DA00047609-001

PROGRAMMABLE AC POWER SOURCE

DP240S/DP360S

Specifications

NF Corporation

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1. Outline

1.1 Overview

The programmable AC power source DP240S/DP360S is a stabilized single-phase AC power source succeeding performance, function and reliability from DP series. It is powered from the three-phase 200 V mains. It provides various interfaces such as the external control input/output, communication interface and a remote controller. Also, it is programmable by itself using Sequence or Simulation functions. Users can test electric devices with high quality waveforms though switching type is adopted in its amplifiers. Users can configure a single-phase three-wire system (72 kVA max.) or three-phase four-wire system (108 kVA max.) connecting the same 2 or 3 models with an optional system-cable.

1.2 Features

■ Various interfaces to address a variety of usage

In addition to RS232, USB, and GPIB (optional) to use for the remote controlling from a computer or sequencer, you can use a contact/TTL signal to turn the output on/off or switch the memory without using a computer. The product also offers the status output for showing the device status and the output which is synchronized with Sequence or Simulation step. With these functions you can achieve various types of systemization and automatization. The AGC and Autocal functions for calibrating the output voltage drop are also provided.

■ Sequence function

Users can program a sequence to change output voltage, frequency, waveforms and so on with this function, which provides automation of switching continuously a number of testing conditions.

■ Power source fluctuation test (=Simulation) function

Users can simulate power line abnormalities, such as blackout, voltage rise, voltage drop, abrupt phase change, abrupt frequency change, and so on.

■ Variable current limiter

This function can limit the effective value and the positive/negative peak value of the output current where the limiting value is variable. Users can set the limiter so that the output is turned off when the limited condition continues for a certain time.

■ Feature-rich measurement function

On the panel the product displays the effective value, peak value, average DC value, current peak-hold value, and active/apparent power of the output voltage/current. Furthermore, the power factor, crest factor, reactive power, and harmonic current are also measured and displayed.

■ Control Software included by default

Users can perform the following operations by using Control Software included in the attached CD-ROM:

- Operations same as those performed on the control panel
- Editing/transferring the arbitrary waveform data
- Data logging (importing the measured values)
- Editing/exporting*/performing Sequence
- Editing/exporting*/performing Simulation
  *Program data is exported to a USB memory.

■ USB memory support (supported format type: FAT32)

Users can write/read the following data to/from a commercial USB memory stick:

- Basic setting
- Sequence
- Simulation
- Arbitrary waveform

■ Options (partial)

- Remote Controller
  A remote controller with the numeric keypad, jog, and shuttle.

- System cable for 1P3W/3P4W connection
  Connects the same models by this cable to configure a polyphase output system.

2. Contents Construction

The contents of this product are as follows.

Main unit		1
Accessories:	Instruction Manual	1
	CD-ROM	1
	Control Software	
	LabVIEW Driver	
	Remote Control Instruction Manual	
	Control Software Instruction Manual	

3. Specifications

Specifications are valid under the following settings and conditions and after a warm-up period of 30 minutes at least, unless otherwise noted.

Load:	Resistive load, power factor = 1.
Signal source:	INT (internal signal source).
Output voltage waveform:	sine.
Remote sensing:	off.
AGC/Autocal:	off.
Current limiter:	factory default setting.

[set] indicates a setting value, and [rdg] indicates a read value.

The description noted with "/" indicates that the specification changes by the output range, such as "100 V range specification / 200 V range specification."

A value with the accuracy is the guaranteed value of the specification. However, an accuracy noted as reference value shows the supplemental data for reference when the product is used, and is not under the guarantee. A value without the accuracy is the nominal value or representative value (shown as typ.).

DP240S/DP360S corresponds to Clause 2 (8) Frequency converter, Appendix 1 of Export Trade Control Ordinance of Japan. The permission for exportation of the Japanese Administration is necessary for export outside Japan.

Notes on Polyphase System

Single-phase three-wire (1P3W) system can be configured by connecting 2 models of the same type (output power capacity). Three-phase four-wire (3P4W) system can be configured by connecting 3 models in the same way. These are called as polyphase system.

Firmware discriminates power capacity and polyphase type at the start-up process just after turning on the system connected with an optional system cable (either 1P3W or 3P4W type), and the system starts to operate as that power capacity and polyphase type.

Output Lo terminals connected together become a neutral phase (N phase) in both the 1P3W and 3P4W system. Hi terminals are called L1, L2 and L3, respectively (L3 exists only in 3P4W system). Output voltage is defined with phase voltage (L1, L2, L3 to N) in this document unless otherwise noted.

3.1 Output Function

	DP240S	DP360S
Output function	Continuous, Sequence, Simulation	

3.2 Output Range

	DP240S	DP360S
Output range	100 V range, 200 V range	

3.3 AC/DC Mode

	DP240S	DP360S
AC/DC mode	AC, AC+DC, DC	

	Description
AC	The signal source and amplification section of this product are AC-coupled, and the DC component is canceled. Only the AC output setting of 40 Hz or higher is available. The signal sources that can be combined are INT, VCA, SYNC, EXT, and ADD. When the waveform superimposed with DC is amplified using EXT and ADD (using external signal sources), it may not be an intended output because the DC component is canceled. In this case, select the AC+DC mode.
AC+DC	The signal source and amplification section of this product are DC-coupled, and the DC component is also amplified. The AC and DC output settings of 1 Hz or higher are available. The signal sources that can be combined are INT, SYNC, EXT, and ADD. In polyphase system only AC setting is available. Fixed to this mode in the Simulation. Select this mode when you want to amplify a signal including DC, to superimpose DC (DC offset), or output a frequency of 40 Hz or lower. Also select this mode when the DC component temporally occurs, for example, by sudden change of voltage or phase.
DC	The signal source and amplification section of this product are DC-coupled. Only the DC setting is available. The signal sources that can be combined are INT and VCA. It is unavailable for the polyphase system.

