

INSTRUCTION MANUAL
FREQUENCY CONVERTERS
PCC-X SERIES

APPLICABLE MODELS

PCC300-100X

PCC500-100X

PCC1K-100X

PCC2K-200X

KIKUSUI ELECTRONICS CORPORATION

82.11.8
824532

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.

(Revision should be applied to items indicated by a check mark ☒)

☐ Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

☐ Input fuse

The rating of this product's input fuse is _____ A, _____ VAC, and _____.

WARNING

- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

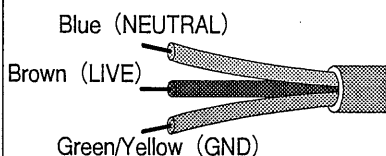
☐ AC power cable

The product is provided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

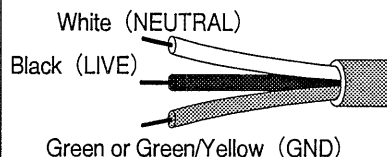
WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

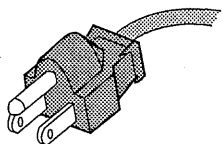
☐ Without a power plug



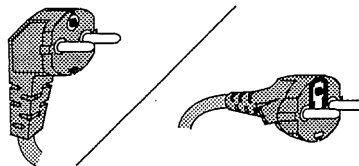
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

FOR PCC-X SERIES AC/AC CONVERTERS

1. GENERAL

The PCC-X Series Frequency Converters are identical with the PCC Series Frequency Converters, except that the former have a crystal oscillator (Type XOP5060) to provide a 50/60 output of a highly stabilized frequency. They also can provide an output covering continuously variably a frequency range of 45 Hz - 65 Hz as is the case of the PCC Series Frequency Converters.

2. SPECIFICATIONS

Output frequency:	50/60 Hz (selectable with switch)
Output frequency deviation:	$\pm 1 \times 10^{-4}$ or less (with respect to reference frequency at 25°C)
Output frequency stability:	$\pm 1 \times 10^{-4}$ or better (with respect to frequency at 25°C)
Long-term output frequency stability:	$\pm 1 \times 10^{-4}$ or better (with respect to initial frequency)

For the items other than the above and those related to the frequency selector switch, refer to the instructions for the PCC Series Frequency Converters which are covered at later parts of this instruction manual.

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3. DESCRIPTION OF PANEL SWITCHES AND TERMINALS

1 "EXT INPUT" Terminals (Input terminal for external control signal)

These terminals are used to apply an external signal with which to control the output frequency of the converter.

Input impedance: Approx. 600 ohms

Input voltage range: 0,2 V rms - 2.0 V rms

Input frequency range: 45 - 500 Hz

2 "INT/EXT" Switch (Internal oscillation signal/external control signal selector switch)

When set in the INT state, internal RC oscillator or crystal oscillator can be selected.

When set in the EXT state, the output frequency and voltage of the converter can be controlled with an external signal applied through terminals 1. The output frequency is the same with the external signal and the output voltage is proportional to the external signal.

3 "FIXED/VARIABLE" switch (Fixed frequency/variable frequency selector switch)

When this switch is set in the FIXED state and INT/EXT 2 switch in the INT state, the that of the built-in crystal oscillator (Type XOP5060).

When this switch is set in the VARIABLE state, the output frequency is adjustable for a continuously-variable range of 45 - 50 Hz as it is controlled with the internal RC oscillator, the oscillating frequency of which is variable with the FREQUENCY ADJ control located on the panel.

4 "50Hz/60Hz" Switch (50Hz/60Hz frequency selector switch)

When FIXED/VARIABLE switch 3 is set in the FIXED state, the output frequency is selectable between the two fixed frequencies of 50 Hz and 60 Hz.

Precaution: Be sure to turn off the main power switch of the PCC-X Converter before selecting the output frequency setting between 50 Hz and 60 Hz. If switching is made while the converter is in operation, overshoots may be produced in the output waveform, which could cause abnormal voltage applied to the load or damage to the load in an extreme case.

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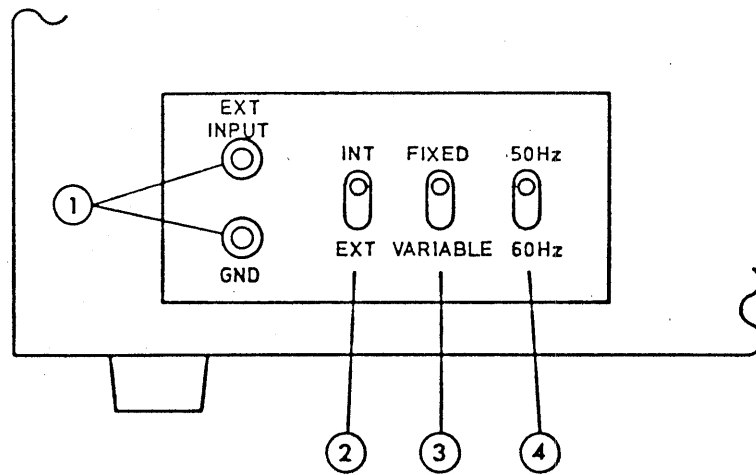


Figure 1. Model PCC300-100 (Rear Panel)

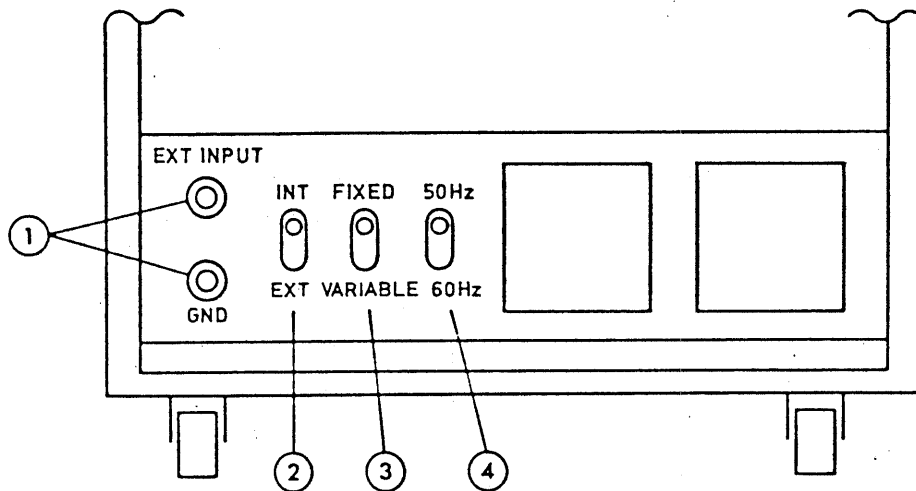


Figure 2. Model PCC500-100 or PCC1K-100 (Front Panel)

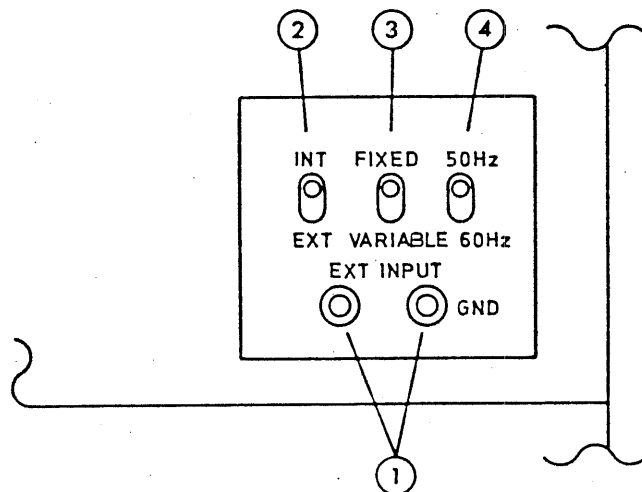


Figure 3. Model PCC2K-200 (Front Panel)

INSTRUCTION MANUAL
FREQUENCY CONVERTERS
PCC SERIES

APPLICABLE MODELS

PCC300-100

PCC500-100

PCC1K-100

PCC2K-200

KIKUSUI ELECTRONICS CORPORATION

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1. GENERAL

1-1. Description

The PCC Series Frequency Converters are compact, linear industrial power equipment. With rational circuit designs, they provide excellent reliability and performances, including low distortion factor, fast response and high accuracy.

The output voltage is finely adjustable with a 10-turn potentiometer for a range of 20 V - 120 V or a range of 40 V - 240 V as selected with a range selector switch. The output circuit is a balanced type and it is isolated from the input circuit.

The switches and controls on the front panel are laid out in convenient locations for the best operability. The housing is a bench-top type (excluding PCC2K-200) and can be installed on a 19-inch or 500-mm standard rack.

A 3-phase power source equipment can be obtained by using three units in combination, with slight modifications. A crystal-controlled oscillator circuit can be incorporated as an optional feature. The output voltage ranges can be modified.

Notes: For these modifications, contact your Kikusui agent.

Before operating this equipment, thoroughly read this instruction manual to make yourself familiar with this equipment.

1-2. Features

(1) Output voltage variable covering a wide range:

The output voltage is finely variable for a range of 20 V - 120 V or range of 40 V - 240 V with a 10-turn potentiometer. Range selection can be done with a range selector switch.

- (2) Wide input voltage range and ambient temperature range:

Input voltage range: Type 100 ... 100 V AC $\pm 15\%$

Type 200 ... 200 V AC $\pm 15\%$

(PCC2K-200 alone can be
operated also on 100 V
AC $\pm 15\%$.)

Ambient temperature range: -10 to $+50^{\circ}\text{C}$ (14 to 122°F)

- (3) Choke-input filter circuit:

As compared with the capacitor-input filter circuit, the choke-input circuit provides a better input power factor, a less apparent input current, less harmonics, and less interferences to the input power line.

- (4) High efficiency:

50% standard (output voltage 80 V - 120 V or 160 - 240 V,
with rated load)

- (5) The internal frequency signal is generated with an RC oscillator and its frequency is adjustable for a range of 45 - 65 Hz.

- (6) The equipment frequency is adjustable for a range of 45 - 500 Hz with an external input signal.

- (7) The output impedance is adjustable with the REGULATION ADJ control.

