 0.1 inches high. The side bezel is 1.7 inches high.

Top View: The monitor has a width of 16.9 inches and a depth of 23.6 inches. The bezel is 0.1 inches thick. The screen area is 16.9 inches wide and 23.6 inches deep. The bottom bezel is 1.7 inches high. The top bezel is 0.1 inches high. The side bezel is 1.7 inches high.

Side View: The monitor has a width of 16.9 inches and a depth of 23.6 inches. The bezel is 0.1 inches thick. The screen area is 16.9 inches wide and 23.6 inches deep. The bottom bezel is 1.7 inches high. The top bezel is 0.1 inches high. The side bezel is 1.7 inches high.

16.9(W) × 5.2(H) × 23.6(D) inch

■ Specifications

▽ Reference (U) Phase Output

Frequency range*	0.001 to 20,000.000 Hz (20 kHz)
Frequency accuracy	5×10^{-5}
Frequency setting resolution	1 mHz (1 Hz setting units) 1 Hz (1 kHz setting units)
Waveforms	Sine, triangle, sawtooth, square (switch selected) Same waveform on all phases when using two and 3-phase options
Maximum output voltage	$\pm 2V$ (4Vp-p), 1.4141 Vrms for sine wave
Output voltage setting units	Vrms or Vp-p
Output voltage setting resolution	0.001 Vrms or 0.001 Vp-p
Output voltage accuracy	$\pm 0.5\%$ (with respect to maximum output voltage for a 400Hz sine wave)
Number of output voltage setting digits	4
Output voltage setting method	Setting is possible with respect to the 4591 signal generator output value or the 4500 Series power amplifier output value (Vrms, Vp-p, Arms, Ap-p). (Selection is made by a rear-panel switch.)
Output voltage frequency characteristics	$\pm 1\%$, with respect to 400Hz sine wave reference
Sinewave distortion	0.1% max., 10 Hz to 20 kHz (at maximum output)
Output impedance	10 Ω max.
Load impedance	2 k Ω min.
Output on/off switching	Front-panel switch (output off when power first applied)
Output connector type	BNC (rear panel)
Monitor output	Output impedance: 2 k Ω
* Settable up to 29,999.999 Hz	

▽ Variable Phase (V, W) Outputs (Option)

Variable phase range	0 to 359.9° (lag), referenced to U phase, each phase independently settable
Phase setting resolution	0.1°
Phase accuracy	$\pm 1\%$ (0.001 Hz to 1 kHz, sine wave)
Amplitude-ganged mode	The voltage on all phases can be varied simultaneously to maintain a constant voltage ratio. Independent master and slave settings for synchronous operation.
Balanced three phase mode	The V and W phases are fixed at 120° and 240°, respectively, with respect to the U phase and the voltages on all phases are the same. Voltage is set as the line-to-line voltage. (When using three phase option only, with the amplifier in the CV mode.)
Other specifications	Same as the reference phase

▽ DC Offset

DC offset level	0 to $\pm 2V$ (same voltage applied to all phases) Maximum output voltage $\pm 4V$ when DC offset is applied
Setting resolution	$\pm 0.001 V$
Setting accuracy	$\pm 0.1\%$ (with respect to maximum value)
Number of setting digits	4
Setting method	Setting is possible with respect to the single generator output value or the 4500 Series power amplifier output value.

▽ Quick Amplitude Change (Momentary Interruption)

Quick-change level	0 to $\pm 100\%$, independently for each phase
Quick-change level resolution	0.1%
Quick-change level accuracy	$\pm 0.5\%$ (0.001 Hz to 1 kHz)
Quick-change starting phase	0 to 359.9°, settable for the output of each phase independently
Quick-change starting phase resolution	0.1°
Quick-change starting phase accuracy	$\pm 1^\circ$ (0.001 Hz to 1 kHz)
Quick-change start timing	Change starts on all phases at the set phase after the start command is given (i.e., after approx. 5 to 10 ms).
Duration time	0 to 9999.9 ms, independently settable on each phase
Duration-time resolution	0.1 ms
Duration-time accuracy	0.1% of setting ± 0.1 ms
Start command	Manual: Pushbutton (front-panel quick-change and start switches) Remote signal: TTL open-collector, negative-logic pulse (applied at rear-panel connector)

▽ GPIB (Option)

Almost all parameters settable from the front panel can be remotely set. Setting data and setting status can be transferred to an external device. Arbitrary waveforms can be written into a waveform RAM (for regeneration later).
Note: When settings are made via the GPIB, the output is set in the same sequence in which data is received.