3.4 Signal Source

	DP240S	DP360S
Signal source	INT, VCA, SYNC, EXT, ADD	

	Description
INT	Uses the internal signal source. Sets the output voltage, output waveform, frequency, output on phase, and output off phase by using the panel or the external interface such as USB. Fixed to INT in the Sequence and Simulation.
VCA	Uses the internal signal source. Controls the output voltage setting of the internal signal source with the DC signal which is input to the external input terminal. The output voltage setting cannot be set from external interfaces such as the panel or USB. All conditions except for output voltage setting are same as INT. In the polyphase system, the setting is common to all the phases. Cannot be selected in the AC+DC mode.
SYNC	Uses the internal signal source. Synchronizes the frequency of the internal signal source with the signal (EXT) from the external synchronization signal input terminal (also used as the external input terminal) or the power supply input frequency (LINE) of the product. The frequency setting cannot be set from external interfaces such as the panel or USB. All conditions except for output frequency setting is same as INT. Cannot be selected in the DC mode.
EXT	Uses the external signal source. Amplifies the signal from the external input terminal by the specified gain(variable), and outputs it. Cannot be selected for the polyphase system. Cannot be selected in the DC mode.
ADD	Uses both the internal and external signal sources. Amplifies the signal from the external input terminal by the specified gain like EXT, and adds the internal signal source component to it. Cannot be selected for the polyphase system. Cannot be selected in the DC mode.

3.5 AC Output

[V]=Vrms, [A]=Arms unless otherwise noted.

	DP240S	DP360S
Mode	Single-phase two-wire Floating output, the Lo terminal can be grounded.	
Setting mode *1	Balanced mode, Unbalanced mode	
Rated output voltage	100 V / 200 V	
Voltage setting range *2	0.0 V to 155.0 V / 0.0 V to 310.0 V 0.0 Vp-p to 440.0 Vp-p / 0.0 Vp-p to 880.0 Vp-p (arbitrary wave)	
Setting resolution	0.1 V	
Voltage accuracy *3	±(0.5% of set + 0.6 V / 1.2 V)	
Line voltage setting range *4	0.0 V to 310.0 V / 0.0 V to 620.0 V (1P3W) 0.0 V to 268.4 V / 0.0 V to 536.8 V (3P4W)	
Setting resolution	0.2 V	
Maximum current *5	240 A / 120 A	360 A / 180 A
Maximum peak current *6	Peak value (Apk) which is four times of the maximum current	
Power capacity	24 kVA	36 kVA
Load power factor *7	0 to 1	
Frequency setting range	40.00 Hz to 550.00 Hz (AC mode) 1.00 Hz to 550.00 Hz (AC+DC mode)	
Setting resolution	0.01 Hz	
Frequency accuracy	±0.01% of set (23°C±5°C)	
Frequency stability *8	±0.005%	
Voltage frequency characteristic *9	±1%	
Output waveform	sine wave, arbitrary wave (16 types), clipped sine wave (3 types)	
Output on phase setting range *10	0.0° to 359.9° variable	
Setting resolution	0.1°	
Output off phase setting range *10	0.0° to 359.9° variable (active/inactive selectable)	
Setting resolution	0.1°	
Phase angle setting range *11	L2 phase: 180.0°±35.0° (1P3W) L2 phase: 120.0°±35.0°, L3 phase: 240.0°±35.0° (3P4W)	
Setting resolution	0.1°	
DC offset *12	Within ±20 mV (typ., fine adjustment available.)	

*1: Can be set only in the polyphase system.

*2: For phase voltage in the polyphase system. Voltage is set in a lump to all phases in balanced mode, and individually to each phase in unbalanced mode.

*3: In the case of 10 V to 150 V / 20 V to 300 V, sine wave, no load, 45 Hz to 65 Hz, DC voltage setting 0 V, 23°C±5°C. For phase voltage in the polyphase system.

*4: Line voltage can be set with sine wave in the balanced mode of the polyphase system.

*5: If the output voltage is higher than the rated value, this is limited (lowered) to satisfy the power capacity. If there is the DC superimposition, the active current of AC+DC satisfies the maximum current. In the case of 40 Hz or lower or 400 Hz or higher, and that the ambient temperature is 40°C or higher, the maximum current may decrease.

*6: For the capacitor input type rectified load (crest factor=4), the rated output voltage, and 45 Hz to 65 Hz.

*7: Phase lead or phase lag, 45 Hz to 65 Hz. External power injection or regeneration are not available.

*8: For 45 Hz to 65 Hz, the rated output voltage, no load or the resistance load for the maximum current, and within the operating temperature range.

*9: For 40 Hz to 550 Hz, sine wave, the rated output voltage, the resistance load for the maximum current at 55 Hz, and 55 Hz reference.

*10: Set for the L1 phase in the polyphase system. The component of the phase angle setting is added for the other phases.

*11: Can be set only in the balanced mode of the polyphase system.

*12: In the case of the AC mode and 23°C±5°C.

3.6 DC Output

[V]=Vdc, [A]=Adc, the polarity is relative to the Lo terminal, unless otherwise noted.

	DP240S	DP360S
Mode	Floating output, the Lo terminal can be grounded.	
Rated output voltage	100 V / 200 V	
Voltage setting range	−220.0 V to +220.0 V / −440.0 V to +440.0 V	
Setting resolution	0.1 V	
Voltage accuracy *13	±(|0.5% of set| + 0.6 V / 1.2 V)	
Maximum current *14	240 A / 120 A	360 A / 180 A
Maximum instantaneous current *15	Peak value (Apk) which is four times of the maximum current	
Power capacity	24 kW	36 kW

*13: In the case of −212 V to −10 V, +10 V to +212 V / −424 V to −20 V, +20 V to +424 V, no load, AC setting 0 V, 23°C±5°C.