- (8) Protective circuits for safety:

- (a) Input overcurrent protection circuit
- (b) Output overvoltage protection circuit
- (c) Output overcurrent protection circuit
- (d) Cooling package overheat protection
- (e) Protection against overpower caused by load power factor fall
- (f) Protection against output shorting

1-3. Specifications

Model	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
Input				
Input voltage	100 V \pm 15%, 50/60 Hz AC, single-phase			200 V \pm 15%, 50/60 Hz AC, single-phase (*1)
Input power	Approx. 1.0 kVA	Approx. 1.6 kVA	Approx. 3.1 kVA	Approx. 6.2 kVA
Output				
Output voltage (*2)	20 V - 120 V or 40 V - 240 V			
Output current (*3)	3 A (20 V - 100 V)	5 A (20 V - 100 V)	10 A (20 V - 100 V)	20 A (20 V - 100 V)
	1.5 A (40 V - 200 V)	2.5 A (40 V - 200 V)	5 A (40 V - 200 V)	10 A (40 V - 200 V)
Output phase	Single phase			
Output power	300 VA	500 VA	1 kVA	2 kVA
Maximum peak current	4.7 A peak	7.8 A peak	16 A peak	31 A peak
Output stability				
Input regulation (within input voltage specification range)	Within \pm 0.2%			
Load regulation (for 0 - 100% variation of output current (resistive load))	Can be set zero with REGULATION ADJ control (*4)			
Frequency regulation (for a range of 45 Hz - 500 Hz)	Within \pm 0.5 dB (*5)			

Model	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
Response speed	Faster than 500 μ sec (theoretical value)			
Efficiency (*6)	50% or better (standard value)			
Output waveform distortion factor (*7)	Not greater than 1%			
Output frequency				
Frequency range				
INT side (internal RC oscillator)	45 Hz - 65 Hz			
OUT side (external oscillator) (*8)	45 Hz - 500 Hz			
Frequency stability				
INT side (internal RC oscillator)	$\pm 0.5\%$ or better (*9)			
External input voltage (input impedance 600 Ω , frequency 45 Hz - 500 Hz)	0.2 V rms - 20 V rms			
Type of circuit	Linear amplifier type			
Ambient temperature	-10°C to +50°C (14°F to 122°F)			
Ambient humidity	0 to 90% RH			

Model	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
External dimensions Unit: mm (in.)				
Mainframe	315W×140H×350D (12.40W×5.51H×13.78D)	210W×358H×370D (8.27W×14.09H×14.57D)	210W×358H×560D (8.27W×14.09H×22.05D)	315W×575H×600D (12.40W×22.64H×23.62D)
Maximum dimensions	330W×160H×385D (12.99W×6.30H×15.16D)	210W×400H×400D (8.27W×15.75H×15.75D)	210W×400H×605D (8.27W×15.75H×23.82D)	315W×685H×650D (12.40W×26.97H×25.59D)
Withstanding voltages				
Input to chassis	1 kV AC, 1 minute			1.5 kV AC, 1 minute
Between input and output	1.5 kV AC, 1 minute			
Output to chassis	1.5 kV AC, 1 minute			
Insulation resistance				
Input to chassis	30 MΩ or over, 500 V DC			
Between input and output	30 MΩ or over, 500 V DC			
Output to chassis	30 MΩ or over, 500 V DC			
Weight	Approx. 20 kg	Approx. 30 kg	Approx. 48 kg	Approx. 100 kg
Indicating meters				
Voltmeter (JIS Class 2.5)	300 V			
Ammeter (JIS Class 2.5)	4A/2A	6A/3A	15A/7.5A	25A/12A
Frequency meter (JIS Class 2.5)	45 Hz - 65 Hz			

Model	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
Accessories				
Input power cable	3-core cabtire cable, with grounding wire, approx. 3 meters (9.8 ft) long			
Instruction manual	1 copy			
Eyebolts				4

Notes

- (*1): Can be operated also on an AC line of 100 V $\pm 15\%$, 50/60 Hz, single-phase.
- (*2): With VOLT ADJ knob and output voltage selector switch.
- (*3): The output current varies by output power, as selected by the output voltage selector switch. 100 V - 120 V AC/200 V - 240 V AC: load power factor 0.9 - 1.0. When the load power factor is less than 0.9, the output current varies as shown in the load power factor versus output current chart. (See Figure 6-3.)
- (*4): As measured at the output terminal block (outlet). Excluding the voltage drop in the load connection cable.
- (*5): Regulation of the output voltage with reference (0 dB) to that when the output voltage is 100 V, the output current is the rated value, and the frequency is 200 Hz.
- (*6): Ratio between input power and output power when the input voltage is the rated voltage, the output voltage is 80 V - 120 V AC/160 V - 240 V AC, the power factor is 0.9 - 1.0, and the output power is the rated value.
- (*7): Ratio between fundamental frequency component and harmonics component of output voltage when the input voltage is the rated value, the output voltage is 80 V - 120 V AC/160 V - 240 V AC, the load power factor 0.9 - 1.0, the output frequency 45 Hz - 500 Hz, and the output power at the rated value.
- (*8): With an external oscillator of output frequency 45 Hz - 500 Hz, output distortion factor 0.3% or less, and output impedance 600 ohms (sinusoidal wave).
- (*9): With reference to the set frequency at ambient temperature 25°C (77°F).

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2. NOTES BEFORE USE

2-1. Unpacking, Inspection, and Cable Gauges

When unpacking the equipment, check for any damage which might be sustained when in transportation and for any missing accessories. Especially carefully check the following items:

- (1) Check that there is no sign of damage or distortion of the front and side panels.
- (2) Check that the terminals, switches, meters and knobs indicate no signs of damage.
- (3) Check that there is no missing item. The supplied items are as follows:

- | | |
|--|---|
| (a) Mainframe | 1 |
| (b) Instruction manual | 1 |
| (c) Accessories | |
| Power cord (approx. 3 m (9.8 ft) long) | 1 |
| Eyebolts (PCC2K-200 only) | 4 |

Table of accessories

	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
Guard cap	2	2	2	2
Switch guard	1	1	1	1
Power cord	2.0 mm ² cable	3.5 mm ² cable	8 mm ² cable	8 mm ² cable
Eyebolts				4

Table of cable gauges and current ratings:

To select input and output cables, refer to the following table.

Ambient temperature: 30°C

mm²: Square-millimeter

Nominal cross section	Rating recommended by Kikusui	Electrical Installations Technical Standards (Ordinance Article 29)
1.25 mm ²	5 A	19 A
2.0 mm ²	10 A	27 A
3.5 mm ²	15 A	37 A
5.5 mm ²	20 A	49 A
8 mm ²	30 A	61 A
14 mm ²	50 A	88 A

2-2. Notes for Installation

- (1) Allow a space of 50 cm (20 in.) or more for each of the ventilation holes of the equipment.
- (2) Do not place any object which is not heat resistant near the fan air outlet from which hot air comes out.
- (3) Note that equipment failure may be caused if the equipment is used in dusty, highly humid atmosphere.
- (4) Install the equipment in a place where is reasonably free from mechanical vibration.
- (5) Do not place any high sensitivity instrument on or near the equipment lest the indication of the instrument should be degraded due to magnetic flux leakage from transformer and choke coil of the equipment.

- (6) Do not install the equipment on a workbench or a slanted base.
Be sure to fix the equipment (PCC500-100, PCC1K-100).

See on page 18 to 19.

Note: PCC300-100 with rubber studs
PCC500-100, PCC1K-100 ... with stopper bolts
PCC2K-200 casters with stopper

2-3. Power Line and Power Cord

- (1) The AC power line must be of voltage 85 V - 115 V and frequency 48 Hz - 62 Hz, single-phase.
- (2) For the input current consumption, see Figure 6-4.
- (3) The green wire of the power cable supplied is for grounding.
Be sure to connect this wire to an earth ground to avoid electrical shock hazards.