▽ Arbitrary Waveforms (Via GPIB)

Waveform data range	-2046 to +2046 (equiv. to 12 bits)
Number of words	4096
Amplitude setting range	0 to 100%
Amplitude setting resolution	0.1%
Output voltage range	-4 to +4 V, with respect to -2046 to +2046 data (for an amplitude setting of 100%)

▽ Superimposed Harmonics (Option)

Up to five harmonics can be superimposed to generate a distorted waveform. This is possible when the waveform setting is sinewave.	
Harmonic order	2 to 64
Number of superimposed harmonics	5 (excluding the fundamental)
Maximum harmonic frequency	20 kHz
Harmonic phase	0 to 359° lag (with respect to the fundamental component at phase 0°)
Phase setting resolution	1 degree
Harmonic level	0 to 100% (with respect to fundamental level)
Harmonic level resolution	1%
Composite waveform level	$\pm 4V_{max.}$, displayable as rms value
Note: For two phase and three phase output, the order of the harmonics, levels and phases may be set independently for each phase.	

▽ Other Functions

- (1) MODIFY function: Continuously variable frequency, amplitude, phase (fundamental) and DC offset are possible.
- (2) External signal added input: An external signal can be added to each phase output.

Input frequency range	DC to 20 kHz
Input voltage range	0 to ± 2 V
Maximum allowable input voltage	± 100 V
Input impedance	10 k Ω , unbalanced
Adder adjustment	0 to 100%, continuously variable (by means of a rear-panel trimmer)
Gain	1.0 (with the adder adjustment at maximum setting)
Gain error	$\pm 5\%$ (with the adder adjustment at maximum setting)
Input connector type	BNC (rear panel)
- (3) Amplifier setting condition input and display function.
- (4) Calibration function: Power amplifier gain calibration signal output.

Frequency	400 Hz
Waveform	Sine
Output voltage	1.2 Vrms (corresponds to amplifier rated output voltage)
Phase	Two phase: 0°, 90° Three phase: 0°, 120°, 240°
Indicators	CAL lamp and CAL data display
- (5) Emergency stop function (signal off): An external signal can be used to turn the signal output off.

Input signal	Contact closure to TTL open-collector (negative-logic pulse) turns signal off. Reset is made by a front-panel switch.
Input connector type	BNC (rear panel)
- (6) Program function: Up to 10 sets of setting conditions can be stored in non-volatile memory, recalled and executed as desired.
- (7) Sync-signal output: When frequency, amplitude, phase and DC offset are set (with the exception of the modify function), and when the quick-change and recall functions are executed, a sync signal is output.

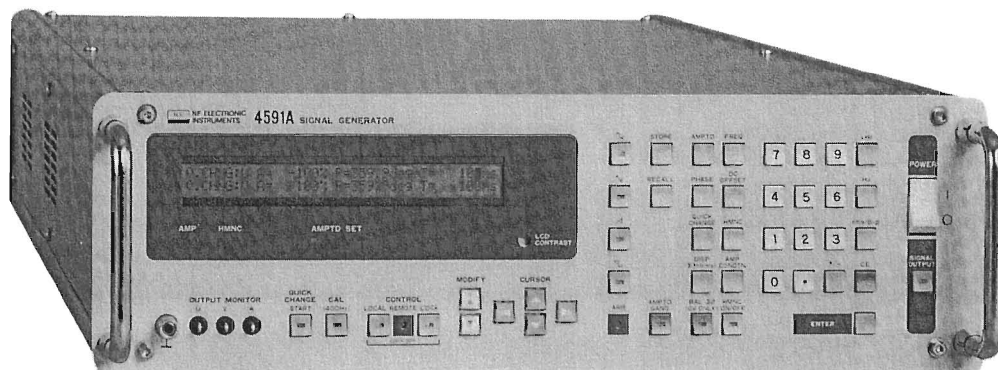
Sync signal	TTL open-collector negative-logic pulse Pulse width: 5 to 10 ms
Output connector type	BNC (rear panel)
- (8) Synchronous (master/slave) operation: Two 4591A signal generators can be operated in sync (master/slave operation).
(The master/slave mode is selected by a rear-panel switch.)
The phase of each of the output phases (U, V, W) of the slave unit are set with respect to the master-unit U phase.
- (9) Display function (displays of amplifier overload, amplitude setting mode, signal generator output setting values, amplifier output setting values, master/slave mode, modify-function enable/disable condition, and waveform clipping for superimposed harmonics).
- (10) Other functions: Setting values are held in battery backed up memory.