*14: If the output voltage is higher than the rated value, this is limited (lowered) to satisfy the power capacity. If there is the AC superimposition, the active current of DC+AC satisfies the maximum current. In the case that the ambient temperature is 40°C or higher, the maximum current may decrease.

*15: Instantaneous = within 2 ms, at the rated output voltage.

3.7 Output Voltage Stability

	DP240S	DP360S
Fluctuation with input voltage *16	Within ±0.15% (typ.)	
Fluctuation with output current *17	DC 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	
Fluctuation with ambient temperature *18	Within ±0.01%/°C (typ.)	

*16: For power input 170 V to 250 V, power input 200 V reference, the resistance load at the maximum current, the rated output voltage, DC or 45 Hz to 65 Hz. Transition state immediately after a change of the input power-supply voltage is not included.

*17: In the case that the output current is changed from 0% to 100% of the maximum current. For output voltage 75 V to 150 V/150 V to 300 V, no load reference. However, if the output voltage is higher than the rated value, the maximum current is limited to satisfy the power capacity.

*18: For power input 200 V, no load, the rated output voltage, DC or 45 Hz to 65 Hz.

3.8 Distortion of Output Voltage Waveform

	DP240S	DP360S
Distortion *19	0.5% or lower	

*19: 40 Hz to 550 Hz, 50% or higher of the rated output voltage, the maximum current or lower, AC and AC+DC modes, THD+N.

3.9 Power Input

	DP240S	DP360S
Voltage	200 V±15%	
Frequency	50 Hz±2 Hz or 60 Hz±2 Hz	
Phase	Three-phase 3-wire	
Power factor *20	0.90 or higher (typ.)	
Efficiency *20	77% or higher (typ.)	
Maximum power consumption	36 kVA or lower	54 kVA or lower

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

3.10 Withstand Voltage and Insulation Resistance

Power input - Output/Chassis and Power input/Chassis - Output

	DP240S	DP360S
Withstand voltage	AC 1500 V or DC 2130 V, 1 minute.	
Insulation resistance	30 MΩ or higher (DC 500 V)	

3.11 Measurement Function

All accuracy of the measurement function is indicated for 23°C±5°C.

View

	DP240S	DP360S
Normal	Displays almost all the measured and setting values excluding the harmonic current measurement on one screen.	
Simple	Enlarges and displays three items among all the measured values except the harmonic current measurement.	

Voltage *21

		DP240S	DP360S
Effective value (rms)	Full scale	250.0 V / 500.0 V	
	Resolution	0.1 V	
	Accuracy	DC, 45 Hz to 65 Hz ± (0.5% of rdg + 0.3 V / 0.6 V) 40 Hz to 550 Hz ± (0.7% of rdg + 0.9 V / 1.8 V)	
DC average value (avg)	Full scale	±250.0 V / ±500.0 V	
	Resolution	0.1 V	
	Accuracy	DC ± (|0.5% of rdg| + 0.3 V / 0.6 V)	
Peak value (pk) (each of max and min)	Full scale	±250 V / ±500 V	
	Resolution	0.1 V	
	Accuracy *22	DC, 45 Hz to 65 Hz ± (|2% of rdg| + 1.0 V / 2.0 V)	

*21: In the polyphase system, this specification is for the phase voltage and the DC average value display cannot be selected.

*22: The accuracy of the peak value is for a waveform of DC or sine wave.

Voltage (Line voltage of polyphase system, only with sine waveform output.)

		DP240S	DP360S
Effective value (rms) *23	Full scale	1P3W: 500.0 V / 1000.0 V 3P4W: 433.0 V / 866.0 V	
	Resolution	0.1 V	

*23: The displayed value is the result of calculation with the phase voltage measured value and the phase angle setting value regarding the output voltage waveform as a sine wave.

Current *24 *25

		DP240S	DP360S
Effective value (rms)	Full scale	320 A / 160 A	480 A / 240 A
	Resolution	0.1 A	
	Accuracy	DC, 45 Hz to 65 Hz	
		± (1% of rdg + 0.7 A / 0.4 A)	± (1% of rdg + 1.0 A / 0.5 A)
		40 Hz to 550 Hz	
		± (1.4% of rdg + 0.7 A / 0.4 A)	± (1.4% of rdg + 1.0 A / 0.5 A)
DC average value (avg)	Full scale	±320 A / ±160 A	±480 A / ±240 A
	Resolution	0.1 A	
	Accuracy	DC	
		± (|1% of rdg| + 0.7 A / 0.4 A)	± (|1% of rdg| + 1.0 A / 0.5 A)
Peak value (pk) (each of max and min)	Full scale	±1280 A / ±640 A	±1920 A / ±960 A
	Resolution	0.1 A	
	Accuracy (Reference Value) *26	DC, 45 Hz to 65 Hz	
		± (|2% of rdg| + 3.2 A / 1.6 A)	± (|2% of rdg| + 4.8 A / 2.4 A)
	Hold	Holds the maximum values of |max| and |min| with the polarity (with the clear function)	

*24: Accuracy values are in the case that the output current is 5% to 100% of the maximum current.
*25: In the polyphase system, these are the specifications for the phase current. The DC average value display cannot be selected.
*26: The accuracy of the peak value is for a waveform of DC or sine wave.

Power *27 *28 *29 *30

		DP240S	DP360S
Active (W)	Full scale	28800 W	43200 W
	Resolution	1 W	
	Accuracy *31	45 Hz to 65 Hz	
		±(2% of rdg + 12 W)	±(2% of rdg + 18 W)
Apparent (VA)	Full scale	36000 VA	54000 VA
	Resolution	1 VA	
	Accuracy	45 Hz to 65 Hz	
		±(3% of rdg + 24 VA)	±(3% of rdg + 36 VA)
Reactive (var)	Full scale	36000 var	54000 var
	Resolution	1 var	
	Accuracy *32	45 Hz to 65 Hz	
		±(3% of rdg + 24 var)	±(3% of rdg + 36 var)

*27: All in the case of sine wave, 50 V or higher output voltage, and that the output current is 10% or higher of the maximum current.
*28: In the polyphase system, these are the specifications for each phase.
*29: In the polyphase system, the all-phase total display is available.
*30: The apparent and reactive powers are not displayed in the DC mode.
*31: For the load with the power factor 0.5 or higher.
*32: For the load with the power factor 0.5 or lower.

