

INSTRUCTION MANUAL

3-PHASE DIGITAL SYNTHESIZER

MODEL DPO7500

KIKUSUI ELECTRONICS CORPORATION

832075

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.

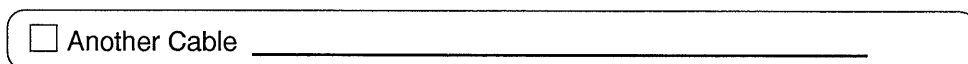
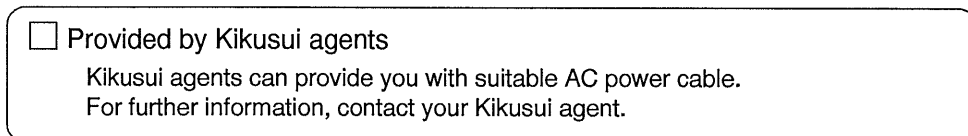
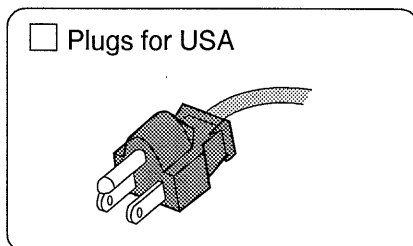
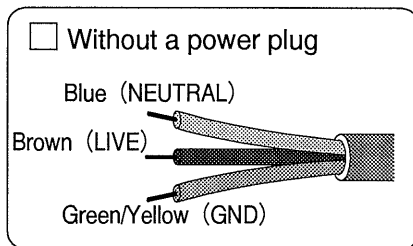


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SECTION 1. GENERAL

Model DP07500 3-phase Digital Sine Synthesizer is one of Kikusui's DPO Series Digital Programming Options. It is used in conjunction with three units of Kikusui's PCC Series Frequency Converters to make up a 3-phase frequency converter system.

Note: Note that the DP07500 has been designed specifically as an optional instrument for Kikusui's PCC Series Frequency Converters (hereafter, referred to as PCC Series instruments) and it cannot be used in conjunction with other models of instruments. If it is used in conjunction with other model of instruments, full performance may not be attainable or damage may be caused.

When using the DP07500, refer also to the instruction manual of the PCC Series instruments used in conjunction.

SECTION 2. SPECIFICATIONS

Model		DP07500
Power requirements		100 V \pm 15%, 50/60 Hz single-phase AC
Output frequency	Variable range	45.0 - 499.9 Hz
	Setting resolution	0.1 Hz (*1)
	Stability	$\pm 1 \times 10^{-4}$ or better (including setting accuracy)
Output voltage (*3)	Variable range (*4)	0 - 2 V rms
	Setting resolution	0.02% (theoretical) (*2)
	Difference between phases	Not greater than $\pm 1\% + 10$ mV
	Temperature coefficient	100 ppm/ $^{\circ}$ C (typical)
	Frequency characteristics	$\pm 0.5\%$ or better (with reference to voltage when frequency is 165 Hz)
	Waveform distortion factor	0.3% or less (when output voltage is 0.3 - 2 V rms)
	Phase shift	$\pm 1.5^{\circ}$ or less with respect to 120°
Output connection		Star connection
Insulation resistance (*4)		30 M Ω or over, with 500 V DC
Withstanding voltage (*4)		1000 V AC, 1 minute
Ambient temperature and humidity		0 to 40° C (32 to 104° F), 10 - 90% RH
Weight		Approx. 3.5 kg (7.7 lbs)
External dimensions		210 W \times 70 H \times 300 D mm (8.27 W \times 2.76 H \times 11.81 D in.) 215 W \times 85 H \times 380 D mm (*5) (8.46 W \times 3.35 H \times 14.96 D in.)

Protective circuits, etc.		<p>The output is cut out and an alarm lamp lights when in any of the following cases:</p> <p>(1) When output frequency setting is not within 45.0 - 499.9 Hz.</p> <p>(2) When the POWER switch is turned on with the OUTPUT switch set in the ON state.</p> <p>(3) When the REMOTE/LOCAL switch is set in the REMOTE state.</p>
Accessories	Output cable	Cable (one), with DIN plug, 2 meters long (6.6 ft long)
	Ground cables	Cables (two), with crimping terminal, 1 meter long (3.3 ft long)
	Mounting brackets	1 set
	Instruction manual	1 copy

[Remarks]

(*1): Output frequency can be set with 4-digit digital switches.

(*2): Output voltage can be set with 10-turn potentiometer.

(*3): When this instrument is used in conjunction with PCC Series instruments, the 3-phase output characteristics of the PCC Series instruments are as follows.

Note: The specifications of the PCC Series instruments are applicable except the following items and the specifications shown in the following table.

The input and output capacities are increased to 3 times. For output frequency and ambient conditions, the specifications of the DPO7500 apply. The protective functions of the DPO7500 are added to those of the PCC Series instruments.