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3. OPERATION METHOD

3-1. Explanation of Front Panel

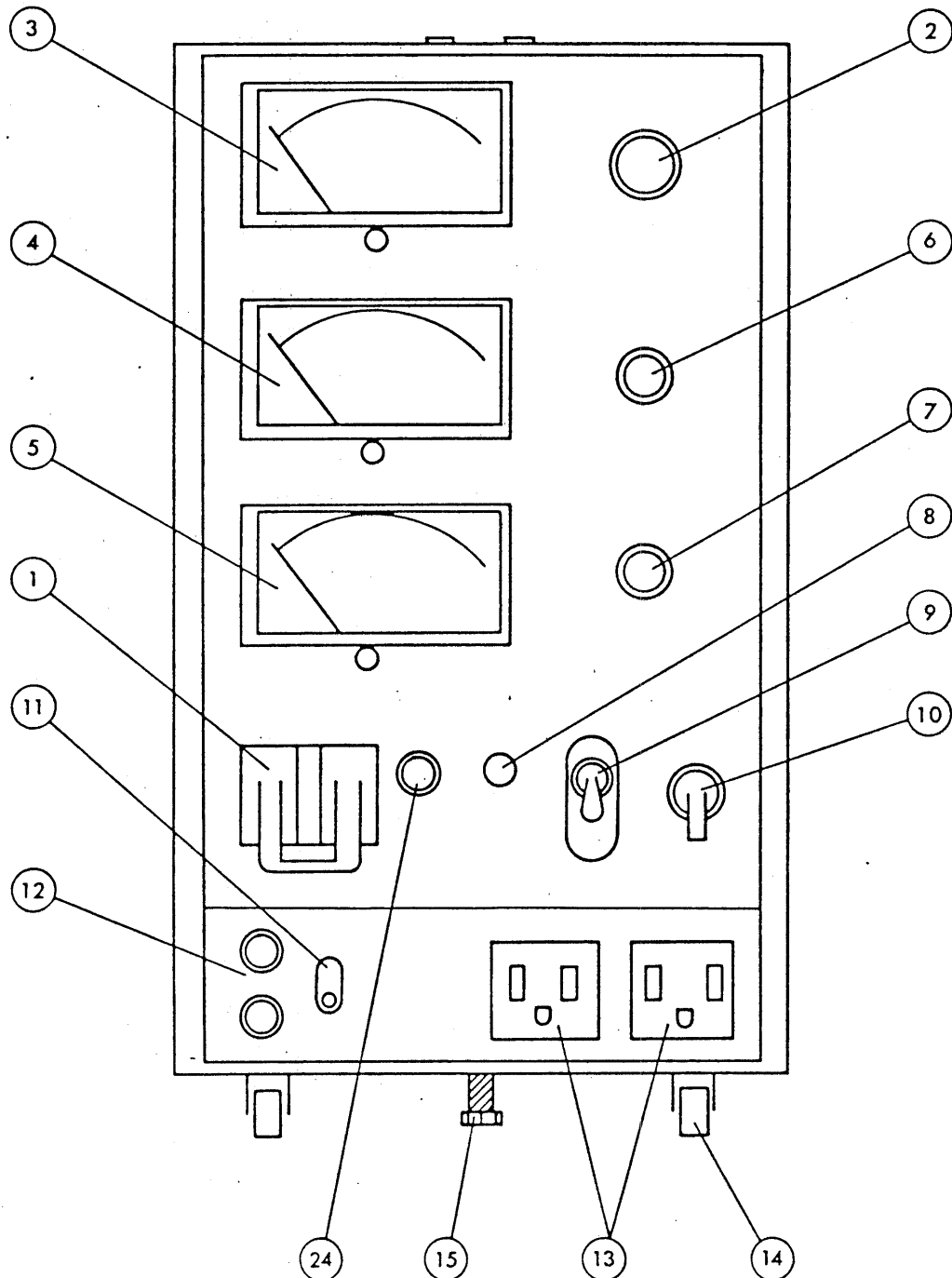


Figure 3-1. Front panel of PCC1K-100 or PCC500-100

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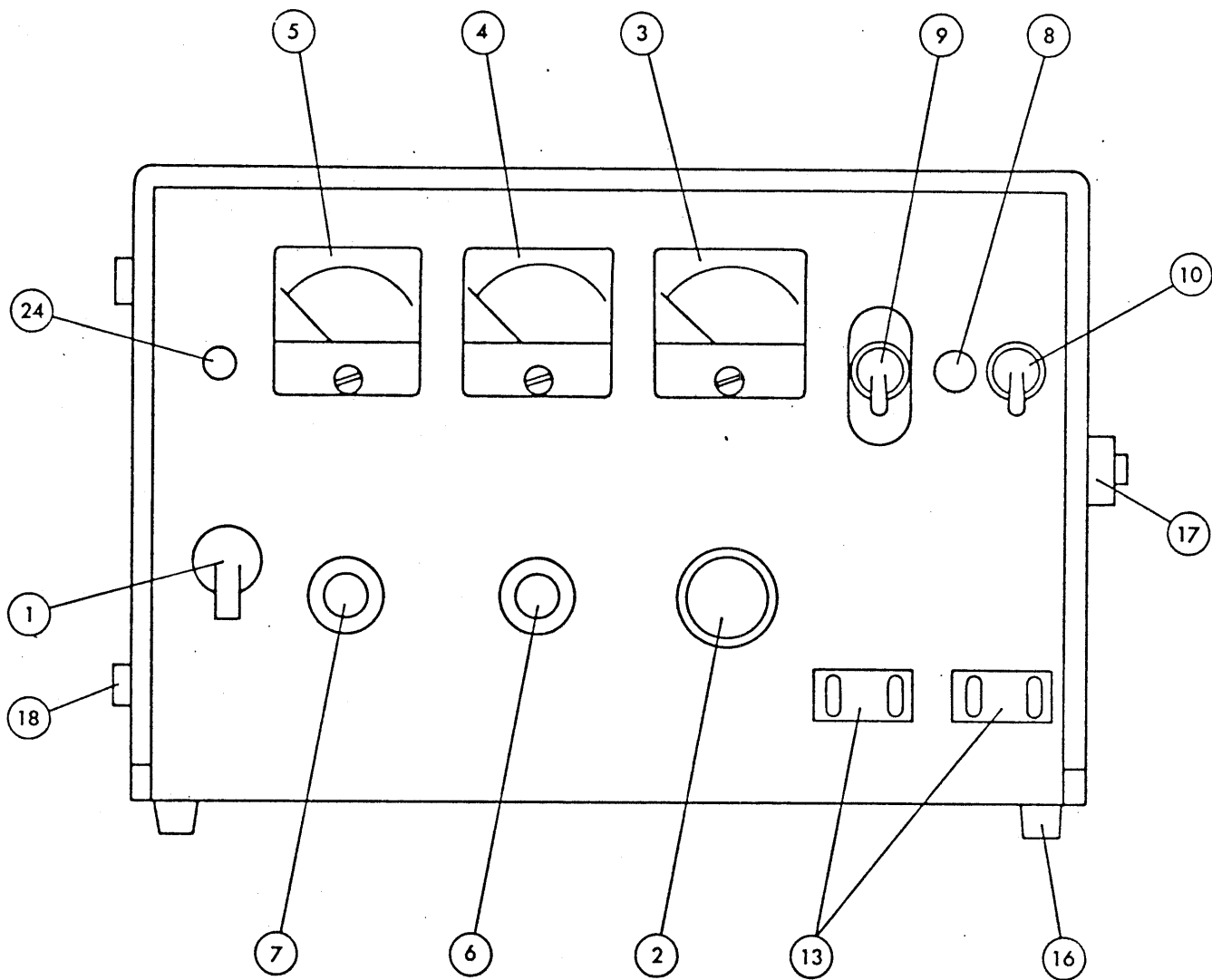


