INSTRUCTION MANUAL

DIGITAL SINE SYNTHESIZER

MODEL DP06200

KIKUSUI ELECTRONICS CORPORATION

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.

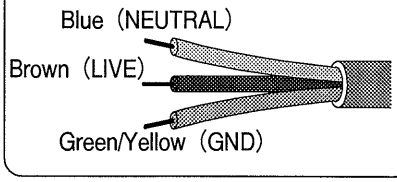
☐ AC power cable

The product is porvided 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.

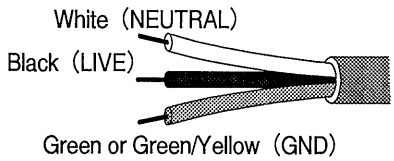
WARNING

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

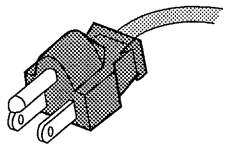
☐ Without a power plug



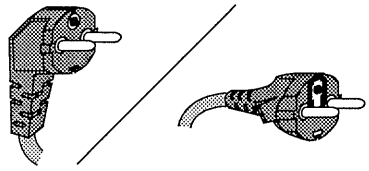
☐ Without a power plug



☐ 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 _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

TABLE OF CONTENTS

SECTION 1. GENERAL

Model DP06200 Digital Sine Synthesizer is one of Kikusui's DPO Series Digital Programming Options. It is used to control a Kikusui's PCC Series Frequency Converter through a GP-IB bus (IEEE-488-1975).

Outstanding features of the DP06200 are as follows: The output frequency covers a range of 45.0 ~ 499.9 Hz with 0.1-Hz resolution, with a stability of $\pm 1 \times 10^{-4}$. When it is used in conjunction with a PCC Series instrument, the output voltage of the PCC Series instrument is controllable for a range of 0 ~ 120 V or 0 ~ 240 V (selectable with the 100V/200V mode selector switch of the PCC Series instrument) with a resolution of 0.39% (8 bits). The control operation of the DP06200 is selectable between the remote mode and the local mode. When in the remote mode, the output frequency can be set with the digital switches (for 4 digits, resolution 0.1 Hz) on the front panel. It also is possible to set manually the output voltage with the 10-turn potentiometer on the front panel.

Note: Note that the DP06200 has been designed specifically as an optional instrument for Kikusui's PCC Series Frequency Converter (hereafter, referred to as PCC Series instrument) and it cannot be used in conjunction with other models of instruments. If it is used in conjunction with other model of instrument, full performance may not be attainable or damage may be caused.

When using the DPO-6200, refer also to the instruction manual of the PCC Series instrument.

SECTION 2. SPECIFICATIONS

Table 2-1

Model		DPO6200
Power requirements		100 V ±15%, 50/60 Hz single-phase AC
Input signal (*1)	Standards complied with	IEEE-488-1975
	Interface function	(*2) See Table 2-2.
	Codes used	ASCII codes
	Input connector	24 pins (Amphenol)
	Address setting	0 - 31
	Length of bus cables	Total length of bus cables = (Number of devices connected to bus) × 2 m (6.6 ft) ≦ 20 m (66 ft)
Output frequency	Variable range (*3)	45.0 - 499.9 Hz
	Setting resolution	0.1 Hz
	Stability	$\pm 1 \times 10^{-4}$ or better (including setting accuracy)
Output voltage	Variable range (*4)	0 - 2 V rms
	Setting resolution	0.39% ±4 mV rms
	Temperature coefficient	100 ppm/°C (typical)
	Frequency characteristics	±0.3% 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)

Insulation resistance (*5)		30 MΩ or over, with 500 V DC
Withstanding voltage (*5)		1000 V AC, 1 minute
Ambient temperature and humidity		0 to 40°C (32 to 104°F), 10 - 90% RH
Weight		Approx. 3.3 kg (7.3 lbs)
External dimensions		210 W × 70 H × 300 D mm (8.27 W × 2.76 H × 11.81 D in.) 215 W × 85 H × 380 D mm (*6) (8.46 W × 3.35 H × 14.96 D in.)
Acces-sories	Output cable	2-conductor shielded cable, with DIN plug, 1 meter long (3.3 ft long)
	GND cable	30-conductor cable, with crimping terminal, 1 meter long (3.3 ft long), 2 ea.
	Mounting brackets	1 set
	Instruction manual	1 copy

[Notes]

(*1): GP-IB control or manual control is selectable with the REMOTE/LOCAL selector switch. When in the local mode, the functions of (*1) are unavailable.

(*2): Interface functions

Table 2-2

Symbol	Interface function	With/without
SH	Source handshake	Without
AH	Acceptor handshake	With
T	Talker	Without
L	Listener	With
SR	Service request	Without
RL	Remote/Local	Without
PP	Parallel poll	Without
DC	Device clear	Without
DT	Device trigger	Without
C	Controller	Without

(*3): When in the local mode of operation, frequency can be set with the digital switches (4 digits) on the front panel. If a frequency not within the range of 45.0 - 499.9 Hz is set, the output is cut off either when in the remote or local mode of operation.

(*4): When in the local mode of operation, output voltage can be set with the 10-turn potentiometer on the front panel. Resolution of voltage setting depends on the potentiometer (0.02% theoretically).

(*5): Between terminals as follows: Input power - chassis, output - chassis, input signal - chassis, input power - input signal, input power - output, and input signal - output.

(*6): Maximum dimensions when the connectors are connected.

SECTION 3. OPERATION METHOD

3-1. General Precautions

(1) Ambient Temperature

- The ambient temperature specification of the Synthesizer is 0°C to 40°C. Use it within this temperature range.

  The ambient temperature specification of the PCC Series instrument is -10°C to 50°C. When it is used in conjunction with the Synthesizer, use both instruments within the temperature range of 0°C to 40°C.