Difference between phases	Not greater than $\pm 1.5\% + (0.5\%$ of maximum output voltage). (When no load, at 25°C). (See Note.)
Temperature coefficient	$\pm 0.1\%/^{\circ}\text{C}$ or better
Frequency characteristics	$\pm 1.5\%$ or better (with respect to voltage when frequency is 165 Hz)
Phase shift	Not greater than $\pm 3^{\circ}$ (45 - 165 Hz) or $\pm 6^{\circ}$ (165 - 499.9 Hz) with respect to 120°. (When at 70 - 100% of maximum output voltage, with resistive load)

Note: With respect to output voltage difference between phases which is assumed to be zero when the output voltage is maximum.

(*4): Applicable to all of between input power and chassis, output and chassis, and input power and output.

(*5): Maximum dimensions when connectors are connected.

(*6): The output is delivered when the OUTPUT switch is turned off once and then turned on again.

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SECTION 3. OPERATION METHOD

3-1. General Precautions

(1) Ambient Temperature

- o The ambient temperature specification of the Synthesizer is 0°C to 40°C (32 to 104°F). Use it within this temperature range.

The ambient temperature specification of the PCC Series instruments is -10°C to 50°C (14 to 122°F). When they are used in conjunction with the Synthesizer, use all of these instruments within the temperature range of 0°C to 40°C (32 to 104°F).

(2) Installation Position

- o The Synthesizer is designed so that it can be fixed on top of a PCC Series instrument. It is most recommendable to use the Synthesizer being fixed on top of one of the U-, V-, and W-phase PCC Series instruments.

Note: Some models of the PCC Series instruments manufactured before 1982 are not designed for installing the Synthesizer on the top. They can be modified for installing the Synthesizer on the top. For this modification, please contact your Kikusui agent.

- o Be sure to securely connect the PCC Series instruments to the Synthesizer using cables supplied. For the connection method, refer to Section 3-3, 1, (2).

Note: Be sure to ground the GND terminal of the Synthesizer and connect it with those of the PCC Series instruments. These are important from the viewpoints of protecting the operator against electrical shock hazards and preventing the instruments from erroneous operation which could be caused by external noise.

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- o To fix the Synthesizer on any model of PCC Series instrument, follow the procedure of steps ① → ④ in the following illustrations. Items ① - ④ are supplied as accessories of the Synthesizer.