Load power factor, Load crest factor

		DP240S	DP360S
Power factor *33	Measurement range	0.00 to 1.00	
	Resolution	0.01	
Crest factor	Measurement range	0.00 to 50.00	
	Resolution	0.01	

*33: The power factor is not displayed in the DC mode.

Synchronization frequency (only SYNC)

	DP240S	DP360S
Display range	38.0 Hz to 525.0 Hz	
Resolution	0.1 Hz	
Accuracy	±0.2 Hz	

Harmonic current (AC-INT, fundamental wave 50Hz/60Hz only, phase current) *34

		DP240S	DP360S
Effective value (rms) Percent (%)	Measurement range	Up to 40th order of the fundamental wave	
	Full scale	320 A / 160A 100%	480 A / 240A 100%
	Resolution	0.1 A 0.1%	
	Accuracy (at RMS, reference value)	Up to 20th ± (2% of rdg + 3.2 A / 1.6 A)	± (2% of rdg + 4.8 A / 2.4 A)
		21st to 40th ± (3% of rdg + 3.2 A / 1.6 A)	± (3% of rdg + 4.8 A / 2.4 A)

*34: The measurement does not conform to the IEC or other standard.

3.12 Power Unit Energization Setting

The power consumption can be decreased by decreasing the number of the power units in operation according to the load capacity. Each power unit can be enabled (energized)/disabled (not energized) separately.

	DP240S	DP360S
Maximum output power per unit	3 kVA	4.5 kVA
Working unit number setting range	1 to 8	

3.13 Current Limiter

This controls the output voltage for the output current to be within the limiter setting value when the peak value or RMS exceeds it. The output can be configured to be turned off when the limited state continues over the specified time.

In the polyphase system, the settings are made for the phase current and common to all the phases.

If a user increased or decreased the number of working units by the power unit energization setting, the setting range and the factory default setting vary in proportional to the ratio of the working units to all the units (8 units). Refer to the example below. Digits under resolution are rounded to the larger absolute value. Limiter settings are reset to their factory defaults when the number of working power units is changed.

Peak current limiter

		DP240S	DP360S
Positive current	Setting Range (Peak value)	+120.0 A to +1008.0A / +60.0 A to +504.0 A	+180.0 A to +1512.0 A / +90.0 A to +756.0A
	Factory default	+1008.0 A / +504.0 A	+1512.0 A / +756.0 A
Negative current	Setting Range (Peak value)	–1008.0 A to –120.0 A / –504.0 A to –60.0 A	–1512.0 A to –180.0 A / –756.0 A to –90.0 A
	Factory default	–1008.0 A / –504.0 A	–1512.0 A / –756.0 A
Resolution		0.1 A	
Limiter operation		Select whether to recover automatically (continuous, factory default) or turn the output off when the limited state continues over the specified time (1 s to 10 s, resolution 1 s).	

RMS current limiter

	DP240S	DP360S
Setting range (effective value)	12.0 A to 252.0 A / 12.0 A to 126.0 A	18.0 A to 378.0 A / 18.0 A to 189.0 A
Factory default	252.0 A / 126.0 A	378.0 A / 189.0 A
Resolution	0.1 A	
Limiter operation	Select whether to recover automatically (continuous, factory default) or turn the output off when the limited state continues over the specified time (1 s to 10 s, resolution 1 s).	

Setting ranges and factory defaults when working unit number changed (example)

If the number of working units is changed from 8(max.) to 7, setting ranges and factory defaults of each current limiter become 7/8 of those above. Here is an example of DP240S:

Peak current limiter

Positive Setting range +120.0 A to +1008.0 A / +60.0 A to +504.0 A
→ +105.0 A to +882.0 A / +52.5 A to +441.0 A
Factory default +1008.0 A / +504.0 A → +882.0 A / +441.0 A

Negative Setting range –1008.0 A to –120.0 A / –504.0 A to –60.0 A
→ –882.0 A to –105.0 A / –441.0 A to –52.5 A
Factory default –1008.0 A / –504.0 A → –882.0 A / –441.0 A

RMS current limiter

Setting range 12.0 A to 252.0 A / 12.0 A to 126.0 A
→ 10.5 A to 220.5 A / 10.5 A to 110.3 A
Factory default 252.0 A / 126.0 A → 220.5 A / 110.3 A

3.14 Setting Range Limit Function

This is the limit function for the setting of the internal signal source. It works when the signal source is INT, VCA (frequency setting limit only), SYNC (voltage setting limit only), or ADD (internal signal source only). The limitation does not work for the Sequence and Simulation. It does not also work for the external signal source of EXT and ADD.

In the polyphase system, the setting is common to all the phases.

Voltage setting limit 1 (in the AC mode, and sine wave or clipped sine wave is selected)

	DP240S	DP360S
Setting range (effective value) *35	Phase voltage setting 0.1 V to 155.0 V / 0.1 V to 310.0 V	
	Line voltage setting (single-phase three-wire) 0.2 V to 310.0 V / 0.2 V to 620.0 V	
	Line voltage setting (three-phase four-wire) 0.2 V to 268.4 V / 0.2 V to 536.8 V	
Factory default	Phase voltage setting, 155.0 V / 310.0 V	
Resolution	Phase voltage setting: 0.1 V, line voltage setting: 0.2 V	

*35: The line voltage setting is available only when the output voltage setting is set as the line voltage and sine wave is selected in the balanced mode of the polyphase system.