(2) Installation Position

The Synthesizer is designed so that it can be fixed on top of the PCC Series instrument. It is most recommendable to use the Synthesizer being fixed on top of the PCC Series instrument.

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.

- Be sure to securely connect the PCC Series instrument to the Synthesizer and to ground the instruments using the cables supplied. This is 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.

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

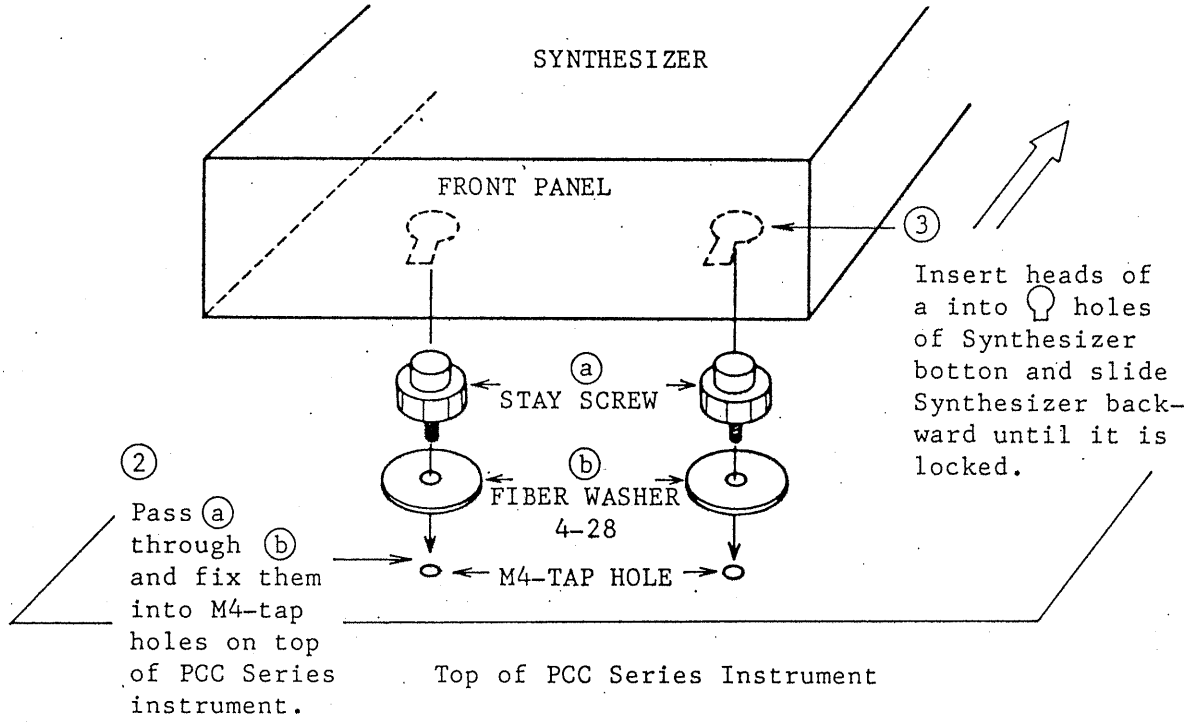
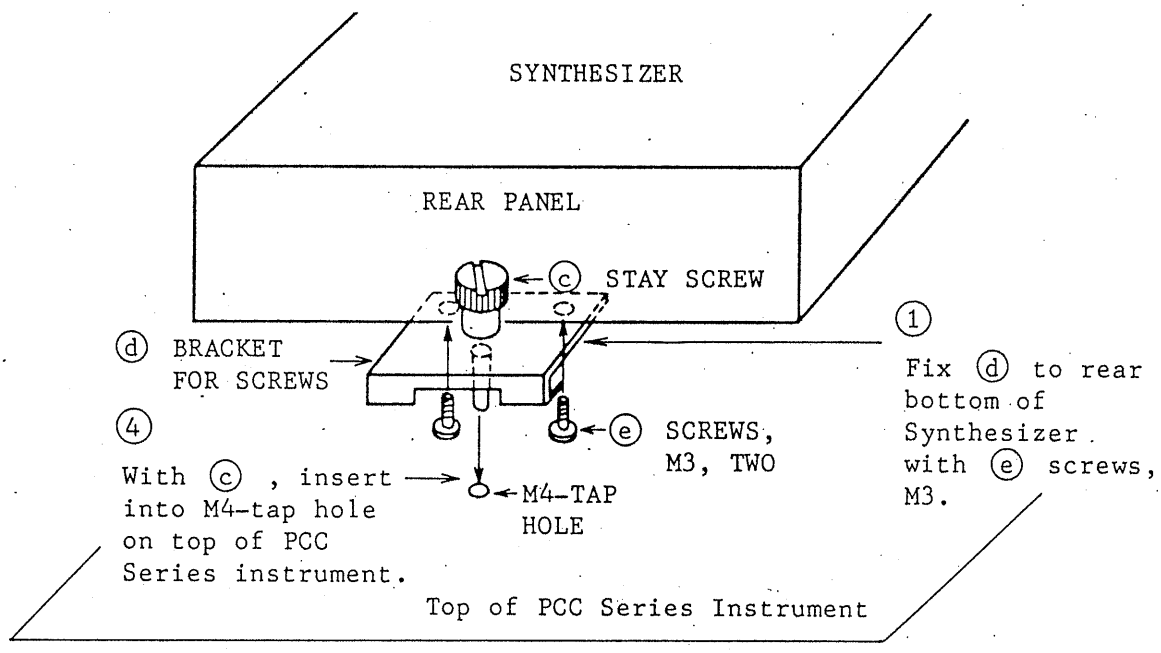
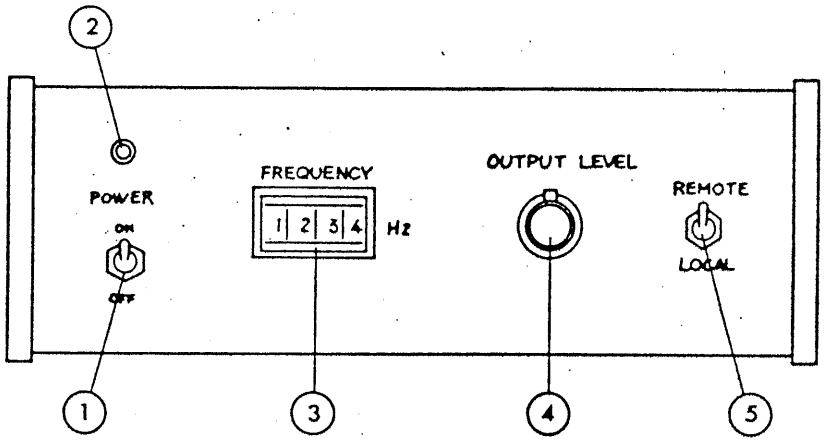