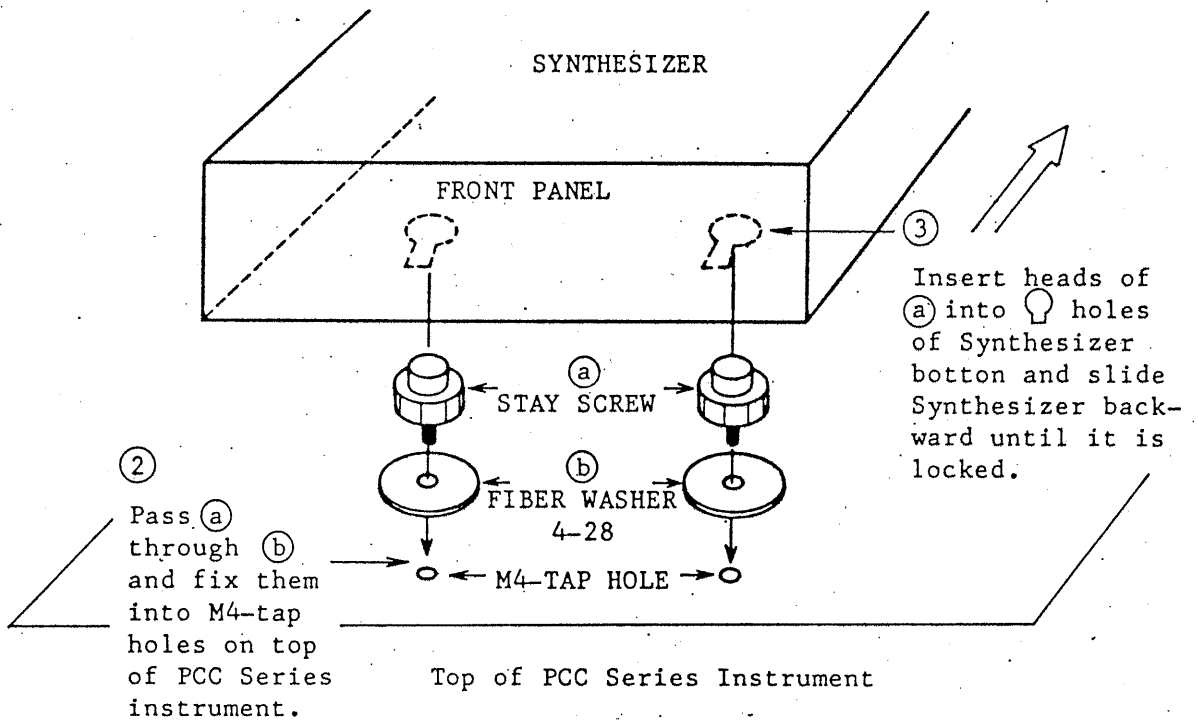
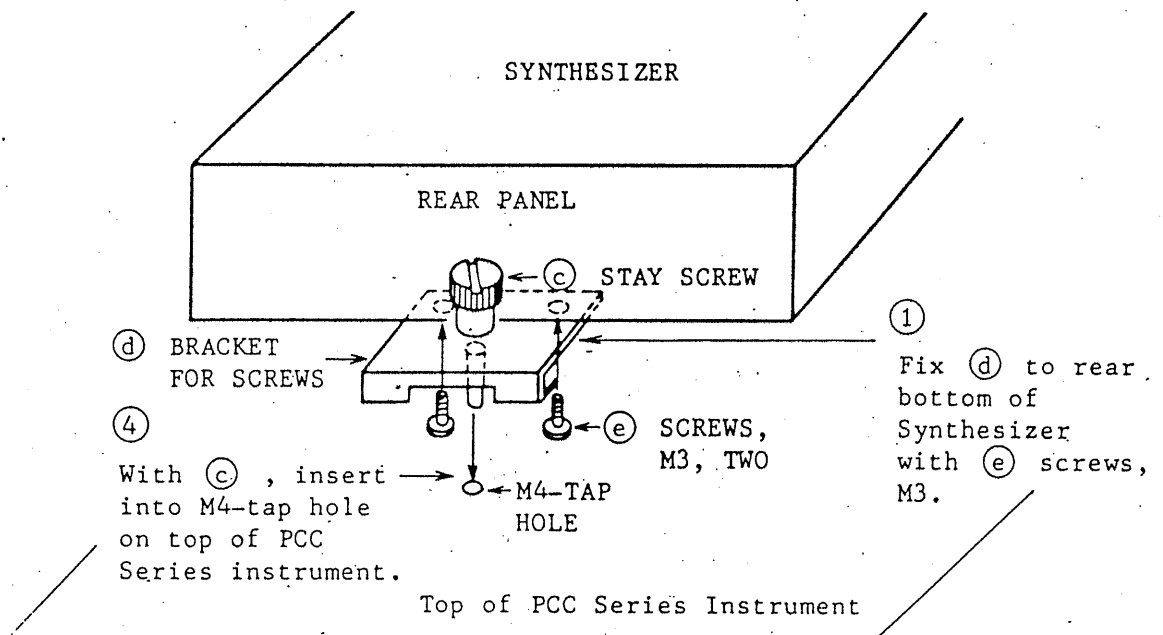
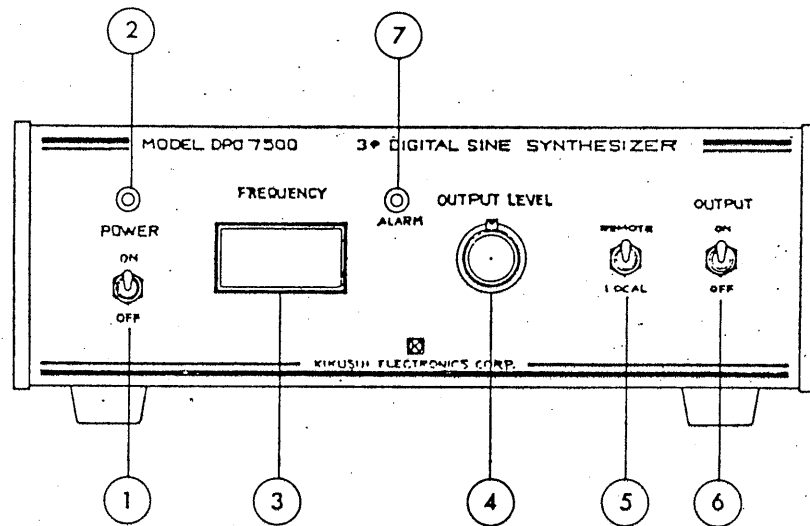