Figure 3-2. Front panel of PCC300-100

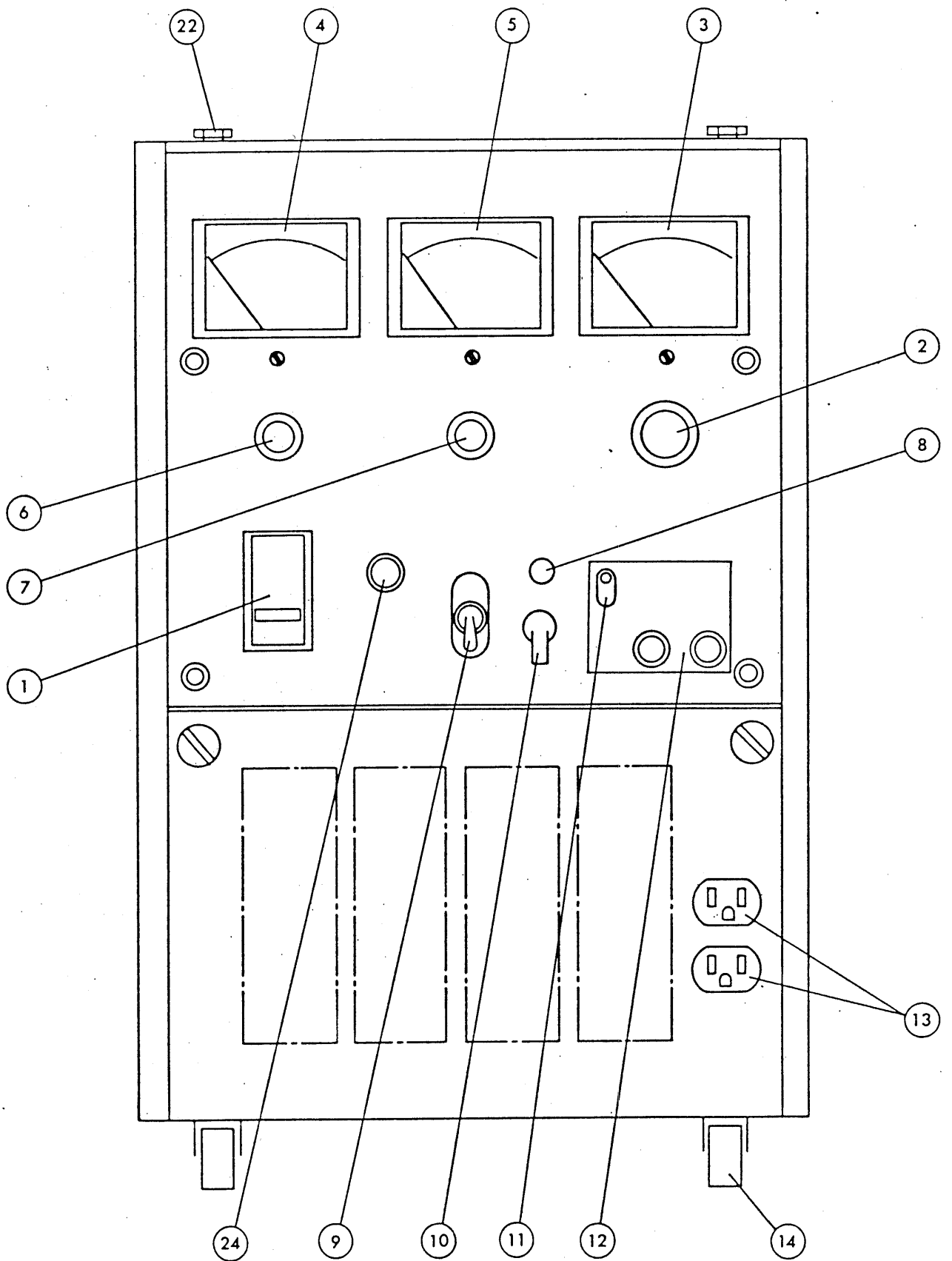


Figure 3-3. Front panel of PCC2K-200

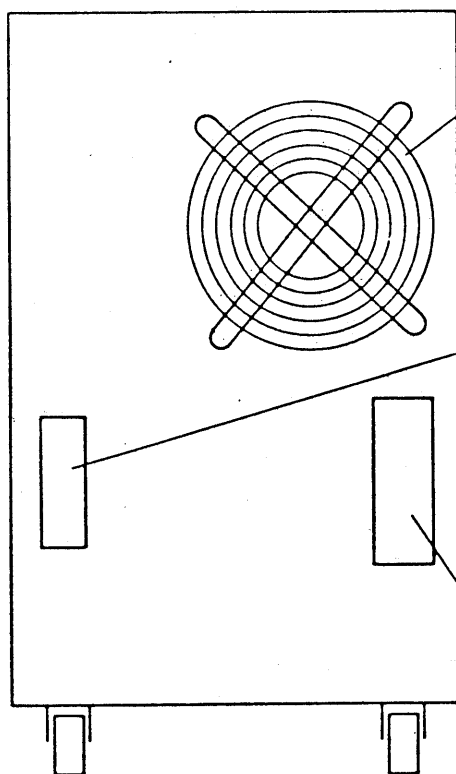


Figure 3-4. Rear panel of PCC1K-100

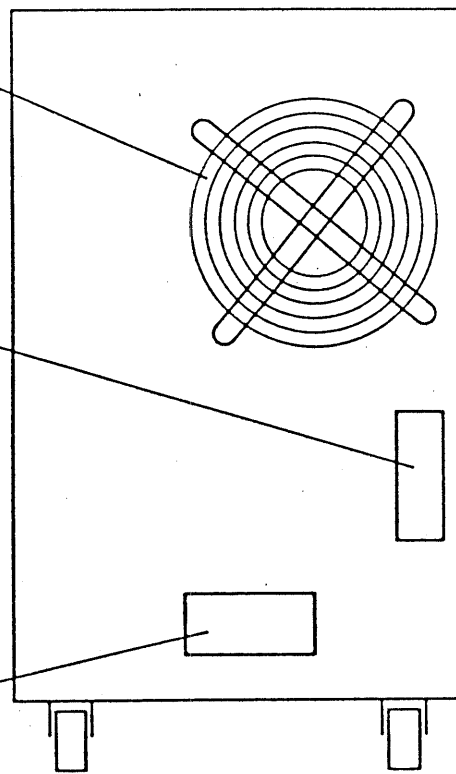


Figure 3-5. Rear panel of PCC500-100

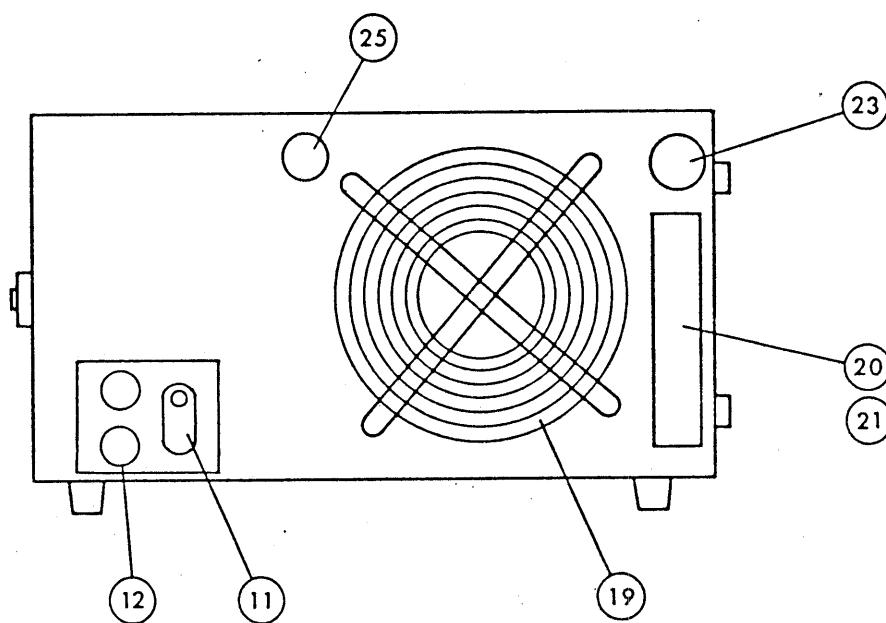


Figure 3-6. Rear panel of PCC300-100

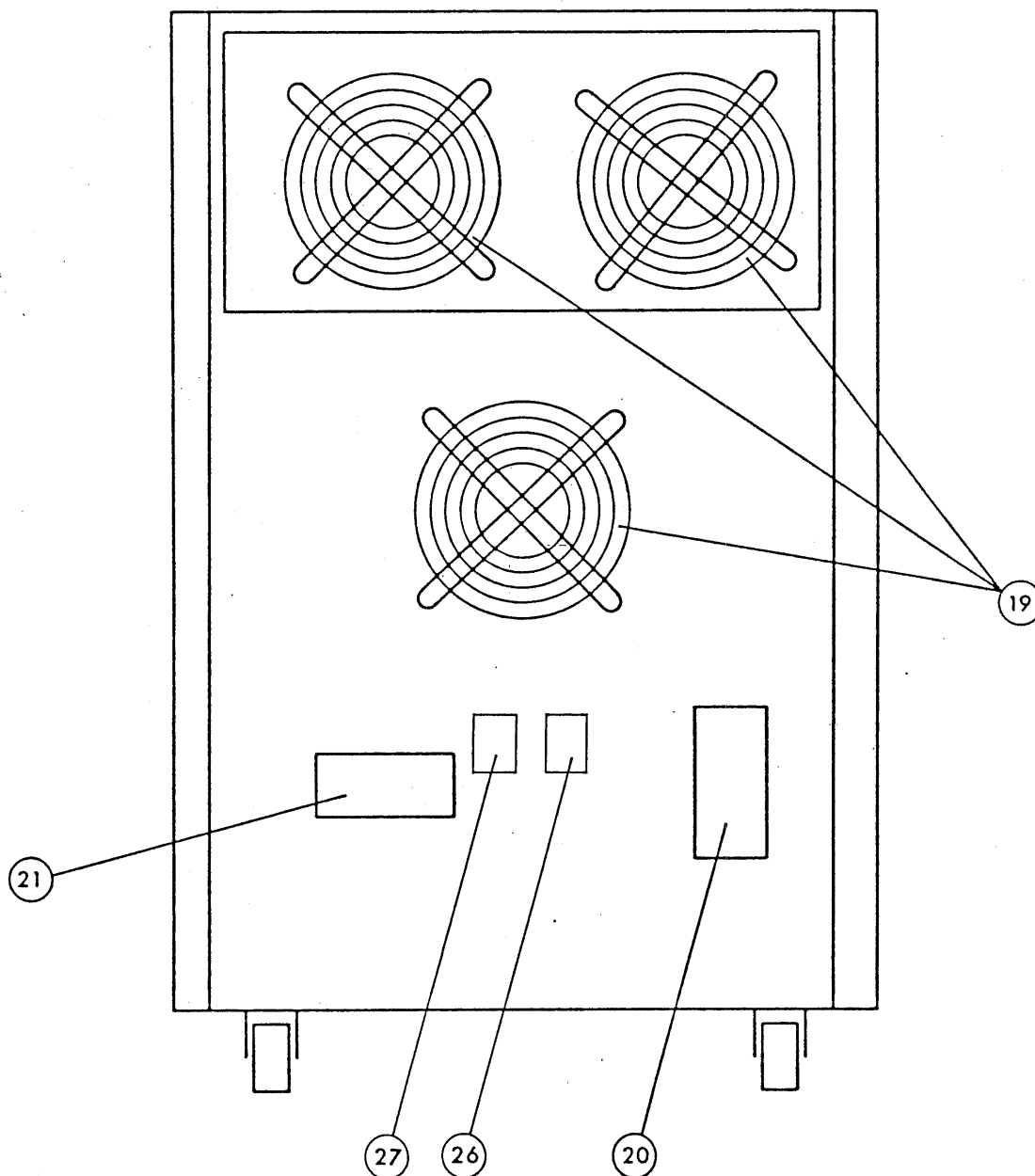


Figure 3-7. Rear panel of PCC2K-200

① POWER: Power switch

Main power on-off switch. When thrown to the top position, the equipment power turns on and the power pilot lamp ②④ lights.

Note: This switch is automatically turned off when an internal protective circuit (overcurrent protection, overvoltage protection, or overheat protection) has tripped.

② VOLT ADJ: Output voltage setting knob

With this 10-turn potentiometer the output voltage is continuously variable for a range of 20 V - 120 V or 40 V - 240 V.

③ Voltmeter

Indicates the output voltage. (JIS Class 2.5)

④ Ammeter

Indicates the output current. (JIS Class 2.5)

(The ammeter range selector is linked to the output voltage selector switch ⑨. The top scale is for 100 V and the bottom scale is for 200 V.)

⑤ Frequency meter

Indicates the output frequency. (JIS Class 2.5)

(Indicates the frequency when the INT/EXT switch ⑪ is set in the INT position.)

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⑥ REGULATION ADJ: Output voltage regulation adjustment

Controls compensation for variation of output voltage caused by load current. When operating with the rated load, output voltage variation at the outlet or output terminal can be adjusted to zero.

(A guard cap is provided. See Figure 3-8.)

⑦ FREQUENCY ADJ: Output frequency adjustment

Controls the oscillating frequency of the internal RC oscillator within a range of 45 Hz - 65 Hz. The frequency stability is $\pm 0.5\%$ of the set frequency.

(A guard cap is provided. See Figure 3-8.)

⑧ OVERLOAD: Overload indicator lamp

This lamp turns on when the output current has exceeded a certain limit and the overcurrent protective circuit has tripped.

⑨ 200V/100V: Output voltage selector switch

Selects output voltage range between 200 V and 100 V.

200V: 40 V - 240 V AC

100V: 20 V - 120 V AC

(A switch guard is provided. See Figure 3-9.)

⑩ OUTPUT: Output circuit breaker

The output is supplied when this breaker is ON. It breaks the output within several seconds after the output current has exceeded the rated value, when the 200V/100V selector switch ⑨ is set in the 100V state.

Note: The PCC300-100 has an output switch instead of this circuit breaker.

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- ⑪ EXT/INT: External/internal frequency source selector switch

With the INT position, the oscillating frequency of the internal RC oscillator is adjustable for a range of 45 Hz - 65 Hz with the FREQUENCY ADJ control ⑦. With the EXT position, the output frequency of the equipment is dictated by the external signal applied to the EXT INPUT terminal ⑫ for a range of 45 Hz - 500 Hz. The output voltage also is proportional to the external input signal.

- ⑫ EXT INPUT, 45 - 500 Hz: External signal input terminal

The output frequency of the equipment can be dictated by setting the EXT/INT switch ⑪ in the EXT state and applying the external signal to this terminal. The conditions are as follows:

Input impedance: Approx. 600 Ω

Input voltage range: 0.2 V rms - 20 V rms

Frequency range: 45 Hz - 500 Hz

- ⑬ MAX A: Outlet receptacles

These outlet receptacles (rating 15 A maximum) provide output current depending on setting of the output voltage selector switch as follows:

100 V (20 V - 120 V): A max.

200 V (40 V - 240 V): A/2 max.

The rating of the output receptacles of the PCC300-100 is 5 A.

- ⑭ Casters.

The two casters of the front side of the PCC2K-200 has a stopper for each of them. Be sure to fix these casters when installing the equipment.

⑮ Stopper bolts

Use these bolts to settle the equipment in the place of use. To settle the equipment, turn these bolts so that the casters of the front side are slightly lifted from the floor.

⑯ Rubber stud

⑰ Handle

To carry the equipment.

⑱ Shock absorbing stud

To protect the equipment against shocks when it is moved by means of its handle.

⑲ Fan air outlet

The air outlet of the cooling package. Hot air comes out of this outlet. Do not place any object which is not heat resistant near this outlet. Allow a space of 50 cm (20 in.) or more from the wall.

⑳ INPUT, GND, AC100V: Input terminal block

Input power terminal block to which the power cord (supplied, approximately 3 meters long) is to be connected. The input voltage of the PCC2K-200 is 200 V AC.

㉑ OUTPUT, GND, AC20V - 240V: Output terminal block

These terminals are connected in parallel with the outlet receptacles.

㉒ Hex bolts

Can be replaced with the eyebolts (lifting bolts) supplied. (for PCC2K-200 only)

②③ Fuse holder

Fuse of the output circuit. (for PCC300-100 only)

②④ Power indicator lamp

Indicates that the input power is on.

②⑤ Fuse holder

Fuse of the input circuit. (for PCC300-100 only)

②⑥ PARALLEL CONTROL INPUT connector

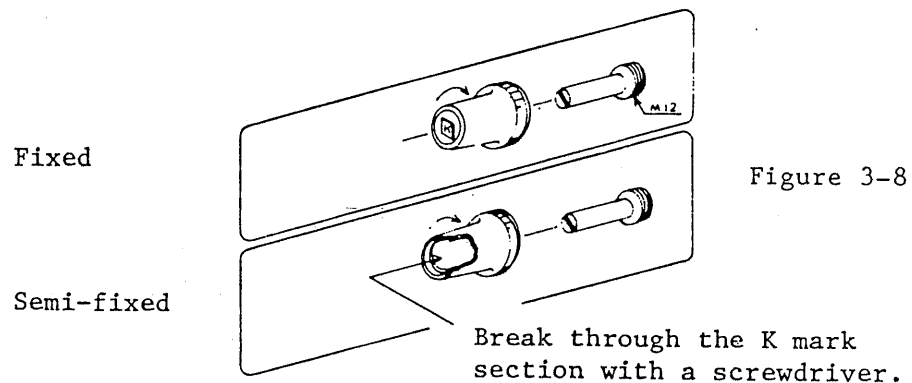
Connector for signal input for one-control parallel operation. When the plug of the signal cable (supplied) is connected to this connector, the equipment automatically becomes a slave unit. When the plug is not connected, the equipment operates as a master unit.

②⑦ PARALLEL CONTROL OUTPUT connector

Connector for signal output for one-control parallel operation.

Guard caps

The guard caps are used to fix or semi-fix the REGULATION ADJ control ⑥ and the FREQUENCY ADJ control ⑦. For how to use them, see the following illustration.



Switch guard

Guards the output voltage selector switch 9 against inadvertent switching. When the equipment is shipped from its manufacturer's factory, the switch is set and guarded in the 100 V position.



(The guard can be removed by pulling it in the arrowhead direction.)

Figure 3-9

3-2. Output Voltage Adjustment

The output voltage of the equipment is finely adjustable for a wide range with the VOLT ADJ knob (a 10-turn helical potentiometer).

Output voltage selector switch	Variable range
100 V	20 V - 120 V AC
200 V	40 V - 240 V AC

Set the switch guard in the corresponding position.

A. EXT mode

To operate the equipment with an external input signal, proceed as follows: Turn the VOLT ADJ knob to the extremely counterclockwise position. Apply an external signal of 2 V rms of the desired frequency to the external signal input terminal. To obtain the desired voltage, turn clockwise the VOLT ADJ knob.

If an external signal of higher than 500 Hz is applied, the external frequency protection circuit will trip and the output voltage will drop. If the frequency of the external signal is lower than 45 Hz, the equipment may be adversely affected and the circuit breaker may trip.