▽ General specifications

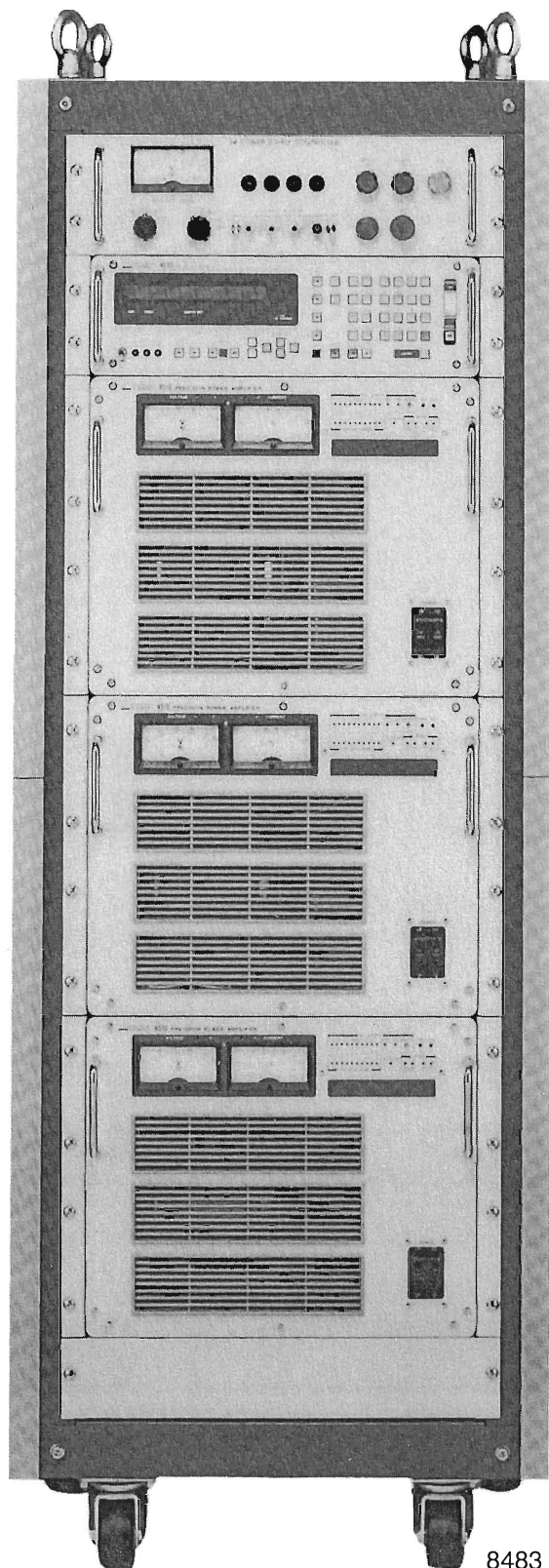
Line power input	90 to 132 VAC or 180 to 274 VAC, 48 to 62 Hz, approx. 120 VA (100 V operation) (For three phase output, with the GPIB option)
Insulation resistance	50 M Ω (measured with 500 VDC)
Withstand voltage	1500 VAC for 1 minute (between AC input and cabinet)
Ambient temperature/humidity ranges	Operating: 0 to 40°C, 10 to 90% RH Storage: -10 to +50°C, 10 to 80% RH
Weight	Approx. 17 kg, 37.4 lb (For three phase output, with the GPIB option)

▽ Options

Two Phase Output
Three Phase Output
Superimposed Harmonics
GPIB



System 8400



8483

This system consists of a power-line environment test system configured by combining the 4591A Signal Generator with 4500 Series Precision Power Amplifiers. It is housed in a sturdy rack and includes a control panel which enables overall power control and monitoring functions.

Large Power Output

The system provides up to 10kVA single phase output and up to 12kVA three phase output.

Advanced Simulation Capabilities

The ability to make use of all the functions of the 4591A Signal Generator enables accurate simulation of virtually any power-line abnormality, including momentary interruption, arbitrary waveforms*, and superimposed harmonics*.