Figure 3-1

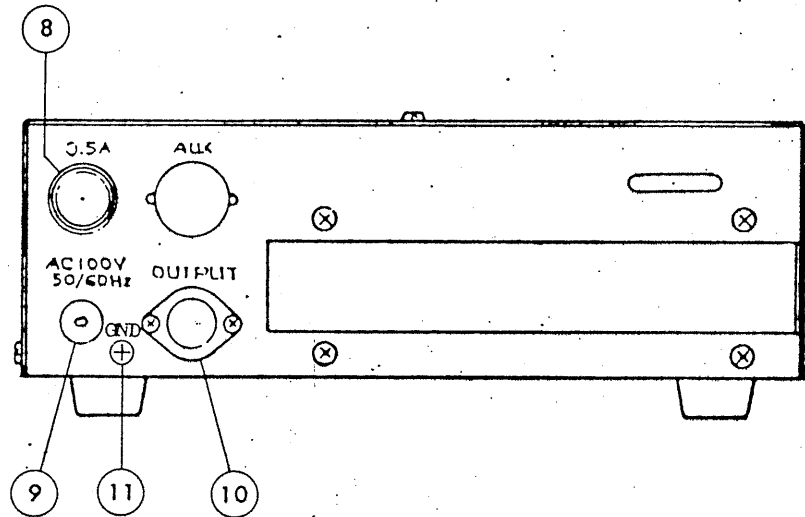


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3-2. Description of Panel Controls and Other Items



Front Panel



Rear Panel

Figure 3-2

① Power switch "POWER":

To on/off-control the main power of the Synthesizer. When the switch is thrown to the upper position, instrument power is turned on and power indicator lamp ② lights.

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② Power indicator lamp:

To indicate that the instrument power is turned on.

③ Frequency setting switches "FREQUENCY":

To set the output frequency, within a range of 45.0 - 499.9 Hz with 0.1-Hz resolution.

④ Output voltage setting knob "OUTPUT LEVEL":

A 10-turn potentiometer to set the output voltage. The voltage increases as the knob is turned clockwise.

⑤ Remote/local selector switch "REMOTE/LOCAL":

To select between remote control mode (computer control mode) and local control mode (panel control mode) for DPO7100 (I/O port control) instrument or DPO7200 (GP-IB control) instrument. For this Synthesizer, keep this switch thrown to the LOCAL position. If it is thrown to the REMOTE position, the output is cut off and the ALARM lamp lights.

⑥ Output switch "OUTPUT":

To on/off control the output signal of the Synthesizer.

⑦ Alarm lamp "ALARM":

This lamp lights when any of the following conditions is caused. When this lamp is lighted, the output is cut off.

- ① Output frequency is not set within a range of 45.0 - 499.9 Hz.
- ② The POWER switch is turned on with the OUTPUT switch set in the ON state.
- ③ The REMOTE/LOCAL switch is set in the REMOTE state.

⑧ Fuse holder "FUSE 0.5A":

To hold the fuse of the input power line of the instrument. Be sure to use a fuse of the rated current (0.5 A). Never use a fuse of other rating. If the replaced fuse blows out again, the failure is inside the instrument. In such a case, please contact your Kikusui agent.

⑨ Input power cable "AC100V, 50/60Hz":

Connect this cable to an AC line outlet of 85 - 115 V, 50/60 Hz.

⑩ Output connector "OUTPUT":

This connector delivers the output of the Synthesizer. For connections to the PCC Series instruments, be sure to use the output cable supplied as an accessory of the Synthesizer.

⑪ Frame ground terminal "GND":

This terminal (M4 screw) is for frame grounding and connection to the GND terminals of the PCC Series instruments. Use the ground cables supplied.