B. INT mode

To operate the equipment with its internal frequency source, proceed as follows:

- (1) Check that the input voltage is within the required range. Connect the input power cable.
- (2) Turn the VOLT ADJ knob to the extremely counterclockwise position.
- (3) Set the frequency control potentiometer in a midposition of its adjusting range. (The cap can be removed by turning it counterclockwise.)
- (4) Turn on the power switch. The green power pilot lamp will light and the output voltage of approximately 20 volts will be delivered in approximately 3 seconds (when in 100 V output operation).
- (5) Set the output voltage at the desired value, reading it on the voltmeter. Set the frequency at the desired value, reading it on the frequency meter.
- (6) Connect the load to the outlet receptacle or to the output terminal block on the rear panel. Turn on the OUTPUT switch.

Note: Pay attention to the inrush current when the load is a lamp, capacitor, motor, transformer, or other device which may draw an inrush current.

3-3. REGULATION ADJ Control

The effect of the REGULATION ADJ may slightly vary by the output frequency and temperature. With this control, the voltage drop caused in the circuit up to the output receptacles or the output terminal block can be compensated for. The compensating procedure is as follows:

- (1) Set the equipment in the no-load state. Set the output voltage at the desired value with the VOLT ADJ knob.
- (2) Connect to the equipment a load which will draw a current the same as the maximum current of the varying load to be served. (See the Note.)
- (3) Adjust the output voltage to the desired value of Step (1) above, with the REGULATION ADJ control. The output voltage will increase as the REGULATION ADJ knob is turned clockwise, and vice versa.

Within a range of 45 Hz - 500 Hz, the output impedance can be made zero with the REGULATION ADJ knob.

Note: It is possible that the output voltage oscillators if the REGULATION ADJ knob is turned to the full sclockwise position with a load set at a low power factor when a capacitor of large capacitance is connected to the output terminals of this equipment. In such a case, please consult your Kikusui agent. If the output voltage waveform can be observed with an oscilloscope, turn the REGULATION ADJ knob counterclockwise to a point where oscillation ceases.

3-4. Frequency Adjustment

When in the INT mode, the output frequency of the equipment is controlled by the internal RC oscillator, the oscillating frequency of which is adjustable for a range of 45 Hz - 65 Hz with the FREQUENCY ADJ control. The frequency is indicated by the frequency meter.

When in the EXT mode, the output frequency of the equipment is controlled with an external signal applied to the EXT input terminal. The frequency meter is disconnected from the circuit and does not indicate the frequency.

3-5. EXT Mode

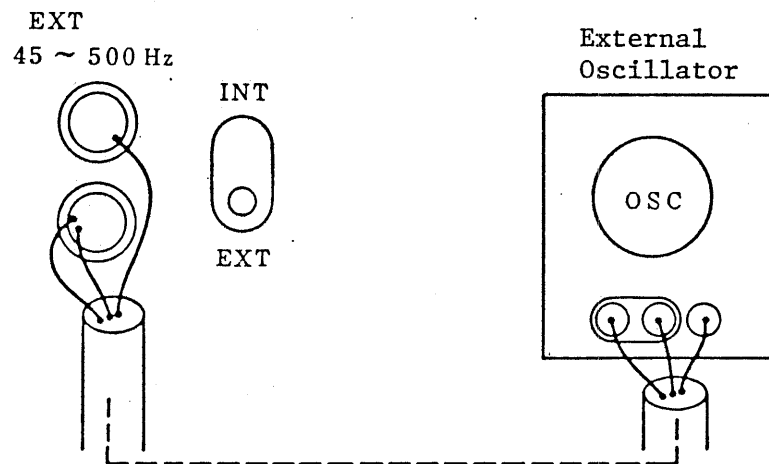


Figure 3-10

To operate the equipment in the EXT mode with an external signal, make connections as shown in Figure 3-10. The requirements of the external signal applied to the EXT input terminal are as follows:

Voltage: 0.2 V rms - 2.0 V rms (sinusoidal)

Frequency: 45 Hz - 500 Hz

Output impedance: Approx. 600 ohms

Distortion factor: 0.3% or less

When the above requirements are not met, protective circuits may trip.

Input overvoltage protection:

Clamps the output voltage (degraded distortion factor).

Trips the breaker.

External frequency protection:

Reduces the output voltage if the frequency is higher than 500 Hz.

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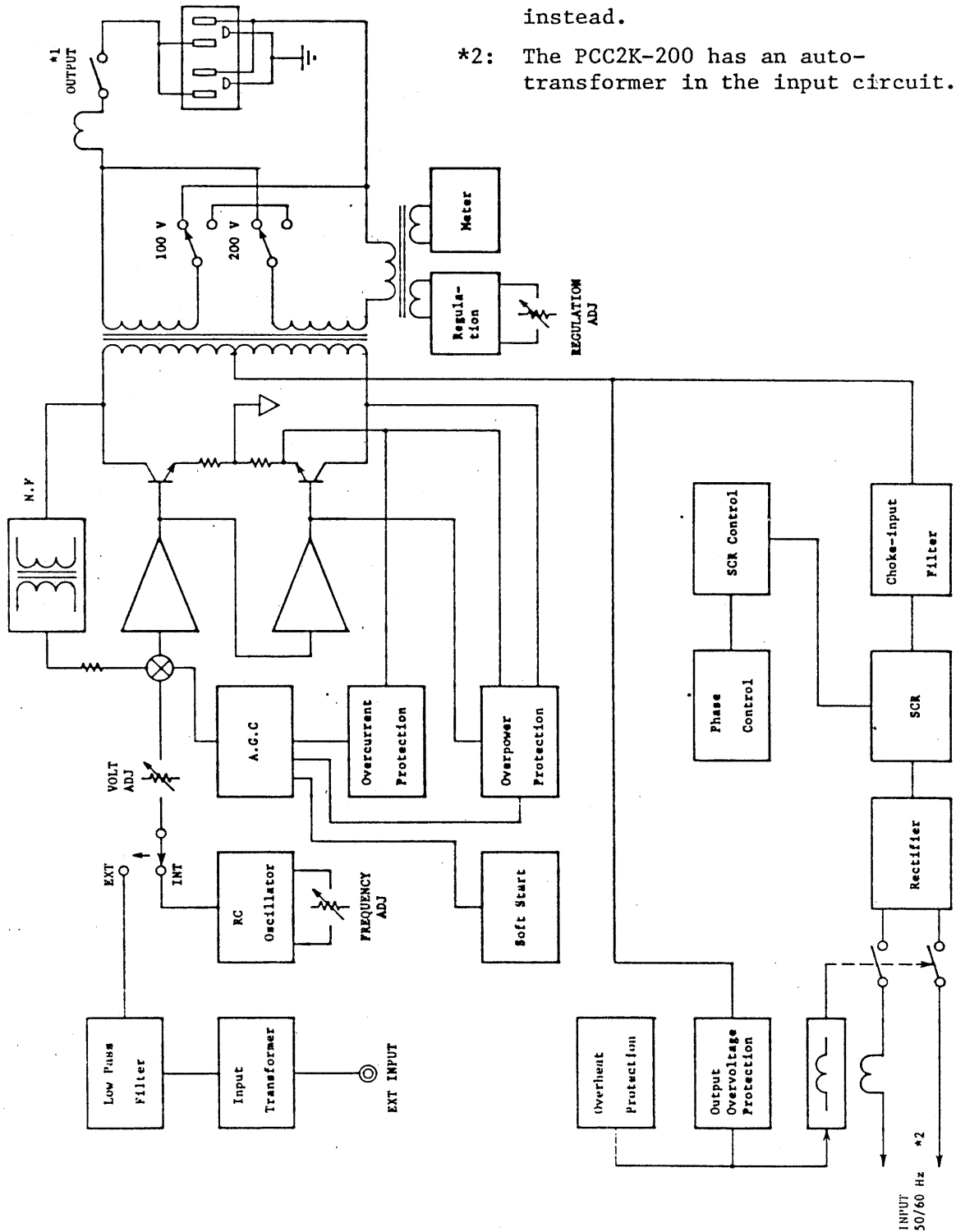
4. OPERATING PRINCIPLE

4-1. Block Diagram (PCC500-100, PCC1K-100)

The input circuit and output circuit of the PCC300-100 and PCC2K-200 are slightly different from those shown in Figure 4-1.

*1: The PCC300-100 has a fuse instead.

*2: The PCC2K-200 has an auto-transformer in the input circuit.



4-2. Phase Control Circuit

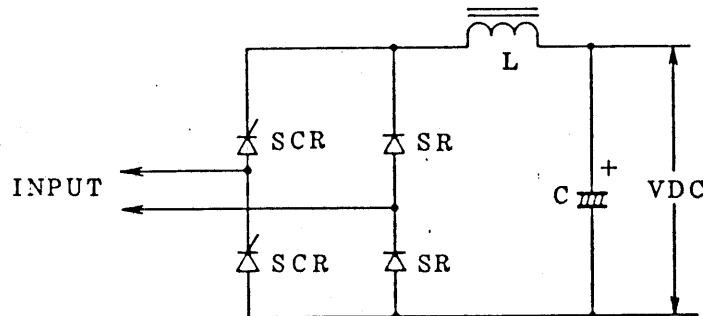


Figure 4-2. Rectifier circuit

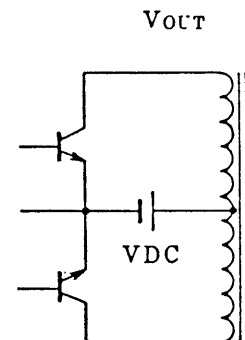


Figure 4-3. Push-pull circuit

The rectifier circuit is a compound bridge circuit consisting of SCR's and SR's as shown in Figure 4-2. The SR's operate as rectifier diodes and freewheel diodes. The filter circuit is a single-stage choke-input L type filter, which provides a better power factor than that of a capacitor input type.

The phase control circuit compares the voltages of V_{OUT} and V_{DC} , and controls the gates of the SCR's with the differential voltage.

4-3. Control Circuit and Power Circuit

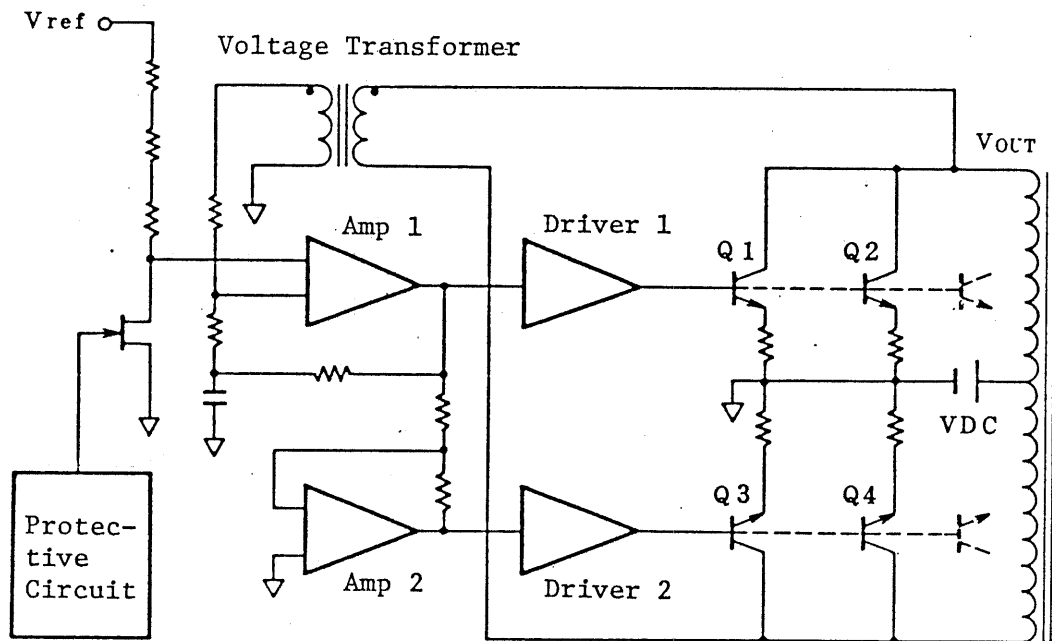


Figure 4-4

The control circuit is schematically shown in Figure 4-4. It has an error amplifier (amplifier 1) which compares the output voltage with V_{ref} (the sinusoidal signal generated by the internal RC oscillator or that applied via the EXT INPUT terminal) and an inverter amplifier (amplifier 2) which inverts the output of amplifier 1. The power amplifier (push-pull amplifier) consists of power transistors $Q_1 - Q_n$ and their drivers (drivers 1 and 2).