*Optional

Three Phase Output

By specifying systems 8481 through 8485, it is possible to perform power-line environment testing of equipment normally powered from three phase lines. These systems can also be used as high-precision three phase regulated AC power supplies. Each of the output phases can be varied in the range 0 to 359.9° in 0.1° steps.

Automated Testing

By using the GPIB (optional) capability of the 4591A Signal Generator, it is possible to configure an automated power-line environment test system using a computer as a controller.

■ System Designation and Rate Powers

Single Phase Systems

System name	Rated output power	Amplifier configuration* ¹
8445	4 kVA	4520 × 1 + 4521 × 1
8446	6 kVA	4520 × 1 + 4521 × 2
8447	8 kVA	4520 × 1 + 4521 × 3
8448	10 kVA	4520 × 1 + 4521 × 4

Three Phase Systems*²

System name	Rated output power	Amplifier configuration* ¹
8481	750 VA	4502 × 3
8482	1.5 kVA	4505 × 3
8483	3 kVA	4510 × 3
8484	6 kVA	4520 × 3
8485	12 kVA	4520 × 3 + 4521 × 3

*¹ All systems include the 4591A Signal Generator and control panel which are mounted in a dedicated rack.

*² A three phase output (normally optional) is provided as standard for use as a three phase system signal generator.

● GPIB (including arbitrary-waveform functions) and superimposed harmonics are optional for all systems.

Specifications

▽Single Phase Systems

System name	8445	8446	8447	8448
Output configuration	Balanced output (one side can be grounded) DC/AC constant voltage mode* ¹			
Rated output power	DC	5.10kW	7.65kW	10.2kW
	AC* ²	4kVA	6kVA	8kVA
Maximum output power*⁴	5kVA	7.5kVA	10kVA	12.5kVA
Rated output voltage	±170 (DC output), 120Vrms (AC output sine wave)			
Rated output voltage	±200V (DC output), 141Vrms (AC output sine wave)			
Frequency versus output voltage characteristics*⁷	DC to 10kHz	DC to 7kHz	DC to 5kHz	DC to 4kHz
	±0.2dB in the above frequency ranges (with respect to a 400Hz reference) (Above 45Hz in the AC mode)			
Load regulation*⁸	±0.5% (DC to 1kHz), ±5 (above 1kHz)			
Line regulation*⁹	±0.1% (DC to 1kHz), ±1% (above 1kHz)			
Sine wave distortion*⁷	0.3% max. (10Hz to 1kHz)			
Line voltage	Three phase, 200V ±10%, 48 to 62Hz			
Power consumption	16kVA	24kVA	32kVA	40kVA
Weight	Approx. 340kg	Approx. 440kg	Approx. 540kg	Approx. 650kg
	748.9 lb	969.2 lb	1189.4 lb	1431.7 lb

- *1 Selected by a rear-panel switch on the amplifier (Initial setting AC)
- *2 The frequency range is the same as the AC mode frequency versus voltage output characteristics for each type at the rated output voltage, with a load power factor of 0.7 or greater.
- *3 The frequency range is the same as the AC mode frequency versus voltage output characteristics for each type at the rated output voltage, with a balanced, three phase load and a load power factor of 0.7 or greater.
- *4 This is the maximum output power in the range 45 to 450Hz, for an electronic equipment load having a capacitor-input rectifier circuit with a crest factor (I_{peak}/I_{rms}) of 2.
- *5 For a balanced, three phase output

▽Control Panel

Line input switch	Overall input power on/off control
Output switch	Overall output power on/off control
Monitor terminals	Output connected in parallel with the main output. Current rating 1A
Output voltage meter	Three ranges: 125, 250, and 500V For three phase systems, the meter indicates the line-to-line voltage. Accuracy: ±5% of full scale, rms responding (AC only), 10Hz to 20kHz, distortion of 30% or less. Line input check is possible.
Display lamps	Input line power and output.