3-3. Operation Method

1. Connection Method of Synthesizer, PCC Series Instruments, and Load

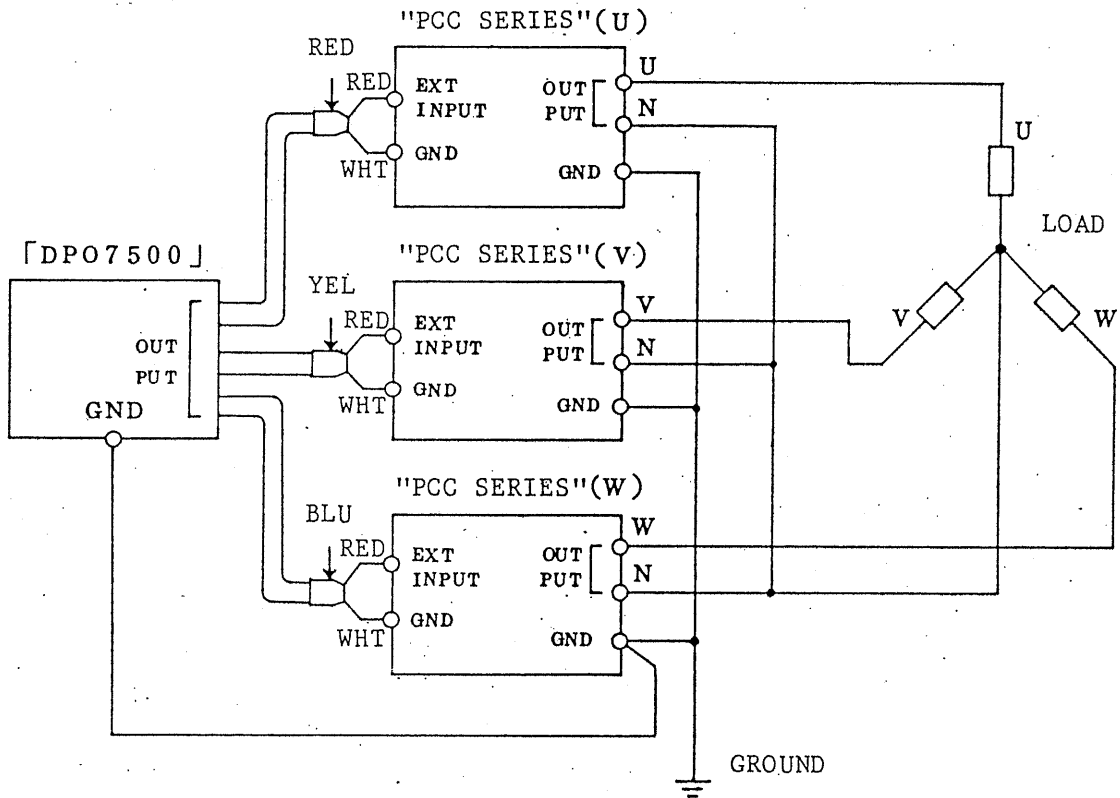


Figure 3-3

(1) Connections between Synthesizer and PCC Series instruments

- o Connect the OUTPUT connector of the Synthesizer to the EXT INPUT terminals (external control signal input terminals) of the PCC Series instruments using the OUTPUT cable supplied. To do this, be sure to insert securely the DIN plug of the cable in the connector in the correct direction. (Unless the direction is correct, the connector will not mate with the plug.) Connect the red wires of the cable to the HOT ones (red ones) of the EXT INPUT terminals of the PCC Series instruments, and connect the white wires of the cable to the GND ones (white ones) of the EXT INPUT terminals. Color coding of the cable terminal caps is red for the U-phase, yellow for the V-phase, and blue for the W-phase. The phases of the

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output of the PCC Series instruments correspond to these phases. (See Figure 3-3.)

- o Securely connect the GND terminal (M4 screw) of the Synthesizer with the GND ones of the OUTPUT terminals of the PCC Series instruments using the ground cables supplied, and ground the GND terminal of the Synthesizer. These are important from the viewpoints of protecting the operator against electrical shock hazards and preventing the instruments from erroneous operation which could be caused by external noise.

[Note] Two types of ground cables for different models of PCC Series instruments are available as follows:

- ① Cable with M4 crimp terminals on both ends:
Models PCC 300-100, PCC 500-100, PCC 1K-100
- ② Cable with M4 crimp terminal on one end and M5 crimp terminal on the other end: Model PCC 2K-200

Some of Model PCC 2K-200 instruments manufactured before 1982 have the M4 screw type of OUTPUT terminals. For such instruments, use cables of type ①.

(2) Connections between PCC Series instruments and load

- o Connect the outputs of the PCC Series instruments in a star connection system (3-phase 4-wire system), connecting together the neutral points. For the neutral points, be sure to connect together the terminals of the same positions of the OUTPUT terminal blocks. See Figure 3-4.

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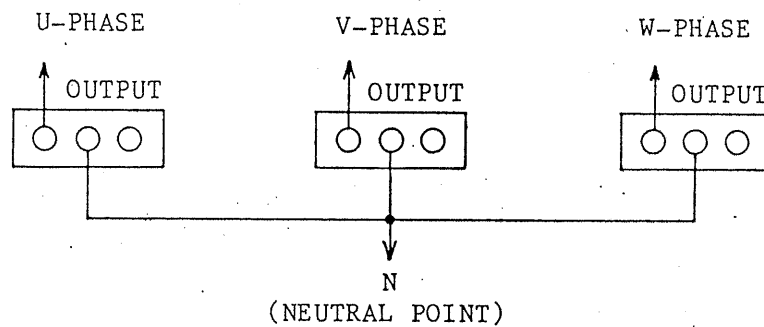


Figure 3-4

(3) Input powers of Synthesizer and PCC Series instruments

- o The Synthesizer operates on an AC line of 100 V $\pm 15\%$, 50/60-Hz single-phase AC. Connect the input power cable plug (2P type) to an AC line outlet (2P type) of the above requirements.
- o Connect the PCC Series instruments to AC line outlets of the specification power requirements of the instruments. (Refer to Section 1-3 of the instruction manual for the PCC Series instruments.) Be sure to ground the GND terminals.
- o To supply the input power through a single cable from a power source, feed the power once to a power junction panel which has a sufficient current capacity and from there distribute power to individual PCC Series instruments using the input power cables supplied.

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2. Operation Method

(1) Power on/off operation

- o Connect the instruments as explained in Section 3-3, 1.
- o To turn on power, proceed as follows: First, turn on the POWER switch of the Synthesizer. Turn off and on (see the note) and confirm that the ALARM lamp is not on. Next, turn on the POWER switches of the PCC Series instruments.