4-4. Protective Circuits

(1) Overcurrent protection circuit

Detects the power transistor current and reduces the output voltage to protect the power transistors

(2) Overpower protection circuit

Detects the power of the power transistors and reduces the output voltage to protect the power transistors.

(3) Soft start circuit

With a slow start circuit, the output voltage gradually rises in 2 - 5 seconds after the equipment power is turned on.

(4) Other protective features

The equipment power is cut out with the following protective features:

- (a) Overheat protection (with the thermal reed switch in the cooling package)
- (b) Input overcurrent protection
- (c) Output overvoltage protection (against overvoltage exceeding the rated value)

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5. MAINTENANCE

5-1. General

In order that the equipment operates in the best conditions for a long time, it should be inspected and serviced as explained in this section.

(1) Operation inspection

Check that the equipment operates normally, satisfying the specification requirements.

(2) Operation failures and probable causes

When the equipment has failed, check for the cause of the failure referring to Section 5-4.

5-2. Service Instruments Required

- (1) AC voltmeter: Moving iron type or rectifier type, 300 V full scale
- (2) AC ammeter: Moving iron type or rectifier type
- (3) High sensitivity AC voltmeter or RMS meter:
Digital voltmeter of four and a half digits or over; or AC voltmeter
- (4) Distortion meter: Resolution 0.3% or finer
- (5) Oscilloscope: 5 mV, 30 MHz or better
- (6) Load: Resistive load
- (7) Oscillator: Frequency 20 Hz - 1 kHz; distortion factor 0.3% or better
- (8) AC power factor meter: Moving coil type

5-3. Operation Inspection

(1) Check of output voltage and output current

Connect to the output terminal of this equipment a matching pure-resistance load and check that the rated output voltage and current are obtained and none of the protective circuit trip lamps light.

Conditions Input voltage: Rated value

Output frequency: 55 Hz

Power factor: 0.9 or over

	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
Output voltage switch	(100 V)	(100 V)	(100 V)	(100 V)
Rated power	300 VA	500 VA	1 kVA	2 kVA
Rated current	3 A	5 A	10 A	20 A
Overcurrent limit value	3.3 A	5.5 A	11 A	22 A

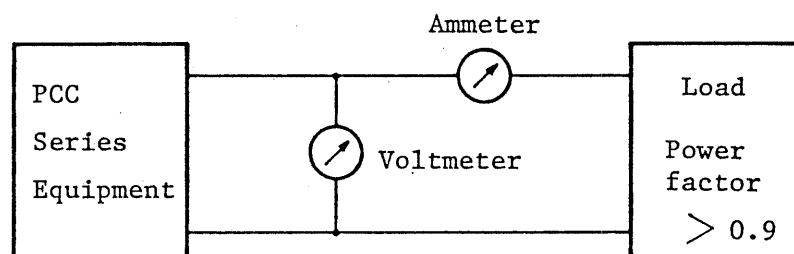


Figure 5-1

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(2) Check of REGULATION ADJ function

Check the output voltage at 100 V rms AC and the output frequency at 55 Hz. Check that the output voltage variation when the load current is varied from 0% to 100% can be made zero by adjusting the REGULATION ADJ knob.

(3) Check of output distortion factor

Set the output voltage at 80 V rms AC and the output frequency at 500 Hz with an external signal in the EXT mode. Set the resistive load at a value to draw the rated output current, connect a distortion meter to the output terminal, and check that the distortion factor is less than 1%. (The distortion factor of the external signal must be less than 0.3%.)

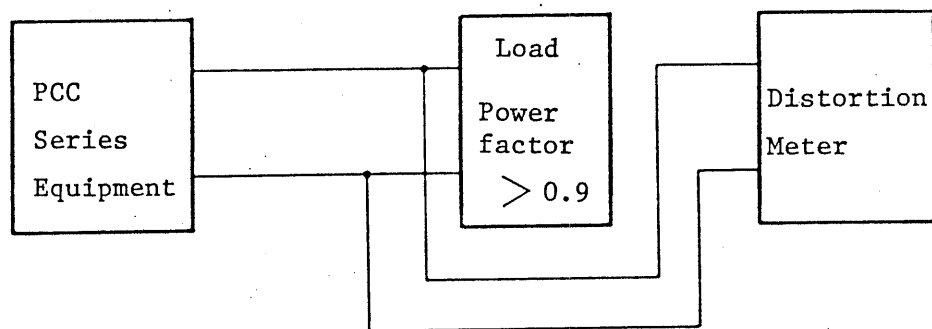


Figure 5-2. Check of distortion factor

(4) Check of output voltage versus frequency characteristics

Check that, when the output voltage is 100 V rms and the output power is the rated value, response of the output voltage meets the following requirement with respect to 200 Hz (0 dB) as reference:

Output frequency 45 Hz - 500 Hz: Within ± 0.5 dB

(5) Check of input power consumption

Check that, when the input voltage is 100 V rms (200 V rms for PCC2K-200) and the output power is the rated value, the input current is approximately the value shown in the following table:

	PCC300-100	PCC500-100	PCC1K-100	PCC2K-200
Input power	Approx. 1.0 kVA	Approx. 1.6 kVA	Approx. 3.1 kVA	Approx. 6.2 kVA
Input current	10 A	16 A	31 A	31 A
Input voltage	100 V	100 V	100 V	200 V

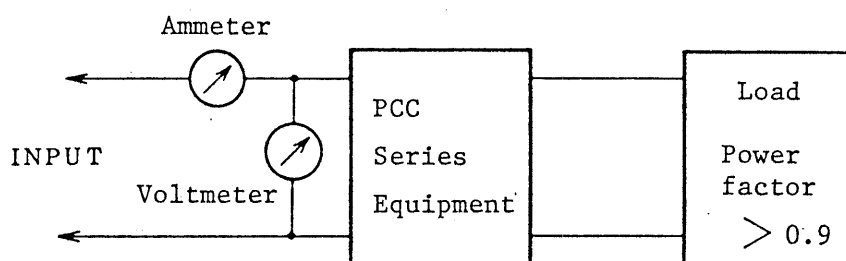


Figure 5-3

5-4. Operation Failures and Probable Causes

When the equipment has failed, check for possible causes referring to the following chart. When a malfunctioning is found, contact your Kikusui dealer. As a general rule, the equipment should be repaired by a qualified serviceman of the Kikusui agent.

Symptom	Check item	Probable cause
o Power switch cannot be turned on (or trips soon).	1. Has not the over-voltage protection circuit tripped?	o Output voltage too high
	2. Has not the fan stopped?	o Trip of overheat thermal relay
	3. Other items	o Failure of rectifier circuit o Failure of power transistors
o No output delivered (not delivered at all or delivered slightly).	1. Has not the fuse blown out?	o Failure of rectifier circuit o Failure of power transistors
	2. Is the POWER lamp on?	o Power cable (open) o Failure of rectifier circuit (auxiliary power circuit)
	3. Is not the output switch in the OFF state?	
	4. Is the oscillator circuit normal?	o Circuit failure
	5. Other items	o Circuit failure

Symptom	Check item	Probable cause
o The output is unstable.	1. Is the input voltage normal?	o Not within the input voltage range
	2. Is not the load a special type of device?	o Pay attention to the exciting current of a transformer load.
	3. Is not the frequency of the signal applied to the EXT input terminal exceeding the specified range?	o Frequency not within 45 Hz - 500 Hz (Set within 45 Hz - 500 Hz.)
	4. Others	o Circuit failure

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6. OPTIONS

(1) XOP5060 (crystal oscillator)

A PCC Series equipment incorporated with this option can provide a highly stabilized frequency output of 50 or 60 Hz (fixed) which is traceable to the accuracy of the crystal oscillator, as well as the 45 - 65 Hz continuously variable frequency output.

- o Accuracy of output frequency: $\pm 1 \times 10^{-4}$ or better

Some models of PCC Series equipment have XOP5060 already built in and these models are denoted as PCC-X Series.

(2) DPO6000 Series (digital programming for single phase output)

This option is a digital synthesizer for external control of output frequency and voltage of PCC Series equipment through GP-IB bus (IEEE-488-1975) or I/O port bus.

- o Output frequency

Variable range: 45.0 - 499.9 Hz

Resolution: 0.1 Hz

Stability: $\pm 1 \times 10^{-4}$

- o Output voltage

Variable range: 0 - 120 V or 0 - 240 V

Resolution: 0.39% (8 bits)

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(3) DPO7000 Series (digital synthesizer for 3-phase output)

This digital synthesizer is used to make up a 3-phase output frequency converter employing 3 units of PCC series equipment. As is the case of DPO6000 series equipment, operation can be computer-controlled,

(4) OP-3 (for parallel operation of PCC2K-200 units)

Up to 5 units of PCC2K-200 equipment can be one-control parallel-operated for an increased output capacity -- up to $[2 \text{ kVA}] \times [\text{The number of PCC2K-200 units}]$, or 4 kVA to 10 kVA. A setup for this operation can be readily made by simple connections of PCC2K-200 units, without requiring any modifications to them.