Voltage setting limit 2 (other than Voltage setting limit 1, phase voltage setting only) *36

		DP240S	DP360S
Positive voltage	Setting Range (Peak value)	+0.1 V to +220.0 V / +0.1 V to +440.0 V	
	Factory default	+220.0 V / +440.0 V	
Negative voltage	Setting Range (Peak value)	–220.0 V to –0.1 V / –440.0 V to –0.1 V	
	Factory default	–220.0 V / –440.0 V	
Resolution		0.1 V	

*36: The limitation is applied to the additional values of the AC voltage setting (recalculated to a peak value) and the DC voltage setting.

Frequency setting limit (the lower limit ≤ the upper limit) *37

		DP240S	DP360S
Upper limit	Setting Range	1.00 Hz (AC mode : 40.00 Hz) to 550.00 Hz	
	Factory default	550.00 Hz	
Lower limit	Setting Range	1.00 Hz (AC mode : 40.00 Hz) to 550.00 Hz	
	Factory default	1.00 Hz (AC mode : 40.00 Hz)	
Resolution		0.01 Hz	

*37: In the AC mode, the setting range is 40.00 Hz to 550.00 Hz.

3.15 Remote Sensing

This switches the voltage used for measurement. When the remote sensing is on, the sensing input terminal voltage is used. When it is off, the output terminal voltage is used.

By combining with AGC or Autocal, a voltage drop due to wiring to the load can be compensated. When the remote sensing is on, the output voltage detection point corrected by the AGC or Autocal function is switched to the sensing input terminal. When AGC or Autocal is off, only the detection voltage used for measurement display is switched.

Effective only for AC-INT, AC-VCA, AC-SYNC, DC-INT, and DC-VCA and when the waveform is sine wave or DC. It is turned off when the Sequence or Simulation is selected.

	Measurement voltage, power, power factor	AGC/Autocal	
		Off	On
On	Use the sensing input terminal voltage	Not active	Active
Off	Use the output terminal voltage	Not active (factory default)	Active

3.16 AGC

When the AGC (Automatic Gain Control) is on, the detection point voltage is always measured, and the output voltage is continuously corrected so that its effective value is equal to the output voltage setting value. The fluctuation of the detection point voltage can be suppressed even when the load is fluctuated. The detection point can be switched between the sensing input terminal (remote sensing on) and the output terminal (remote sensing off).

Effective only for AC-INT, AC-VCA, AC-SYNC, DC-INT, and DC-VCA and when the waveform is sine wave or DC. It is turned off when the Sequence or Simulation is selected. It cannot be selected when the Autocal is set to on.

	DP240S	DP360S
Response time	Within 100 ms (typ.) (DC/50 Hz/60 Hz, at the rated output voltage)	
Operation range	The output voltage setting is 8 V or higher	
Calibration range	Within ±10% (difference between the output voltage and measured value) The output voltage should be within the allowed voltage setting range of the product.	
Accuracy	Within ±0.5 V / ±1.0 V (in the case of DC, 40 Hz to 550 Hz, 50 V or higher output voltage, resistance load, the output current is the maximum current or less)	

3.17 Autocal (Output Voltage Compensation)

When the Autocal (Automatic Calibration) is on, the detection point voltage is always measured, and the output voltage is continuously corrected so that its effective value is equal to the output voltage setting value. The ratio (correction factor) of the detection point voltage to the output voltage setting value is used until the Autocal or the power is turned off. Therefore, the detection point voltage is not necessarily maintained if the load changes while the Autocal is on. The detection point can be switched between the sensing input terminal (remote sensing on) and the output terminal (remote sensing off).

Unlike the AGC, it cannot follow a load fluctuation because it does not keep track of the voltage. On the other hand, when the load is stable, it has a merit of short response time on changing the output voltage setting.

Effective only for AC-INT, AC-VCA, AC-SYNC, DC-INT, and DC-VCA and when the waveform is sine wave or DC. It is turned off when the Sequence or Simulation is selected. It cannot be selected when the AGC is set to on.

	DP240S	DP360S
Restriction when on	The output voltage setting is 8 V or higher	
Calibration range *38	Within ±10% (difference between the output voltage and measured value) The output voltage should be within the allowed voltage setting range of the product.	
Accuracy *38	Within ±0.5 V / ±1.0 V (in the case of DC, 40 Hz to 550 Hz, 50 V or higher output voltage, resistance load, the output current is the maximum current or less)	

*38: The values of the calibration range and accuracy are the ones at the time when the Autocal is turned on.

3.18 Sequence

Effective only for AC-INT, AC+DC-INT, and DC-INT.

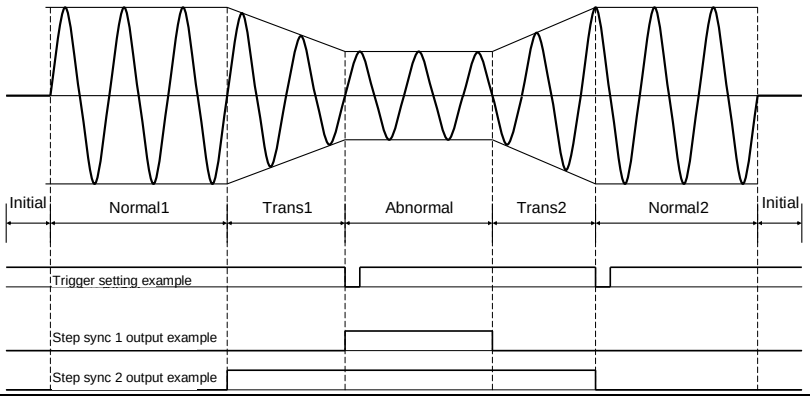
	DP240S	DP360S
Number of memories	5 (non-volatile)	
Number of steps	Maximum 255 (for each sequence)	
Setting range of Step Time	0.0010 s to 999.9999 s	
Intra-Step behavior	Constant, Keep, Linear Sweep	
Parameter *39 *40	Output range AC/DC mode (The signal source is fixed to INT) (The above 2 items are common within one sequence) AC voltage, frequency, waveform DC voltage Start Phase Stop Phase Phase angle Step termination Jump count (1 to 9999, or infinite) Specification of the Jump-to step Synchronous step output (2-bit) Specification of the branch step Trigger output	
Sequence control	Start Stop Hold Resume Branch 1, Branch 2	

*39: For DC-INT, the AC phase voltage, frequency, waveform, Start Phase, and Stop Phase cannot be set.