Note: If the POWER switch of the Synthesizer is turned on with its OUTPUT switch set in the ON state, the ALARM lamp turns on and the output is cut off. The output is delivered as you turn off the OUTPUT switch once and turn it on again. (Note, however, that the output may be delivered with the ALARM lamp off if you rapidly turn off and on the POWER switch.)

If the ALARM lamp remains lighted even after you have performed the above procedure, the cause of this is either the FREQUENCY switch setting is not within a range of 45.0 - 499.9 Hz or the REMOTE/LOCAL switch is set in the LOCAL state. If the ALARM lamp does not go off even though these settings are correct, it is possible that the Synthesizer has failed. Immediately turn off the POWER switch and contact your Kikusui agent.

- o The output voltages of the PCC Series instruments rise up slowly (in several seconds). The rise up periods differ by individual instruments and consequently the rise up periods of the three phases are not uniform. Therefore, when it is required to apply to the load the voltages of the three phases at the same time, provide a switch between the load and the outputs of the PCC Series instruments.

Note: With the OUTPUT switch of the Synthesizer, it is possible to on/off-control the output signal which is applied to the external control signal input terminals of the PCC Series instruments. When operated in this mode, however,

note the following: Due to the voltage rise up characteristics of the PCC Series instruments in response to an external control signal, it takes about one second for the output voltages to rise up from 0 V to the rated maximum output voltages. During this rise up period, the output voltage waveforms are badly distorted (the peaks of sine waves are collapsed).

The OUTPUT switch primarily is for on/off-control of the 3-phase output when the Synthesizer is used in Kikusui's 3-phase Frequency Converter System.

- o To turn off power, turn off the POWER switches of the PCC Series instruments first and turn off the POWER switch of the Synthesizer next.

Note: Note that if the POWER switches are turned on or off in an incorrect order when in power turn on or off operation, overshoots may be produced in the output circuits of the PCC Series instruments.

(2) Setting method of output voltage and frequency

① Adjustment of maximum output voltages of individual phases (3 phases)

- o Set the switches and controls of the Synthesizer and the PCC Series instruments as follows:

Synthesizer

FREQUENCY switch: Required output frequency

OUTPUT LEVEL knob: Clockwise extreme position

REMOTE/LOCAL switch: LOCAL

OUTPUT switch: OFF

PCC Series instruments

INT/EXT switch: EXT

100V/200V selector: Required output voltage mode

OUTPUT switch: ON

VOLT ADJ control: Counterclockwise extreme position

REGULATION ADJ control: Counterclockwise extreme position

- o In the no load state, connect an AC voltmeter (which provides a sufficient measuring accuracy for the required output voltage) to each of the three phases (to the OUTPUT terminals of each of the PCC Series instruments).
- o Turn on the powers of the instruments as explained in Section 3-3, 2, (1). When this is done, the OUTPUT switch of the Synthesizer is in the ON state. Confirm that the ALARM lamp is off.
- o Gradually turn clockwise the VOLT ADJ control of each of the PCC Series instruments to the point where the output voltage of the instrument becomes the rated maximum output voltage (120 V or 240 V for PCC Series instruments or 140 V or 280 V for PCC-A Series instruments).

Note: Note that output voltage setting may be slightly affected when frequency setting is varied. Variation of the output voltage is within approximately $\pm 1.5\%$ of the output voltage (reference voltage) when its frequency is 165 Hz (reference frequency for this purpose).

② Setting of output voltage

- o As you turn the OUTPUT LEVEL knob of the Synthesizer, the output voltages of all of the three phases increase.

Note: Note that the output voltage waveform is distorted and regulation is degraded at low output voltage ranges of PCC Series instruments (at ranges lower than 20 V when in the 100V mode or at ranges lower than 40 V when in the 200V mode). Avoid, whenever avoidable, operating them in such low ranges.

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- o To feed the output power to the load, adjust the REGULATION ADJ controls on the front panels of the PCC Series instruments so that output voltage variation between when no load is connected and the load is connected becomes minimum. For details of the adjusting procedure, refer to Section 3-3 of the instruction manual for the PCC Series instruments.

Note: Output voltage regulation of the PCC Series instruments varies depending on output frequency, conditions of load (output current, power factor of load, etc.), and output voltage. When any of these items is varied, note that the output voltage regulation may be affected.