Figure 3-1

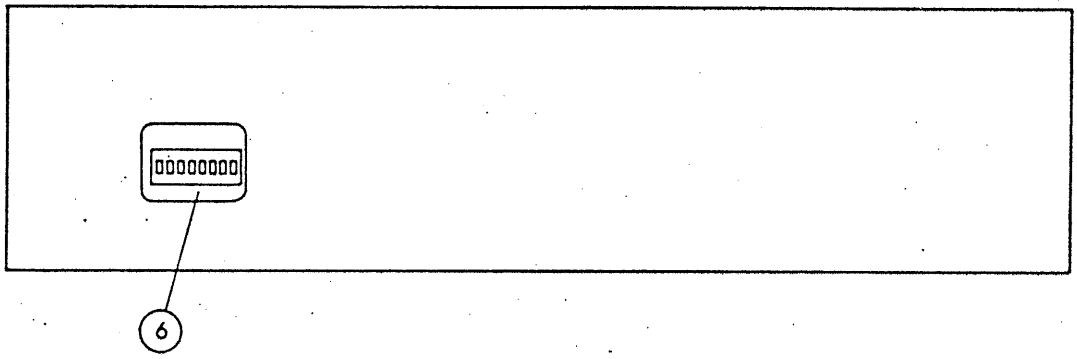


3-2. Description of Panel Items

(Front Panel)



(Left Panel)



(Rear Panel)

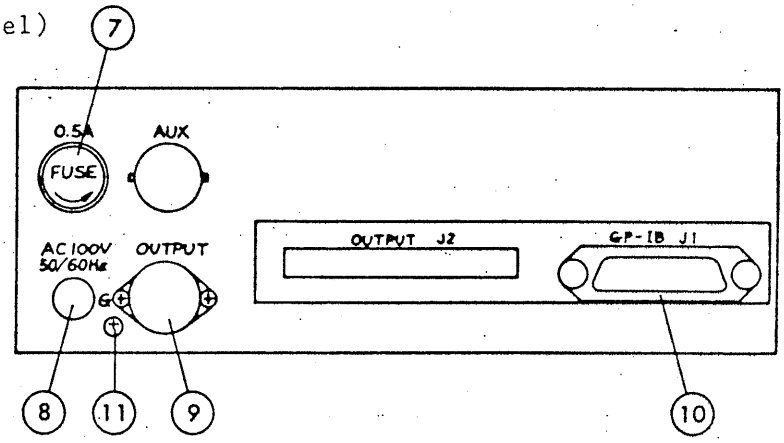


Figure 3-2

①	Power switch "POWER":	For ON/OFF-control of the main power of the instrument. As this switch is thrown to the upper position, the instrument power is turned on and power indicator lamp ② lights
②	Power indicator lamp	Indicates that the main power of the instrument is on.
③	Frequency setting switches "FREQUENCY":	Digital switches to set the output frequency when the REMOTE/LOCAL selector switch ⑤ is set in the LOCAL state. The output frequency range covers 45.0 - 4999.9 Hz, with 0.1-Hz resolution. The lightmost column is for 0.1 Hz. Therefore, to set output frequency for 45.0 - 99.9 Hz, set the switches at 045.0 - 099.9 Hz. Note: If the switches are set at a frequency not within the above range, that is if it is set at a frequency within a range of 000.0 - 044.9 Hz or 500.0 - 999.9 Hz, the protective circuit trips to cut out the output. If setting is changed to a frequency within the range of 45.0 - 499.9 Hz, the output is resumed automatically.
④	Output voltage setting knob "OUTPUT LEVEL":	To set the output voltage when the REMOTE/LOCAL selector switch ⑤ is set in the LOCAL state. This control is a 10-turn potentiometer. The output voltage increases as this control is turned clockwise.
⑤	Remote/local selector switch "REMOTE/LOCAL":	When this switch is thrown to the REMOTE position, the instrument is controlled with the signal fed through the GP-IB bus. When it is thrown to the LOCAL position, the output frequency and output voltage can be controlled with the switches and control on the front panel of the instrument.

⑥	Address setting switches	These 8-element DIP switches can be used to set the address of the instrument for 0 - 31. It also is possible to set for the LISTEN ONLY mode.
⑦	Fuse holder "FUSE 0.5A":	The fuse holder for the fuse (0.5 A) of the instrument input power. Be sure to use a fuse of the specified rating. If the fuse blow out soon or immediately after it has been replaced, the instrument is malfunctioning. Please contact your Kikusui agent.
⑧	Input power cable "AC100V 50/60Hz":	The AC input power of the instrument. The instrument operates on a power of 85 - 115 V, 50/60 Hz AC.
⑨	Output connector "OUTPUT":	The connector for the output signal. Connect this connector to the PCC Series instrument using the cable supplied.
⑩	GP-IB input connector "GP-IB J1":	This connector is for connection to the GP-IB bus cable which runs from a computer. The connector is an Amphenol 24-pin connector of IEEE-488-1975 Standards. To connect to a connector of IEC Standards, use an IEC → IEEE connection adaptor.
⑪	Frame ground terminal "GND":	This terminal is for grounding the Synthesizer and connecting it with the GND terminal of the PCC Series instrument. Use the GND cable supplied.