*40: The phase angle can be set only for the polyphase system. The Start Phase and Stop Phase are specified for the L1 phase, and the component of the phase angle setting is added to them for the other phases.

3.19 Simulation

This allows you to simulate power line abnormalities, such as blackout, voltage rise, voltage drop, abrupt phase change, and abrupt frequency change. It can be used only for AC, sine wave, and AC+DC-INT. Note that it does not support IEC or other standard test. In the polyphase system, only the balanced mode is available.

	DP240S	DP360S
Number of memories	5 (non-volatile)	
Number of steps	6 (Initial, Normal 1, Trans 1, Abnormal, Trans 2, Normal 2)	
Setting range of Step Time	0.0010 s to 999.9999 s (0 s is available only for the Transition Step)	
Parameter	Output range (The above item is common within the Simulation) AC voltage Frequency Waveform (sine wave only) Start Phase (excluding the Transition Step) Stop Phase (excluding the Transition Step) Synchronous step output (2-bit) Trigger output Repeat count (1 to 9999 times or infinite)  	
Simulation control	Start Stop	

3.20 Clipped Sine Wave

The peak clipped sine wave can be output, based on the crest factor (CF) setting or the percent setting to the peak value.

		DP240S	DP360S
Number of memories		3 (non-volatile)	
CF	Variable range	1.10 to 1.41	
	Factory default	1.41	
*41 *42	Setting resolution	0.01	
	Effective value correction	Yes	
Clip ratio	Variable range	40.0% to 100.0%	
	Factory default	100.0%	
*41 *43	Setting resolution	0.1%	
	Effective value correction	None	

*41: In the polyphase system, these are the settings for the phase voltage.

*42: The crest factor is represented as "voltage peak value/voltage effective value." It is 1.41 for sine wave.

*43: When the clip ratio is specified, the peak is clipped by the voltage corresponding to the specified % to the peak value of the setting voltage (100 %).
Example) For the output voltage setting of 100 Vrms and the clip rate of 80%, the peak is clipped at 113.1 Vpk.

3.21 Arbitrary Wave

This uses the waveform data saved in the internal memory, which is transferred and recalled using the external interface or USB memory.

	DP240S	DP360S
Number of memories	16 (non-volatile)	
Waveform length	4096 words	
Amplitude resolution	16 bit	

3.22 External Signal Input

The external signal input works differently depending on the selection of the signal source.

3.22.1 External Synchronous Signal Input (Signal Source SYNC only)

This is the signal to synchronize the frequency of the internal signal source with the one of the external signal source.

When the signal source is SYNC, you can select whether to synchronize with this external signal input or the power input frequency of the product. When synchronizing with the power input frequency, no signal input is needed.

	DP240S/DP360S	Factory default
Synchronization signal source switch	External synchronization signal (EXT) or Power input (LINE)	LINE
Synchronization frequency range	40 Hz to 500 Hz	
Input terminal	BNC connector (rear panel, unbalanced)	
Input impedance	1 MΩ	
Threshold of input voltage	TTL level	
Minimum pulse width	500 μs	
Nondestructive maximum input voltage	±10 V	

3.22.2 Voltage Setting Signal Input (Signal Source VCA only)

This is the signal to set the output voltage amplitude of the internal signal source (DC input).

Output voltage (Vop) = Voltage setting signal (Vdc) × Gain (Vop/Vdc)

Example 1) For the AC mode, signal source = INT, the gain of 100.0, and the voltage setting signal input of 1 Vdc, the output voltage is 100 Vop.

Example 2) For the AC mode, signal source = INT, the gain of 141.4, and the voltage setting signal input of 1 Vdc, the output voltage is 141.4 Vop (=100 Vrms).

		DP240S/DP360S	Factory default
Gain setting range	*44	100 V range: 0.0 to 220.0 times	100
		200 V range: 0.0 to 440.0 times	200
Setting resolution	*44	0.1	
Gain accuracy	*45	±5%	
Input terminal		BNC connector (rear panel, unbalanced) Also used as the external synchronization signal input	
Input impedance		1 MΩ	
Input voltage range		±2.2 V (A/D resolution: 10-bit)	
Nondestructive maximum input voltage		±10 V	

*44: In the polyphase system, the setting is common to all the phases.
*45: DC, 45 Hz to 65 Hz, the gain is the factory default, the rated output voltage, no load

3.22.3 External Signal Input (only EXT and ADD)

This multiplies the input signal by the specified gain and outputs it. For ADD, the internal signal source is added.

EXT: Output voltage (V) = External signal input (V) × Gain (V/V)

ADD: Output voltage (V) = External signal input (V) × Gain (V/V)
+ Internal signal source setting (V)

External signal input cannot be used for the polyphase system.

	DP240S/DP360S	Factory default
Setting Range for gain	100 V range: 0.0 to 220.0 times	100
	200 V range: 0.0 to 440.0 times	200
Setting resolution	0.1	
Gain accuracy *46	±5 %	
Input-output phase	In-phase	
Input terminal	BNC connector (rear panel, unbalanced) Also used as the external synchronization signal input	
Input impedance	1 MΩ	
Input voltage range	±2.2 V (A/D resolution 10-bit)	
Nondestructive maximum input voltage	±10 V	
Input frequency range	DC to 550 Hz (sine wave) DC to 100 Hz (other than sine wave)	

*46: DC, 45 Hz to 65 Hz, the gain is the factory default, the rated output voltage, no load.