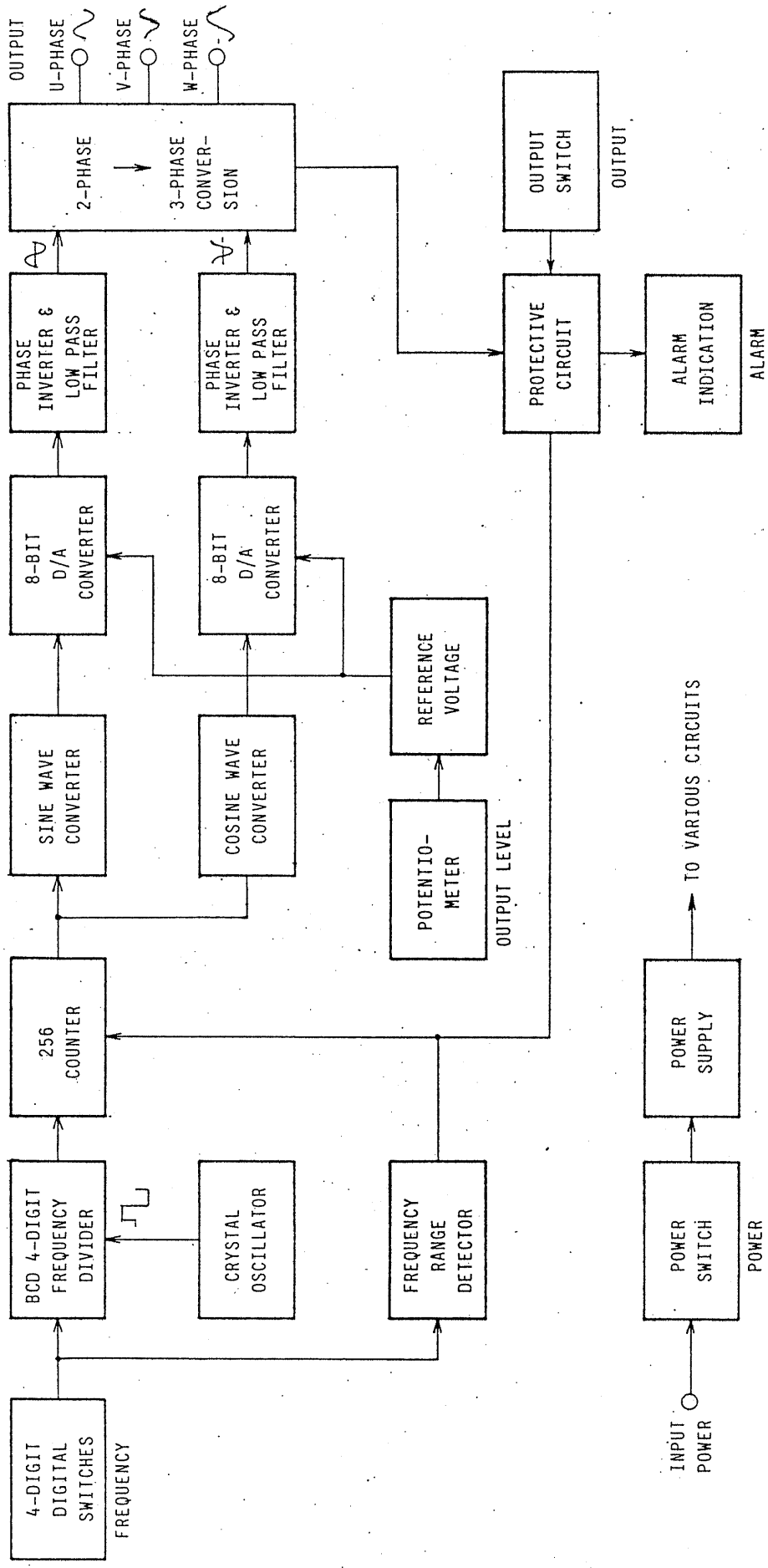
③ Setting of output frequency

- o The output frequency of the Synthesizer can be set with the FREQUENCY switches (4-digit digital switches) on the front panel, for a range of 45.0 - 499.9 Hz with 0.1-Hz resolution. The right-hand end digit is for the order of 0.1 Hz. To set for 45.0 - 99.9 Hz, for example, set the digits as "045.0" - "099.9".

Note: Set the switches for a frequency within a range of 45.0 - 499.9 Hz. If they are set for a frequency not within this range, or if they are set at 000.0 - 044.9 or 500.0 - 999.9, the output voltage is cut off and the ALARM lamp lights. In this case, however, if you change setting to within the range of 45.0 - 499.9 Hz, the output frequency is automatically returns to the set frequency.