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3-3. Operation Method

1. Connection Method

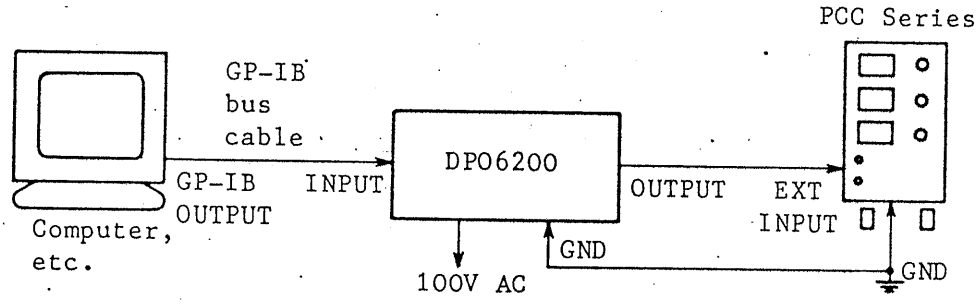


Figure 3-3

(1) Connection Between Synthesizer and Computer

- o Connect the GP-IB (IEEE-488-1975) connector of the computer to the GP-IB input connector (J1) of the Synthesizer using the GP-IB bus cable.

  Note: Never connect or disconnect the connectors when the power of the Synthesizer is on or when the GP-IB bus is in operation. Such will cause erroneous operation and may cause damage to the instruments.

  Be sure to fix securely the connector of the GP-IB bus cable to the connector of the Synthesizer using screws or in other appropriate method.

(2) Connection Between Synthesizer and PCC Series Instrument

- o Connect the OUTPUT connector of the Synthesizer to the EXT INPUT connector (external control signal input connector) of the PCC Series instrument using the cable supplied: Securely connect in the correct direction the DIN 6P plug of the cable to the OUTPUT connector of the Synthesizer. (The connectors will not mate unless they are inserted in the correct direction.) Securely connect the orange wire to the HOT side (red terminal) of the EXT INPUT terminal of the PCC Series instrument and the white wire to the GND side (white terminal).

o Securely connect the GND terminal (M4 screw) of the Synthesizer to the GND terminal of OUTPUT terminal block of the PCC Series instrument using the GND cable. Be sure to ground the GND terminal of the INPUT terminal block of the PCC series instrument. Do not neglect to ground these terminals as they are important from the viewpoints of safety against electric shock hazards and preventing erroneous operations of the instruments caused by external noise. Note that the resistance of the instruments against noise is badly degraded unless the GND terminals of the instruments are connected together.

[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. Operation Method

(1) Turning on the Powers

- Make sure that the POWER switch of the Synthesizer is in the OFF state. Connect the AC input power cable (which has a 2-pin plug on its end) to an AC line receptacle (85 - 115 V, 50/60 Hz AC). Also, connect the AC input power cable of the PCC Series instrument to an AC line receptacle of the rated voltage. For the power cable and other details, refer to the instruction manual of the PCC Series instrument.

- Regarding the order of turning on the powers, turn on the power of the Synthesizer first and that of the PCC Series instrument next, or turn on the powers of both instruments at the same time. Regarding the order of turning off the powers, turn off the power of the PCC Series instrument first. If the above order is not observed, overshoots may be produced in the output voltage of the PCC series instrument.

(2) REMOTE Mode of Operation

- Throw the REMOTE/LOCAL selector switch of the Syntheizer to the REMOTE position.

  Note: Be sure to keep the INT/EXT selector switch of the PCC Series instrument in the EXT state.

(a) Address Setting Method

o An address for the Synthesizer on the GP-IB bus can be set with the address setting switches (8-element DIP switches). Elements 1 - 5 are for setting an address for the Synthesizer. An address number can be set in the binary presentation for 0 - 31. In the case of the example shown in Figure 3-4, the address number of the Synthesizer is binary 10101, or decimal 21.

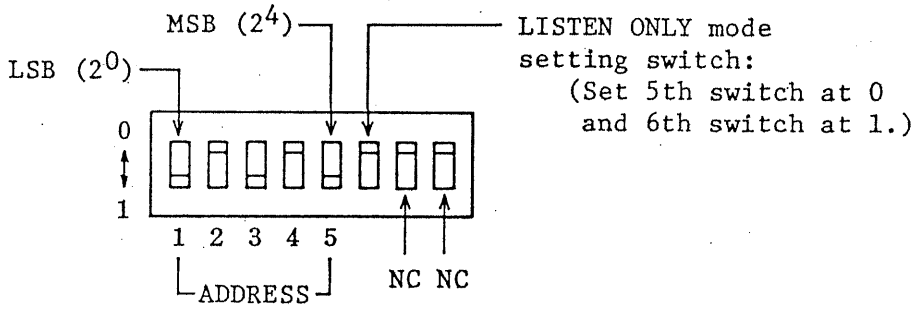


Figure 3-4

o When the 6th switch is 0, the address of the Synthesizer is effective as above. When the 6th switch is 1 and the 5th switch is 0, the Synthesizer operates in the LISTEN ONLY mode and it receives data from the GP-IB bus regardless of its address setting as above. The switch can be used for system operation check.

o The 7th and 8th switches are not used.

(b) Basic LISTENER Format

The Synthesizer has a LISTENER function. For this function, send data from the computer in a fixed format as follows.

o To set the output voltage:

"K□□□V" ..... Write K and V in upper-case letters.
Data

For the data, a 3-digit number within a range of 000 - 255 is valid. When 255 is specified, the output voltage becomes the maximum.

Note: Note however that, even when data is set at 255, the output voltage does not conform with the maximum rated voltage of the PCC Series instrument. To obtain the maximum rated voltage when data is set at 255, adjustment is necessary. For this adjustment, refer to Paragraph (c) on page 14.