3.23 General Function

		DP240S/DP360S	Factory default
LCD display setting	Contrast	0 to 99	
	Color	Blue tone or white tone	Blue tone
Beep (key operation, erroneous operation)		On or Off Alarms on abnormal situation regardless of the setting	On
Key lock		On or Off On: Only key lock-off and output-off are available	Off
Output relay control		On: The output relay is used to turn the output on/off Off: The output relay is not used. High impedance to turn the output off	On
Output setting at power-on		On or Off On: Output on after power-on	Off
Trigger output setting		Polarity: positive ⎍ or negative ⎓ Pulse width: 0.1 ms to 10 ms (resolution 0.1 ms)	Negative 10 ms
Time unit setting for Sequence and Simulation		ms or s	s
Reset function		Resets the items stored in the System Setting Memory (excluding the external interface setting) and the items that are to be reset at power-on, to the factory default settings.	

3.24 Memory Function

You can save basic settings (AC/DC mode, signal source, output range, AC setting, DC setting, current limiter, setting range limit, etc.) in the non-volatile Basic Setting Memory of No.1 to No.30, and recall them to use when the output is off. The No.1 setting is restored at power-on. The No.0 setting includes the setting items for the factory default.

The external control, display, and other settings are saved in non-volatile System Setting Memory when they are changed by the panel operation or remote command.

The Sequence, Simulation, clipped sine wave, and arbitrary wave are saved in their own non-volatile memories.

Items in the Basic Setting Memory

	Factory default
Output range	100 V range
AC/DC mode	AC mode
Signal source	INT
External synchronization signal (LINE or EXT)	LINE
AC voltage setting	0 V
Frequency	50 Hz
Output waveform	Sine wave
Output on phase and output off phase	0.0°
Phase voltage/Line voltage setting selection	Phase voltage
Phase angle setting	Single-phase three-wire: 180° Three-phase four-wire: 120°, 240°
Balanced/Unbalanced	Balanced
DC voltage setting	0 V
Current limiter	Refer to 3.13
Setting range limit	Refer to 3.14
External input gain	100 / 200

Note: Some items do not exist depending on the AC/DC mode or signal source.

Items in the System Setting Memory

	Factory default
Output function	Continuous
DC offset setting	0 mV
Measurement display mode	Normal View
Measurement unit selection	rms
Power unit energization setting	All enabled (energization)
Remote sensing	Off
AGC	Off
General function	See 3.23 (excluding the time unit setting of the Step Time for the Sequence and Simulation)
Monitor output target	Current (L1 phase)
External interface	USB
External control input	Disabled

3.25 Self-diagnosis/Protection Function

At power-on	Description
ROM check	Checks the internal ROM.
RAM check	Checks the internal RAM.
Basic setting Memory check	Checks the Basic Setting Memory.
System Setting Memory check	Checks the System Setting Memory.
Waveform Memory check	Checks the Waveform Memory.
Sequence Memory check	Checks the Sequence Memory.
Simulation Memory check	Checks the Simulation Memory.
Adjustment value memory check	Checks the adjustment data memory.
Version check	Checks the version of the internal software.
System configuration check	Checks the polyphase system.

While energizing	Description
Abnormal output	Turns off the panel display and output when an output overvoltage or overcurrent is detected.
Power unit error	Turns off the panel display and output when a power unit error is detected.
Internal control error	Turns off the panel display and output when an internal communication or other error is detected. Also stops all the operations excluding power-off.

3.26 External Control I/O

When you enabled the external control from the menu, you can control this product by using the external signal (or non voltage contact). The state output is always on. The detection and state switching is done at 10 ms-cycle. If the Remote state is achieved by the external interface, a control input is ignored.

Item			Description	Factory Default
Control input	External control input		Enabled or Disabled	
	Input level		TTL *47	
	Nondestructive maximum input		+10 V / –5 V	
	Input impedance		Pull-up to +5 V at 47 kΩ	
	Control	Output Off	Falling Off	
		Output On	Falling On	
		Sequence start/resume *48	Falling Start	
		Stop of sequence *48	Falling Stop	
		Sequence is in the Hold status	Falling Hold	
		Sequence branch 1	Falling Branch start	
		Sequence branch 2	Falling Branch start	
		Memory recall (+ compile) *49	Falling Recall	
		Memory specification 1	Specify 0 to 3 (Equivalent to memory 1 to 4, respectively)	
		Memory specification 2		
		Clear the current peak-hold value	Falling Clear	
State output	Output level		TTL *50	
	Output impedance		220 Ω	
	Polarity *51		Positive or Negative	Negative
	Status	Power On/Off	Low: Off, High: On	
		Output On/Off*	Low: On, High: Off (Negative)	
		Protection operation*	Low: Active, High: None (Negative)	
		Limiter operation*	Low: Active, High: None (Negative)	
		AGC/Autocal setting state*	Low: On, High: Off (Negative)	
		Software busy*	Low: Busy, High: Ready (Negative)	
		Output range	Low: 200 V, High: 100 V	
		Sequence operation Step sync 1 *48	High level or Low level	
		Sequence operation Step sync 2 *48		
		Trigger	positive ⎍ or negative ⎍	
Terminal	D-sub 25-pin multi-connector (rear panel, female, M2.6 screw)			

*47: Low: 0.8 V or lower, High: 2.6 V or higher, chassis potential.

*48: Sequence start and stop of the control input are effective for the Simulation as well. Also, step sync output 1 and 2 of the control output are effective for the Simulation as well.

*49: The memory recall input of the control input recalls the setting memory for the Normal (Continuous), the Sequence Memory for the Sequence, and the Simulation Memory for the Simulation. For the Sequence and Simulation, the compile data is also included.

*50: Low: 0.4 V or lower, High: 2.7 V or higher, chassis potential.

*51: The polarity of items with * can be changed all together.