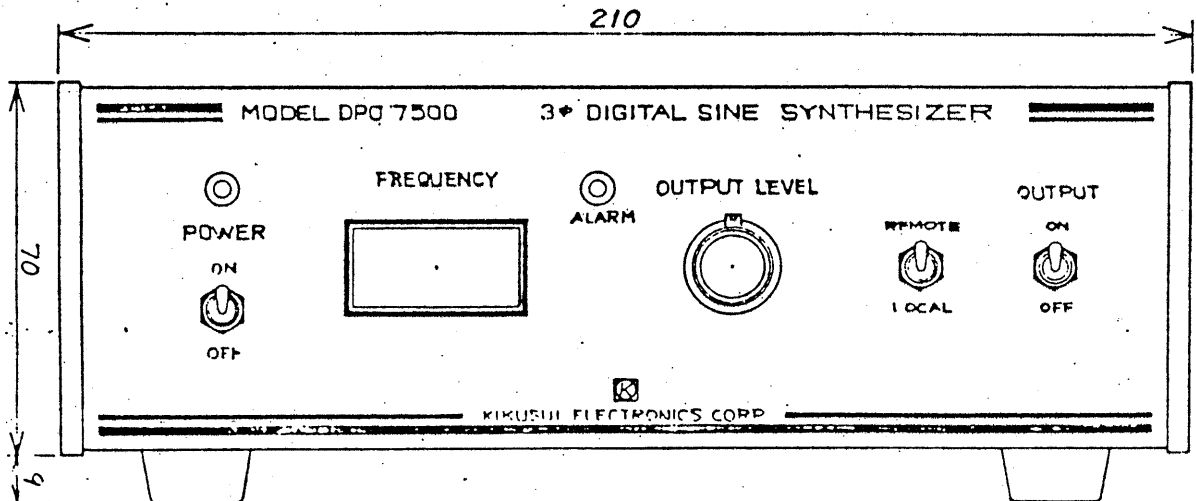
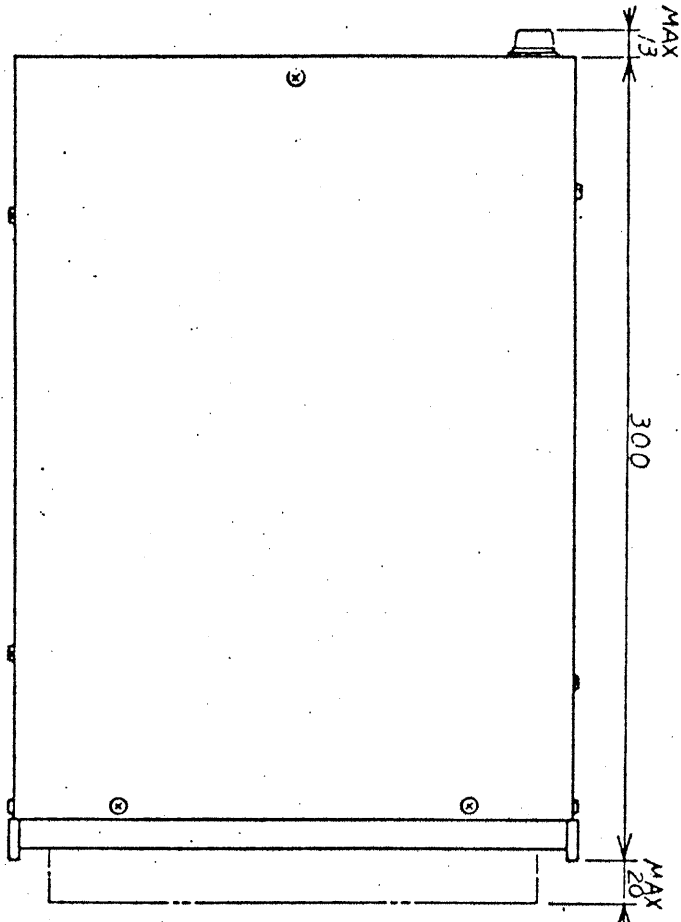
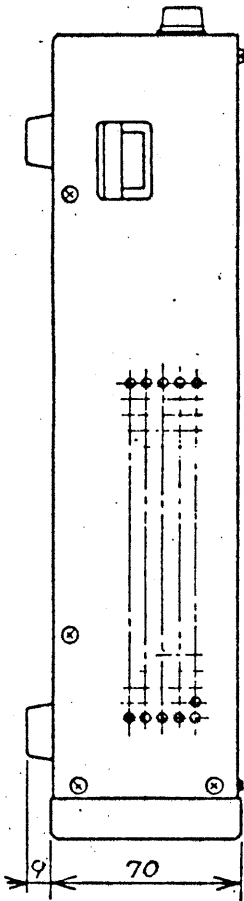
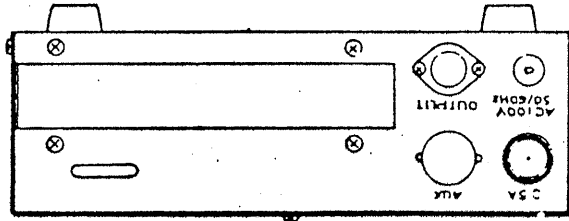
Note that the output voltage may be interrupted when setting of the digital switches is changed and the frequency data changes from the existing one to a new one. After this transiential period is over, the output voltage resumes with the new value.

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BLOCK DIAGRAM

Unit: mm



MECHANICAL OUTLINE DRAWING

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