On the other hand, if a 3-digit number larger than 255 is specified, the output is cut off. If a number smaller than 3 digits is specified, the preceding data is maintained. Non-numerical characters (except K) are ignored.

Examples:

"K225V" or "K999V": Output is cut off.

"K10V" or "K1000V": Preceding data is maintained.

"K1A2B3CV": Output is for data 123.

o To set the output frequency

"K□□□□H" .... Write K and H in upper-case letters.
 └Data┘

For the data, a number within a range of 0450 - 4999 is valid. The 4th column is for the 0.1-Hz order. That is, the minimum frequency is 45.0 Hz when the data is 0450 and the maximum frequency is 499.9 Hz when the data is 4999.

Note: If a number not within the range of 0450 - 4999 is specified for the data, the output is cut off. If a number within the range of 0450 - 4999 is specified again, the output voltage automatically becomes the value corresponding to the specified number.

If a number other than 4 digits is specified, the preceding data is maintained. Non-numerical characters (except K) are ignored.

Examples:

"K0449H" or "K5000H": Output is cut off.

"K100H" or "K10000H": Preceding data is maintained.

"K1A2F3Z4H": Output is for data 123.4 Hz.

o Sending of data

The delimiter must be (CR) or (CR)/(LF). Be sure to send delimiter (CR) or (CR)/(LF) from the computer.

(c) Notes for Setting Programs

o Adjustment of the maximum output voltage of the PCC Series instrument

The relationship between the input signal voltage applied to the EXT INPUT terminal and the output voltage of the PCC Series instrument when the VOLT ADJ knob is set in the clockwise extreme position is such that the output voltage is approximately 60 times of the input voltage (when no load). The maximum deviation including the frequency response characteristics of the PCC Series instrument is approximately ±1.5%. Therefore, when Synthesizer is used in conjunction with the PCC Series instrument and the data is set at 255 as above, the output voltage of the PCC Series instrument does not become the maximum rated output voltage (120 V or 240 V). The maximum output voltage of the Synthesizer is adjusted so that a voltage higher than the maximum rated voltage of the PCC Series instrument is obtained. Therefore, make adjustment so that the maximum rated voltage of the PCC Series instrument is obtained when data is set at 255. For this adjustment, proceed as follows.

① Disconnect the load from the output circuit of the PCC Series instrument. Connect to its output terminal (the OUTPUT terminal on the rear panel or the outlet on the front panel) an AC voltmeter (which provides a sufficient accuracy for the required output voltage setting accuracy).

② Apply data "255" to the Synthesizer from the GP-IB bus (with the frequency set at the required value). Gradually turn clockwise the VOLT ADJ knob on the front panel of the PCC Series instrument so that the output voltage of the PCC Series instrument becomes the maximum rated voltage (120 V or 240 V). If the required maximum output voltage is not higher than 120 V, set the 100V/200V selector switch of the PCC Series instrument in the 100V state; if it is not higher than 240 V, set the switch in the 200V state.

Note: Note that the value set as above will vary if frequency setting is varied. When the Synthesizer is used in conjunction with a PCC Series instrument and the frequency is varied for a range of 45.0 - 499.9 Hz, the frequency characteristics are such that the maximum variation of the output voltage is approximately ±1% with respect to the output voltage when the frequency is 165 Hz.

The accuracy of the instrument with respect to the set value is approximately 0.2% (1/2 LBS) of the maximum output voltage. Take this setting error into consideration when the output voltage is within a range of 000 - 245.

Of the PCC Series instrument, if the output voltage is lower than 20 V (when in the 100V mode) or 40 V (when in the 200V mode), the output waveform distortion factor, regulation, and setting accuracy may be degraded. Do not operate the instrument in such low ranges whenever avoidable.

③ When applying a load to the PCC Series instrument, adjust the output voltage regulation for change from no load to load application by means of the REGULATION ADJ control on the front panel of the PCC Series instrument. For details of the adjusting procedure and other related items, see Sub-section 3-3 of the instruction manual for the PCC Series instrument.

Note: Regulation of the PCC Series instrument may vary depending on output frequency, load conditions (output current, load power factor, etc.), and output voltage. Keep this in mind when varying these items.

o Voltage rise-up characteristics of PCC Series instrument

The PCC Series instrument employs a linear amplifier system. It once converts its AC input power into a DC power and power-amplifies the reference sine wave signal (or the output voltage signal of the Synthesizer as the reference signal when in the EXT mode). If the DC voltage is set constant when the output voltage is low, the power loss of the power amplifier is large and the efficiency becomes poor. As a provision against this, the DC power section of the PCC Series instrument employs a phase control circuit so that the DC voltage is controlled with respect to the output voltage. For details, see Sub-sections 4-1 through 4-3 of the instruction manual for the PCC Series Instrument.

The rise-up time of the DC voltage of the phase control circuit with the rated load is approximately 8 msec/V (100V mode) in output equivalent value. Therefore, for the output voltage to change from 0 to 120 V, it takes about 1 sec. (When no load, the rise-up time is approximately 4 msec/V.) During this rise-up time, the output voltage waveform is such that its crests are cut off. (See Figure 3-5.) When setting a program, therefore, provide a wait time in the program for the rise-up time.

On the other hand, the fall-down time of the output voltage of the PCC Series instrument is fast (1 msec or faster) and causes almost no problems in practice.