Items included in this optional provision

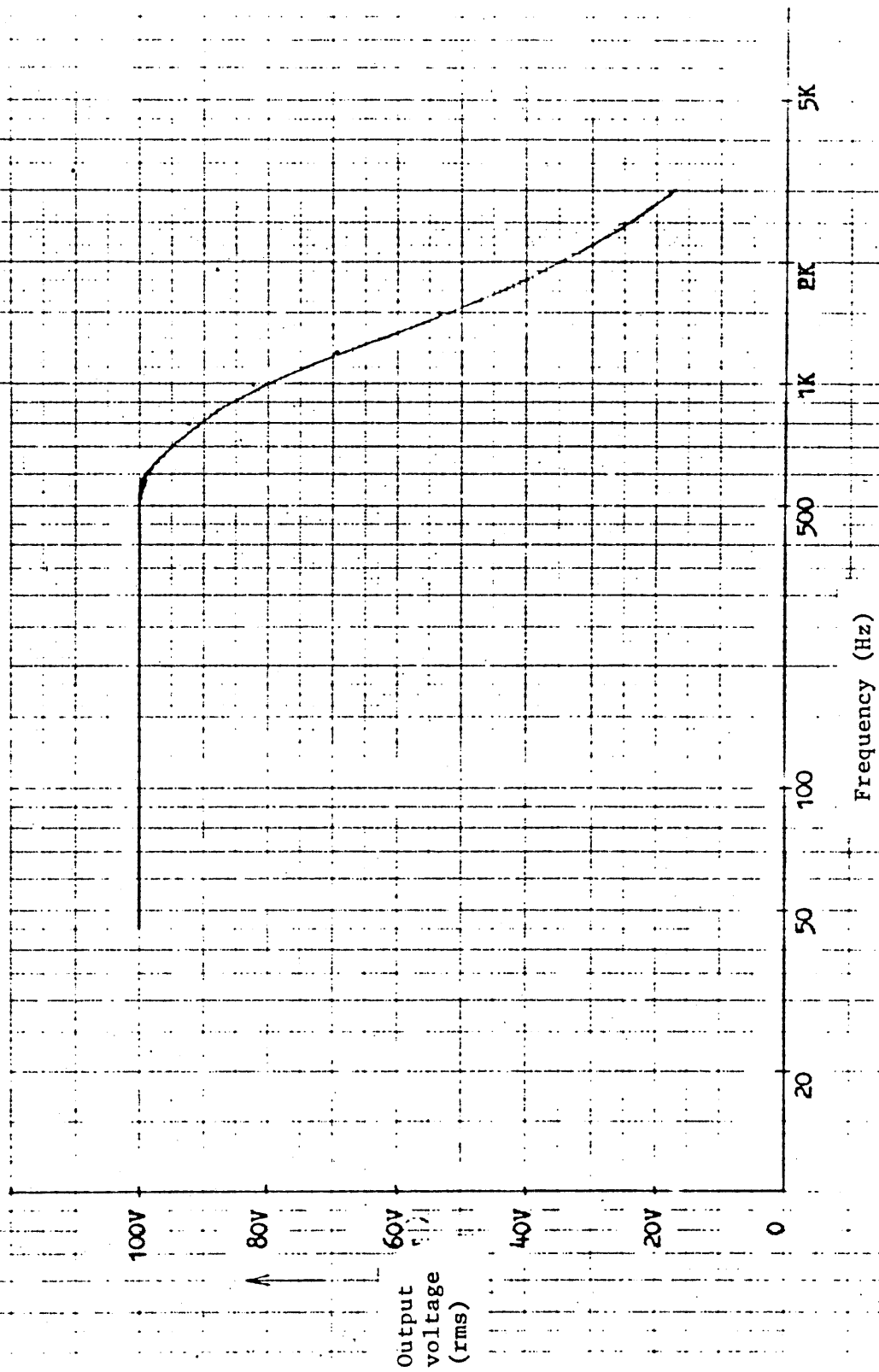
- | | |
|--|---|
| o Signal connection cable (with connector) | 1 |
| o Joint plate for fixing between PCC2K-200 units | 1 |
| o Open-end wrench | 1 |
| o Markplate for indication of slave unit | 1 |

For addition of options or for modifications for them, please contact your Kikusui agent.

Figure 6-1. Output voltage - Frequency Characteristics

EXT INPUT 1**: 45 Hz - 2 kHz

External input voltage: Constant



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Figure 6-2. Distortion - Frequency Characteristics