▽Three Phase System

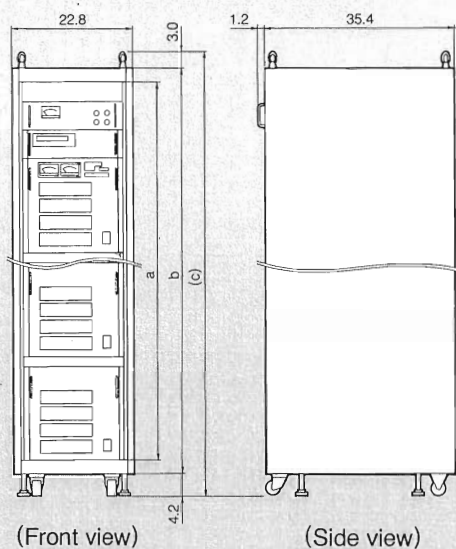
System name	8481	8482	8483	8484	8485
Output configuration	Three phase, four wire (star configuration) DC/AC* ¹ , fixed-voltage mode				
Rated output power*³ (kVA)	0.75	1.5	3	6	12
Maximum output power*⁴ (kVA)	0.939	1.875	3.75	7.5	15
Rated phase voltage	±170V (DC output), 120Vrms (AC output, sine wave)				
Rated line-to-line voltage*⁵	208Vrms (AC output, sine wave)				
Maximum phase voltage*⁶	±200V (DC output), 141Vrms (AC output, sine wave)				
Maximum line-to-line voltage*⁵	244Vrms (AC output, sine wave)				
Frequency versus voltage output characteristics (400Hz reference)*⁷	DC (45Hz) to 5kHz: ±0.2dB, 5Hz to 20kHz: ±0.3dB				DC (45Hz) to 10kHz: ±0.3dB
	(45Hz figure in parenthesis refer to AC mode.)				
Load regulation*⁸	±0.5% (DC to 1kHz), ±5% (above 1kHz)				
Line regulation*⁹	±0.1% (DC to 1kHz), ±1% (above 1kHz)				
Sine wave distortion*⁷	0.3% max. (10Hz to 1kHz)				
Phase setting accuracy	±1% with respect to U-phase output DC (45Hz) to 400Hz, at rated output (45Hz figure in parenthesis refers to AC mode.)				
Line input (48 to 62Hz)	Single phase 100V ±10%		Three phase, 200V ±10%		
Power consumption	3.5kVA	6kVA	12kVA	24kVA	48kVA
Weight	Approx. 230kg	Approx. 270kg	Approx. 360kg	Approx. 440kg	Approx. 765kg
	506.6 lb	594.7 lb	793.0 lb	969.2 lb	1685.0 lb

- *6 The maximum allowable output current when the output current exceeds the rated value is $I = P/3V$. (P: rated output voltage, V: output phase voltage, with a load power factor of 0.7 or greater).
- *7 For a purely resistive load, at the rated output voltage and rated output power.
- *8 At the rated output voltage with a purely resistive load switched on and off.
- *9 With the input line voltage varied ±10%.

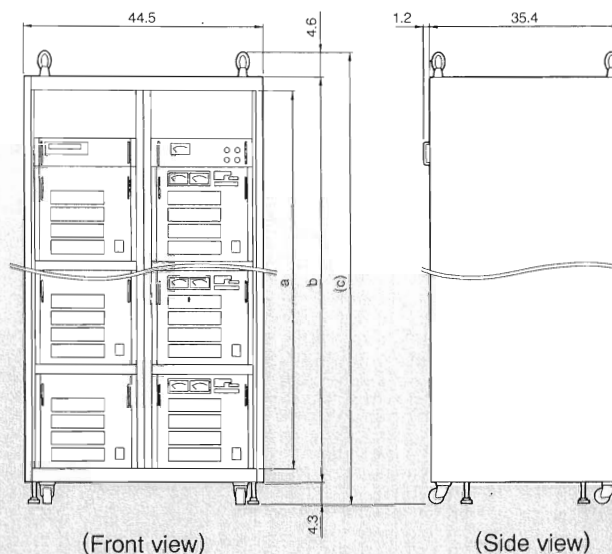
▽Other specifications

Insulation resistance	10MΩ min. (500VDC)
Withstand voltage	1500VAC for one minute Between line input and output/cabinet and output and line input/cabinet
Ambient temperature and humidity	Operating: 0 to 40°C, 10 to 90% RH Storage: -10 to +50°C, 10 to 80% RH

■ Outer dimensions



	a	b	(c)
8481	24U	47.2	54.3
8282	24U	47.2	54.3
8483	32U	61.2	68.3
8484	40U	75.2	62.3
8445	32U	61.2	68.3
8446	40U	75.2	82.3



	a	b	(c)
8485	40U	75.2	84.2
8447	24U	47.2	56.2
8448	32U	61.2	70.2

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

*NF pursues a policy of continuous development and product improvement.
 The specification in this document thus may be changed without notice.

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