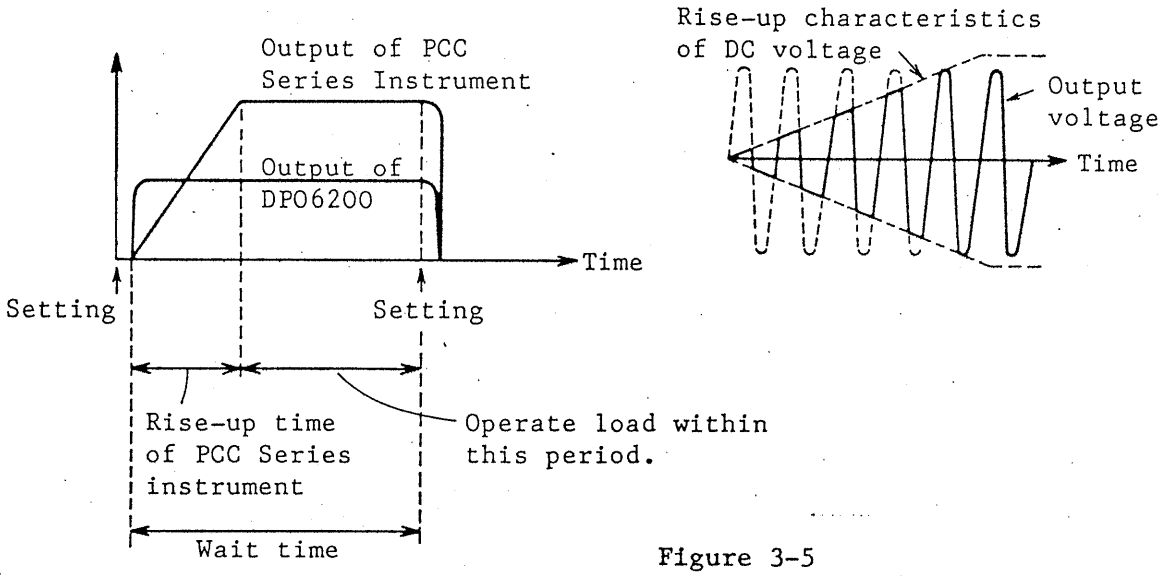


Figure 3-5

(3) LOCAL Mode of Operation

o Throw the REMOTE/LOCAL selector switch to the LOCAL position.

a) Setting of Output Frequency

The output frequency can be set for a range of 45.0 - 499.9 Hz in 0.1-Hz resolution with the FREQUENCY switches (4-digit digital switches) on the front panel of the Synthesizer. The rightmost column is for the 0.1-Hz order. To set for 45.0 - 99.9 Hz, therefore, set as 0.45.0 - 099.9.

Note: If a number other than for 45.0 - 499.9 Hz, that is a number within a range of 000.0 - 044.9 or 500.0 - 999.9 is set, the output is cut off as is the case when in the REMOTE mode of operation. As a number for 45.0 - 499.9 Hz is set, the output automatically becomes the set frequency.

Note that the output may be paused for the data transition period when digital switch setting is changed, the output may be cut off once. The output will resume when setting is over.

b) Setting of Output Frequency

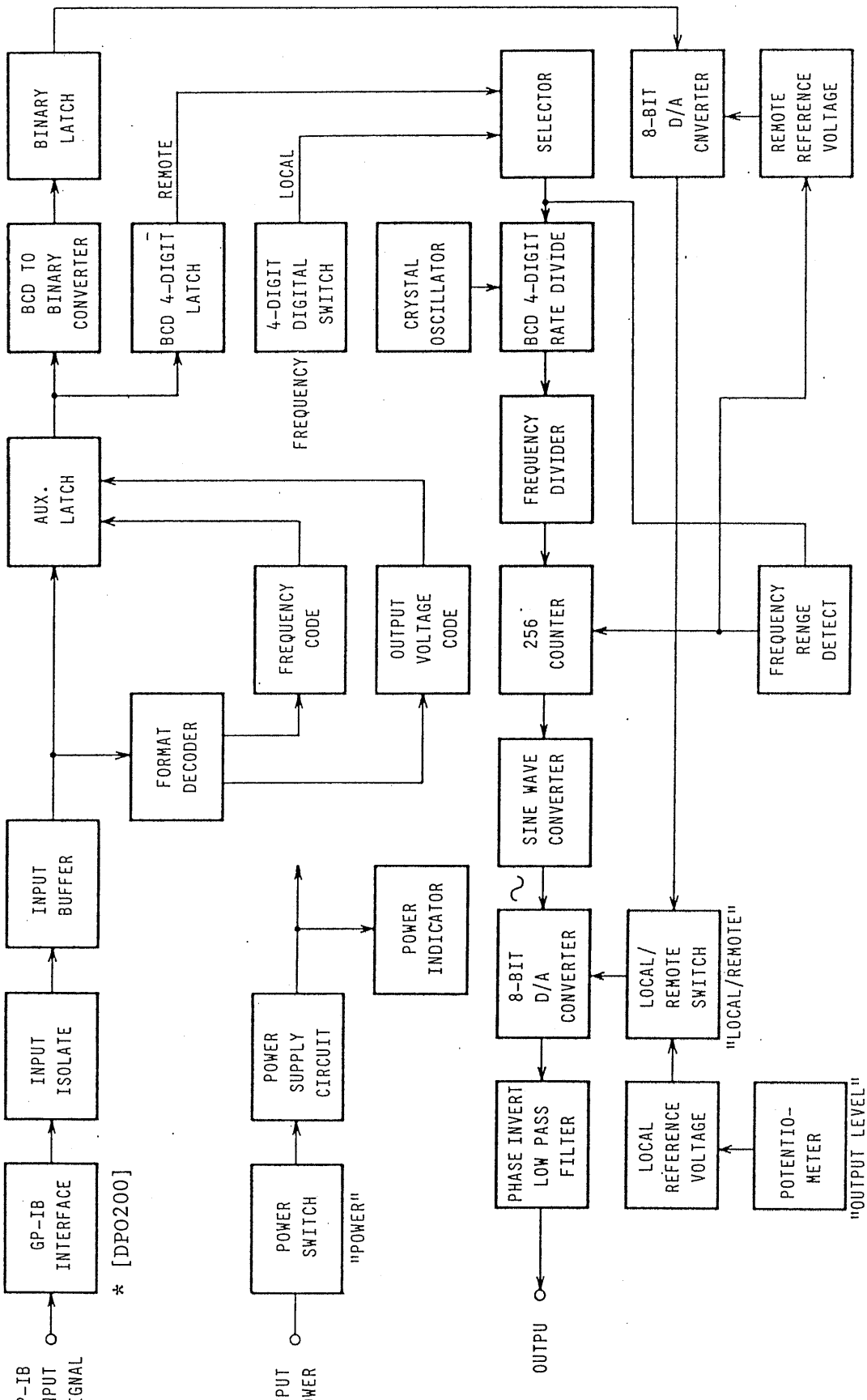
The output voltage is adjustable with the OUTPUT LEVEL control (10-turn potentiometer) on the front panel of the Synthesizer. The output increases as the control is turned clockwise. Thus, the output voltage of the PCC Series instrument can be varied from approximately 0 V to the rated maximum voltage.