3.27 External Interface

This is the interface to control the product from an external computer. The RS232 and USB interfaces are provided by default. The command language is compliant with the SCPI Specification Version 1999.0. (Factory default is USB)

USB interface (USB1.1, USBTMC) *52

Item	Description
ID	Already assigned for each device
Terminator	“LF”

*52: The use of USB hub may cause a communication failure. It is recommended to use a fully-shielded, short cable.

RS232 interface *53 *54

Item	Description or Selection	Factory default
Terminal	D-sub 9-pin (male, UNC #4-40 screw)	
Baud rate	9600 / 19200	9600 bps
Terminator	“CR” “LF” / “CR” / “LF”	“CR” “LF”
Parity	None/Odd/Even	None
Stop bit	1 / 2	1 bit
Data bit	7 / 8	8 bit
Flow control	None/Hardware/Software	None

*53: Binary transmission is not supported.
*54: Use a cross cable.

GPIB interface (IEEE488.1 std 1987 compliant) *55 *56

Item	Description or Selection	Factory default
Address	0 to 30	2
Terminator	“LF”	

*55: Binary transmission is not supported.
*56: Query for the main unit status byte using a serial poll is not supported.

3.28 USB Memory Interface

Commercial USB memory sticks can be used.

	Description
Available memory *57	USB 1.1 or USB 2.0-compliant product
Connector	USB-A (front panel)
Format	FAT32
Writable/readable contents	Basic Setting Memory, Sequence, Simulation, arbitrary wave
File operation *58	Create dedicated directory, rename, load, and save 2-byte characters (Japanese, etc.) are not supported.

*57: We do not guarantee that all USB memories can be operational with this product.
*58: The time stamp recorded on a file is different from the actual date and time.

3.29 Waveform Monitor Output

This can monitor the waveform of the output voltage or current. (only one terminal)

		DP240S				DP360S			
Number of working power units		8, 7	6, 5	4, 3	2, 1	8, 7	6, 5	4, 3	2, 1
Monitored		Output phase voltage or output phase current (switched)							
Gain	Phase voltage (V/V)	$\frac{1}{200}/\frac{1}{400}$							
	Phase current (V/A)	$\frac{1}{800}/\frac{1}{400}$	$\frac{1}{600}/\frac{1}{300}$	$\frac{1}{400}/\frac{1}{200}$	$\frac{1}{200}/\frac{1}{100}$	$\frac{1}{1200}/\frac{1}{600}$	$\frac{1}{900}/\frac{1}{450}$	$\frac{1}{600}/\frac{1}{300}$	$\frac{1}{300}/\frac{1}{150}$
Accuracy *59		±5%							
Output terminal		BNC connector (rear panel, unbalanced)							
Output impedance		600 Ω							

*59: No load on the monitor output, the rated output voltage, the resistance load at the maximum current.

3.30 Operation Environment

	DP240S	DP360S
Operation Environment	Indoor	
Altitude	2000 m or lower	
Operating temperature/ humidity	0°C to +50°C, 5% to 85%RH The absolute humidity should be 1 to 25 g/m^3, without dew condensation. On some specifications, the temperature range limit is stricter.	
Storage temperature/ humidity	–10°C to +60°C, 5% to 95%RH The absolute humidity should be 1 to 29 g/m^3, without dew condensation.	

Figure 1 shows the ranges of the ambient temperature and the humidity.

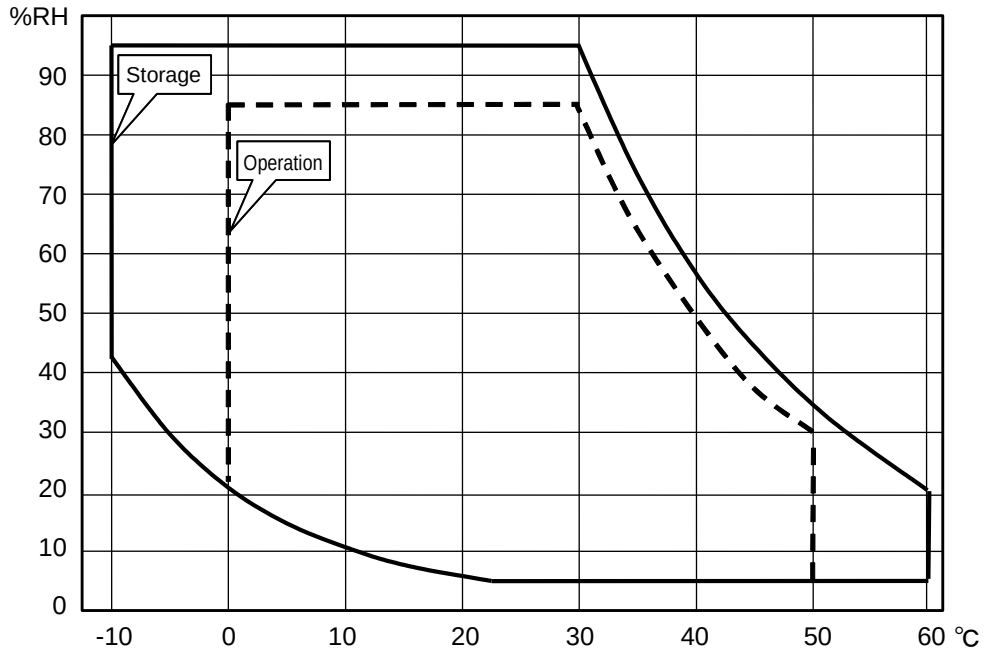


Figure 1 Range of Ambient Temperature/Humidity

3.31 Externals, Weight, and Terminal Block

	DP240S	DP360S
Dimensions (W×H×D) (Excluding projections)	860×1463×649 mm	1290×1463×649 mm
Weight	345 kg approx.	510 kg approx.
Power input terminal (rear)	M10 upset bolt	
Output terminal (rear)	M10 upset bolt	M12 upset bolt
Sensing input terminal (rear)	M4 screw	

Programmable AC Power Source

DP240S/DP360S

Specifications

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