Output: Rated output

Power factor: 0.9 or over

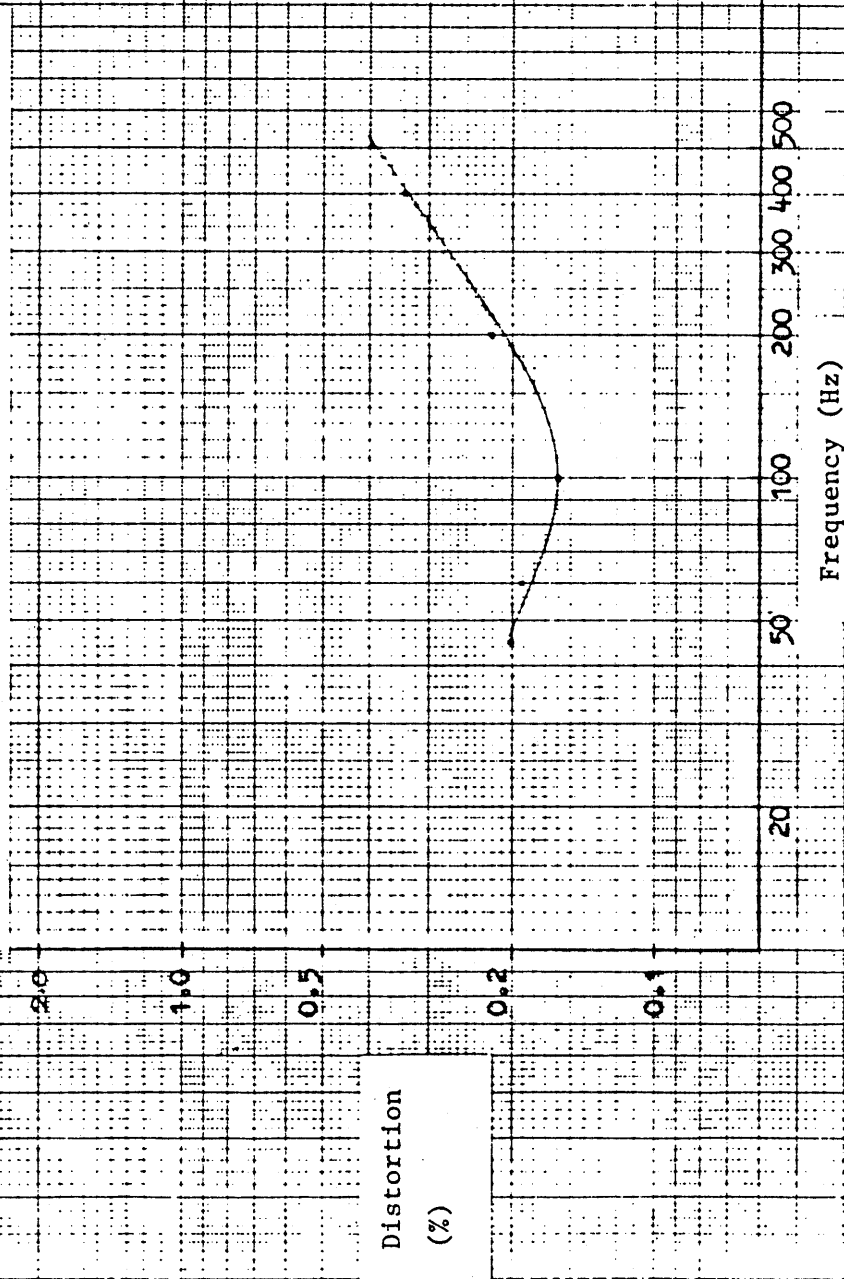


Figure 6-3. Output current - Power factor Characteristics

Output voltage: Rated voltage
Frequency range: 45 Hz - 500 Hz

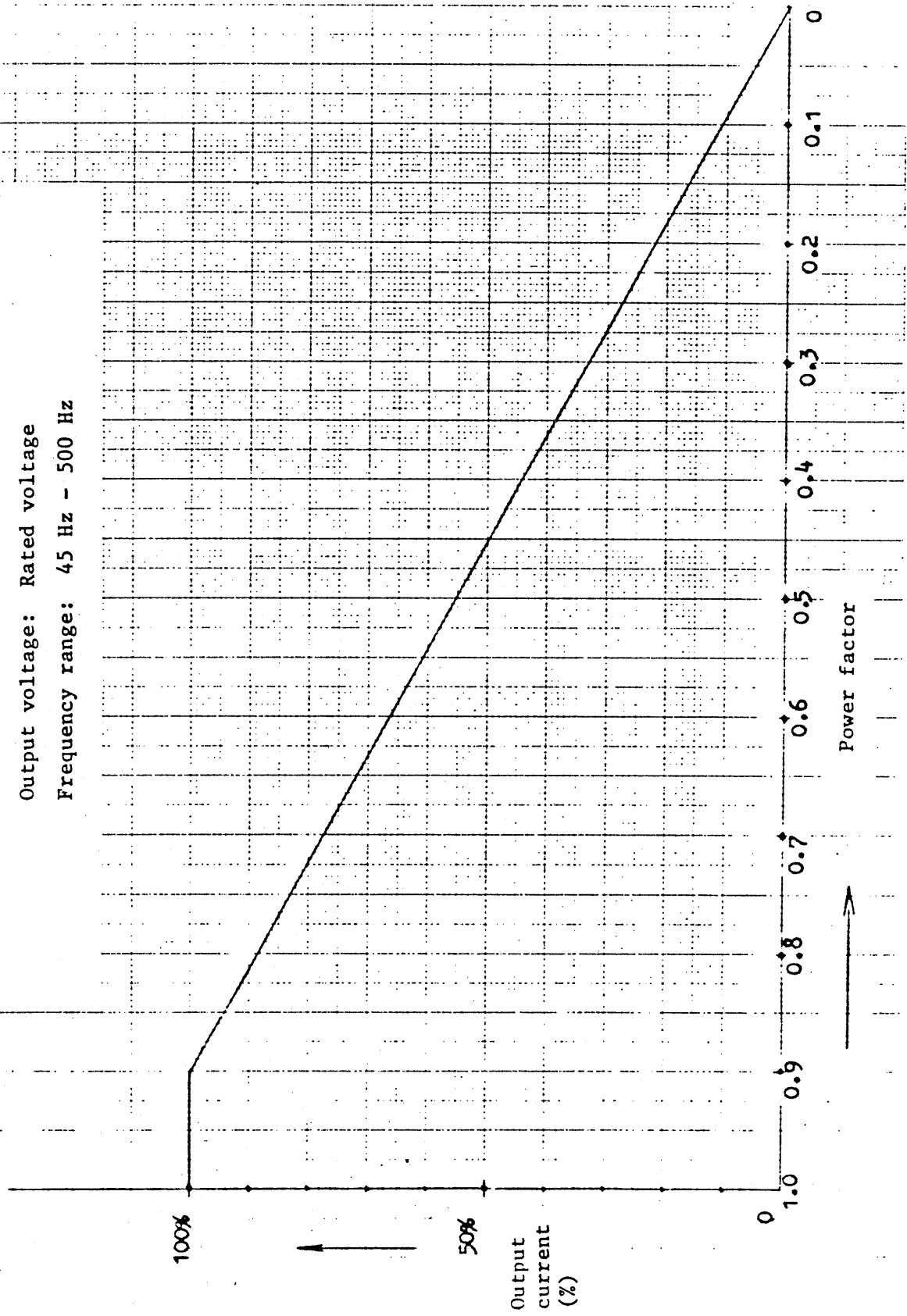


Figure 6-4. Output voltage - Input current Characteristics
Model PCCLK-100

Input voltage: 100 V AC constant

Output current: 10 A or 8 A constant

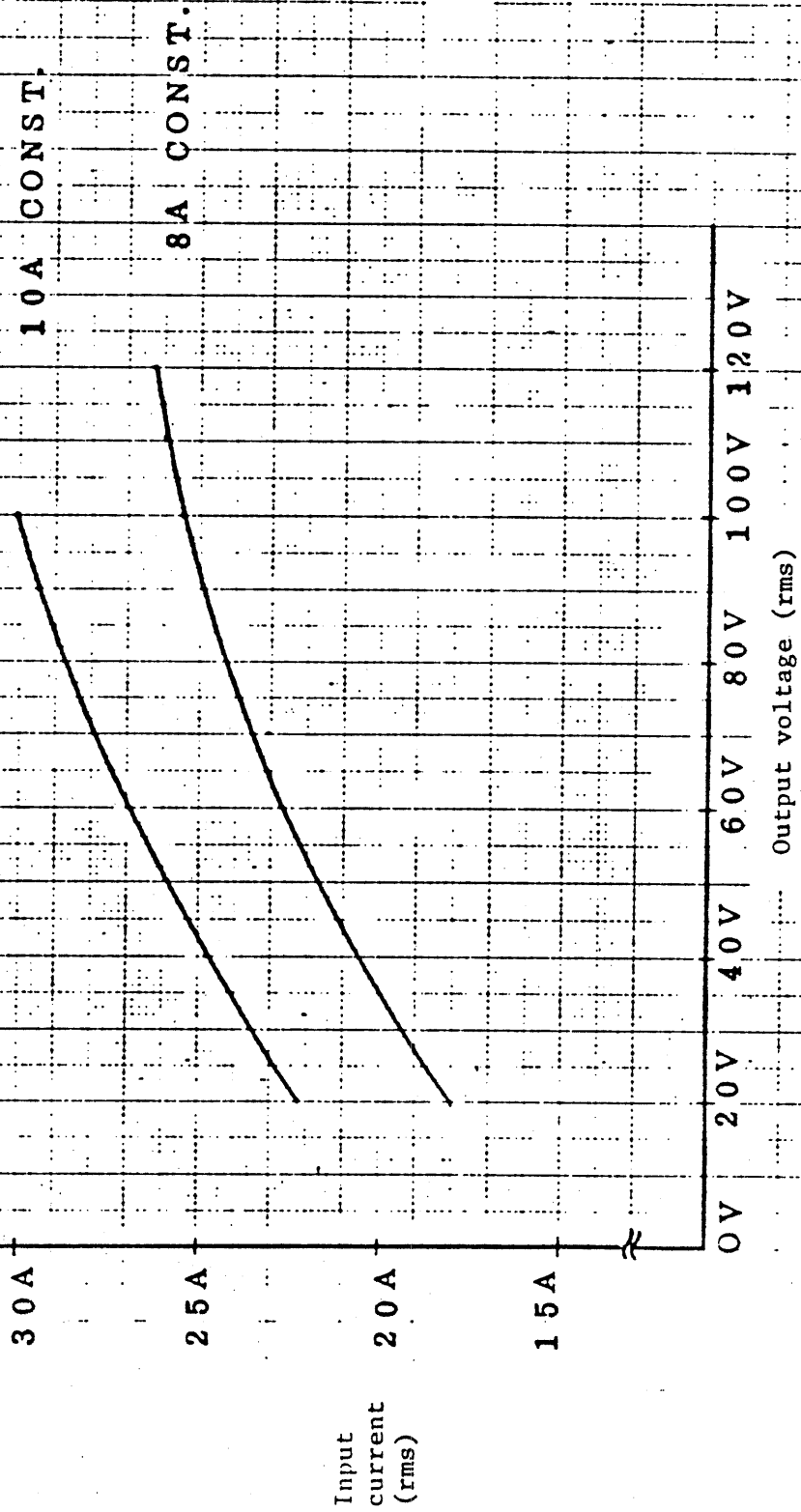


Figure 6-5. Output voltage - Input current Characteristics
Model PCC300-100

Input voltage: 100 V AC constant

Output current: 3 A constant

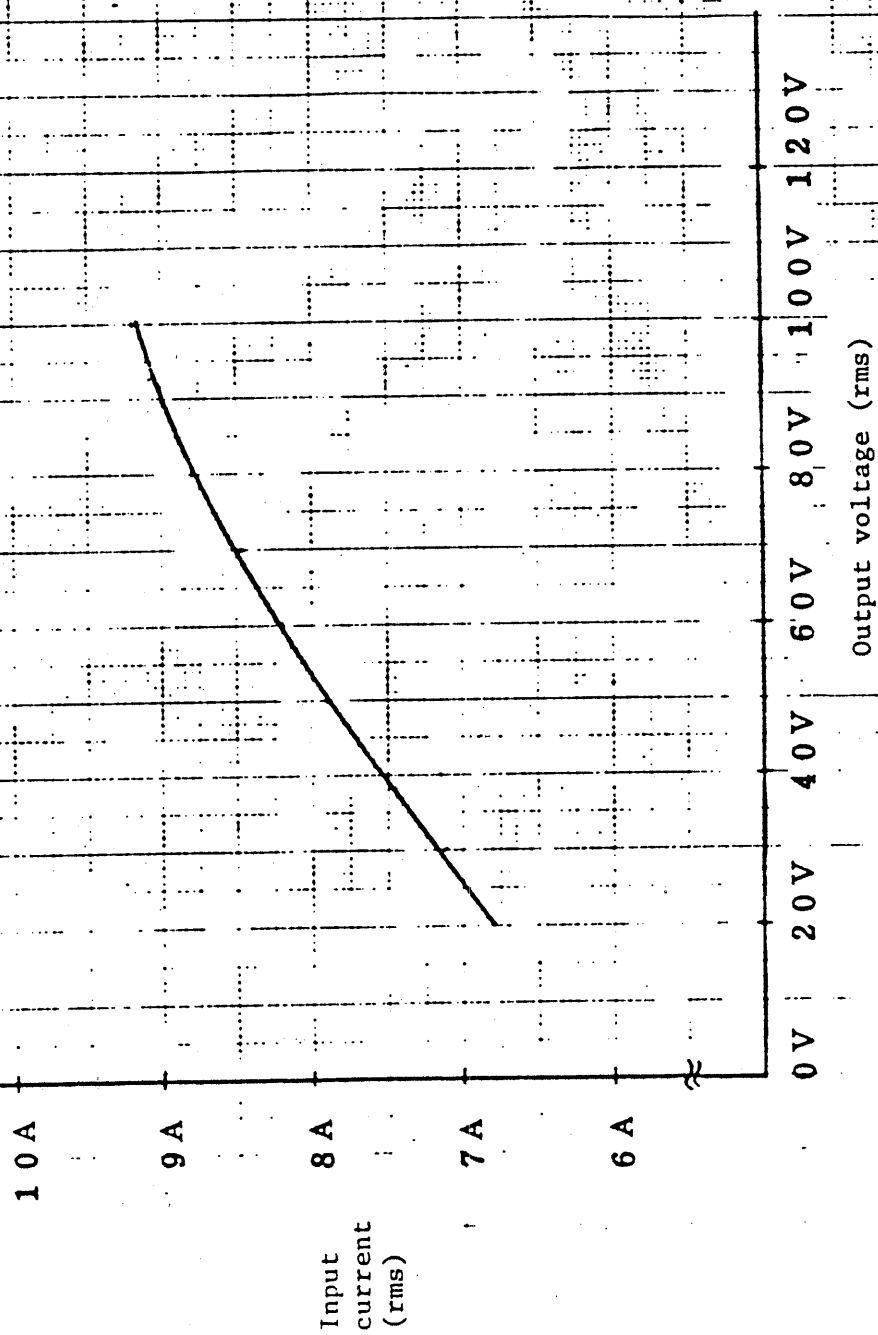


Figure 6-6. Output voltage - Input current Characteristics

Model PCC500-100

Input voltage: 100 V AC constant

Output current: 5 A constant

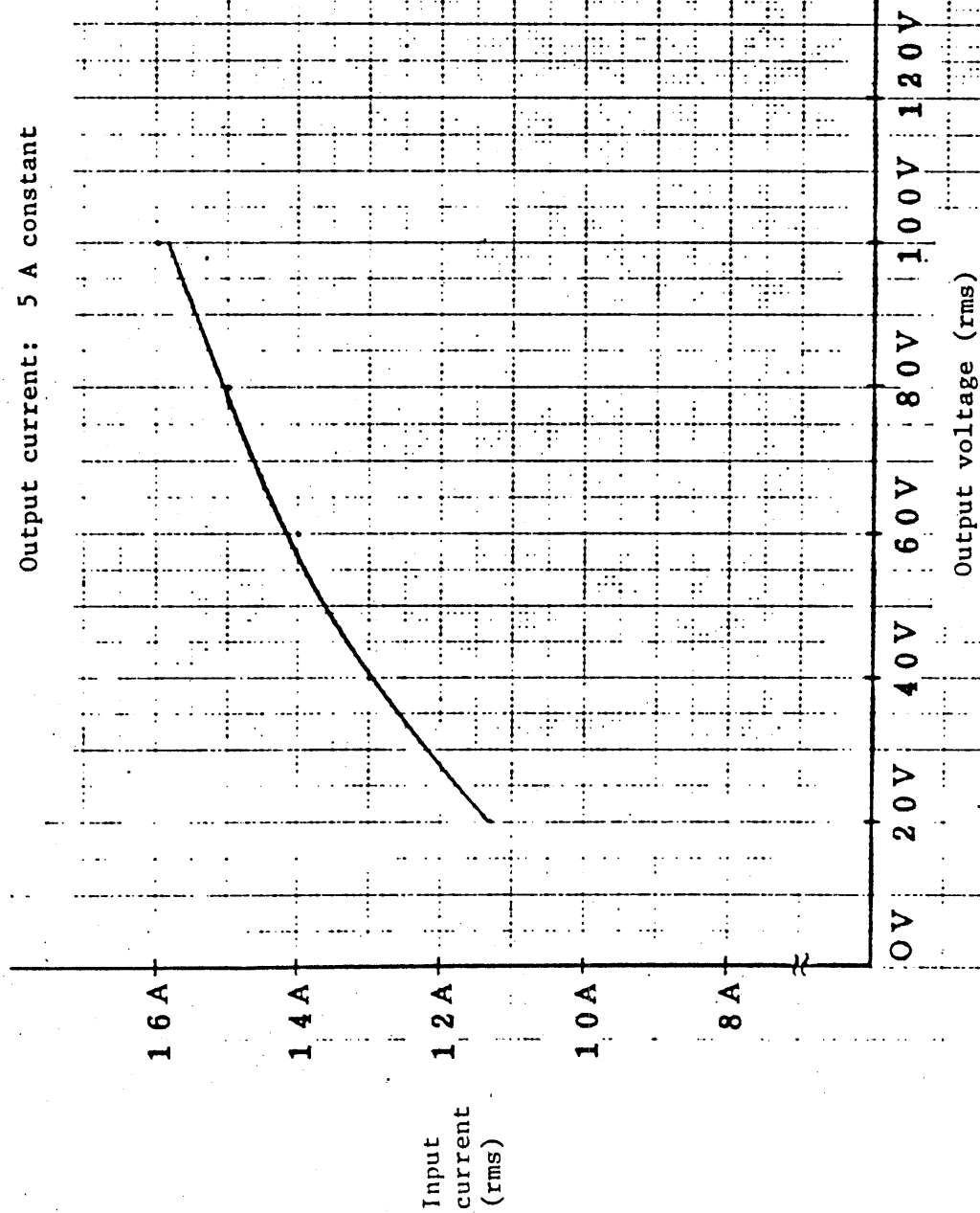


Figure 6-7. Output voltage - Input current Characteristics

Model PCC2K-200

Input voltage: 200 V AC constant *Note

Output current: 20 A constant