Note: If the VOLT ADJ control of the PCC Series instrument is set in the clockwise extreme position, the output voltage may be higher than the rated maximum voltage. Adjust the VOLT ADJ control of the PCC Series instrument so that the rated maximum output voltage is obtained when the OUTPUT LEVEL control of the Synthesizer is set to the clockwise extreme position.

Note also when changing frequency to the fact that the output has frequency characteristics as is the case of the REMOTE mode of operation.

At a range lower than 20 V (when in the 100V mode) or 40 V (when in the 200V mode, pay attention to that the output waveform distortion factor and regulation may be degraded.

SECTION 4. BLOCK DIAGRAM



*: The DPO6200 has a DPO200 unit built-in as a GP-IB input interface unit.

Figure 4-1

SECTION 5. EXAMPLES OF PROGRAMS

The examples of programs introduced in this section are for the case that PC8001 + PC8011 are used. Such items as initial settings of IEEE-related ones are omitted.

1. Program for sequential change of output voltage and frequency data:

```
10  '** Operating Program 1 **
20  A$="0450"                    ←45.0 Hz   } Output frequency data
30  B$="4999"                    ←499.9 Hz  }
40  C$="000"                     ←0 V       }
50  D$="127"                     ←60 V      } Output voltage data
60  E$="255"                     ←120 V     }
70  PRINT @7; "K"+C$+"V"         ←Voltage output statement   } When GP-IB
80  PRINT @7; "K"+A$+"H"         ←Frequency output statement } address is
                                                              } set at No.7
90  GOSUB 220
100 PRINT @7; "K"+D$+"V"
110 GOSUB 220
120 PRINT @7; "K"+E$+"V"
130 GOSUB 220
140 PRINT @7; "K"+C$+"V"
150 PRINT @7; "K"+B$+"H"
160 GOSUB 220
170 PRINT @7; "K"+D$+"V"
180 GOSUB 220
190 PRINT @7; "K"+E$+"V"
200 GOSUB 220
210 GOTO 20
220 FOR A=0 TO 400: NEXTA        ←Wait time
230 RETURN
240 END
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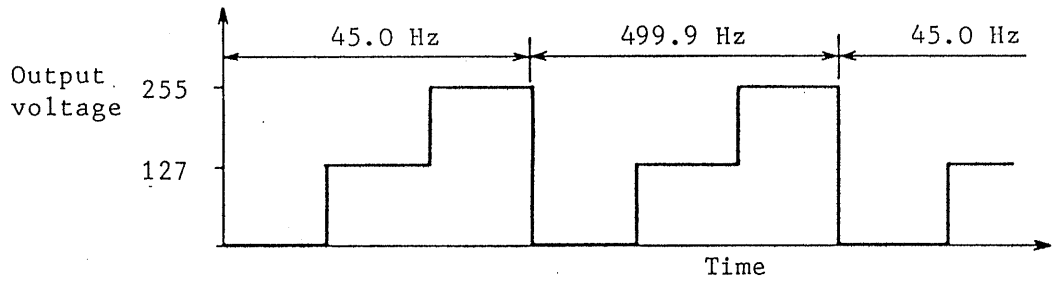


Figure 5-1

Notes: o Be sure to provide a wait time for the rise-up time of the output voltage of the PCC Series instrument. (See page 16.)

o Note that, if the statements of 70 and 80 are interchanged in the above program, the output voltage corresponding to data "E" (255) at the frequency corresponding to data "A" (0450) will be delivered for the period the program advances from statement 70 to statement 80.

2. Program for directly entering the required output voltage and frequency, and delivering the corresponding data:

```
10   '** Operating Program 2-1 **
20   INPUT "FREQUENCY"; F                  ←Output frequency data
30   INPUT "VOLTAGE"; E                    ←Output voltage data
40   PRINT @7; "K"+F$+"H"                  ←Frequency output statement
50   A=INT(E*255/120+.5)                   ←Output voltage calculation
                                             formula*
60   IF A<=99 THEN A$="K0"+STR$(A)+"V"     ┐
70   IF A<=9 THEN A$="K00"+STR$(A)+"V"     ├ Statements to require
80   IF A>=100 THEN A$="K"+STR$(A)+"V"     ┘ entry of 3-digit data
90   PRINT @7; A$                          ←Voltage output statement
110  GOTO 20
120  END
```

* Calculation formula

Assuming the maximum output voltage to be 120 V (when data is 255):

o Output voltage per step: 120/255 (≒ 0.471 V)

o Input data: $A = INT\ (E \times \frac{255}{120} + 0.5)$

E: Output voltage data

INT(X) means an integer (disregarding fractions) not larger than X. Therefore, INT(X+0.5) means an integer obtained by counting fractions of 0.5 and over as a whole number and disregarding the rest.

Note: In this case, the output setting accuracy is affected by an additional error of 0.2% (1/2 of LSB) caused by the rounding calculation.

The same operation as above can be accomplished also with the following program:

```
10   **  Operating Program 2-2  **
20   INPUT "FREQUENCY"; F
30   INPUT "VOLTAGE"; E
40   PRINT @7; "K"+F$+"H"
50   A=INT(E*255/120+.5)+1000
60   B$=STR$(A)
70   C$=RIGHT$(B$, 3)
80   PRINT @7; "K"+C$+"V"
90   GOTO 20
100  END
```

← Three digits following B$ to the right are taken. When E = 5 (V) is entered, for example, A = 1011 and data C = 011.

3. Program for increasing the output voltage from 0 V to the maximum output voltage (120 V) in 1-V steps, and repeating the cycle:

```
10   '**  Operating Program 3      **
20   '** 165.0 Hz 0-120V step 1 V **
30   PRINT @7; "K1650H"
40   FOR E=0 TO 120 STEP 1
50   A=INT (E*255/120+.5)
60   IF A<=99 THEN A$="K0"+STR$(A)+"V"
70   IF A<=9 THEN A$="K00"+STR$(A)+"V"
80   IF A>=100 THEN A$="K"+STR$(A)+"V"
90   PRINT @7; A$
100  NEXT E
110  GOTO 30
120  END
```

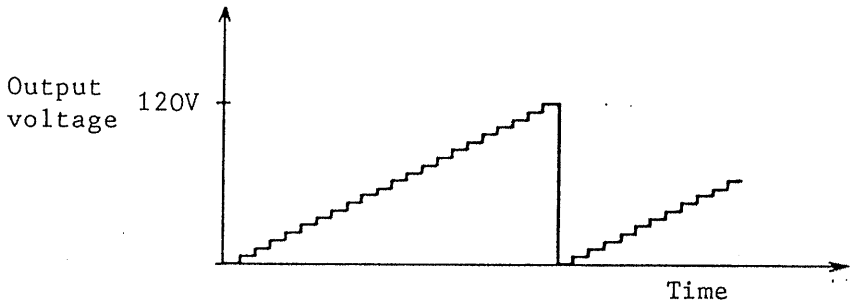


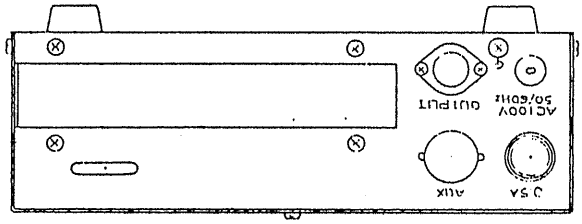
Figure 5-2

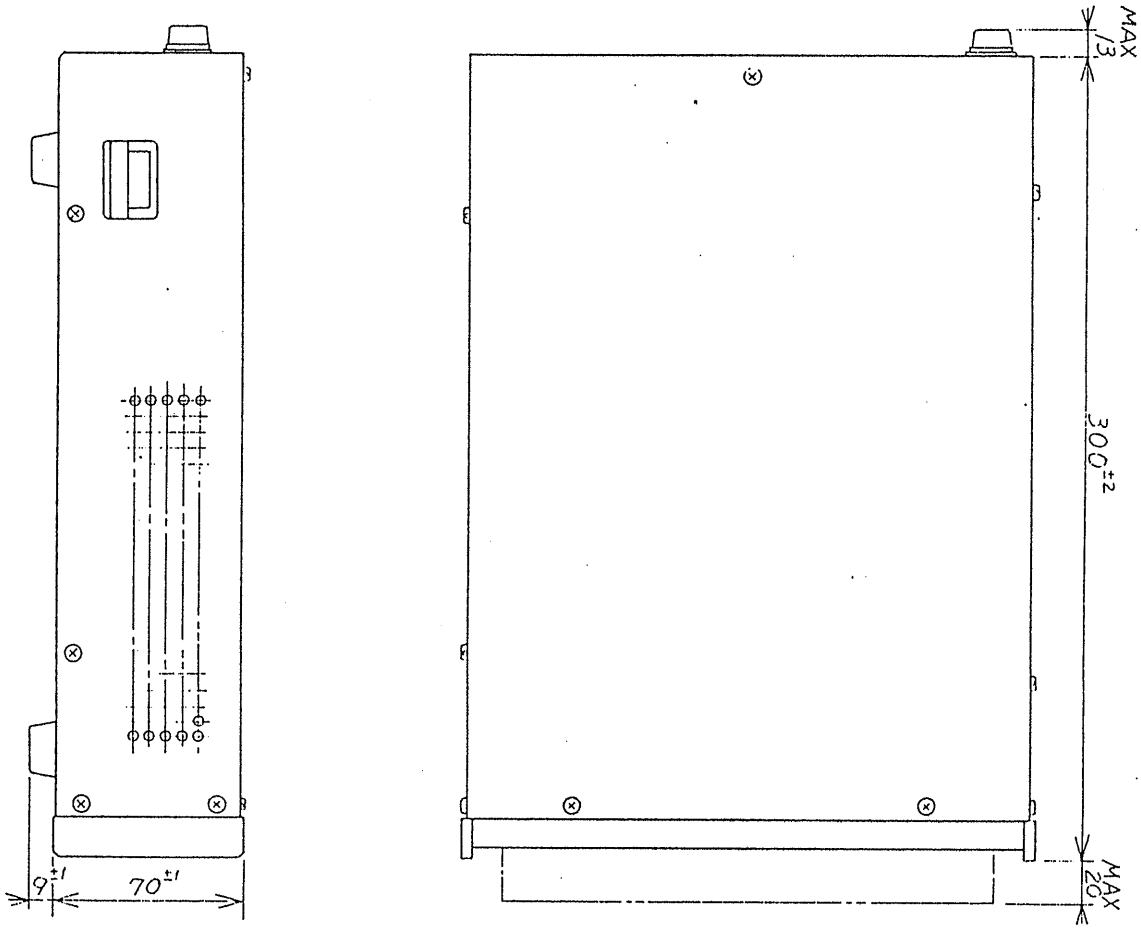
Note: To control the output voltage step-up time, insert between statements 90 and 100 a statement for a wait time such as [FOR J=0 TO : NEXT J].

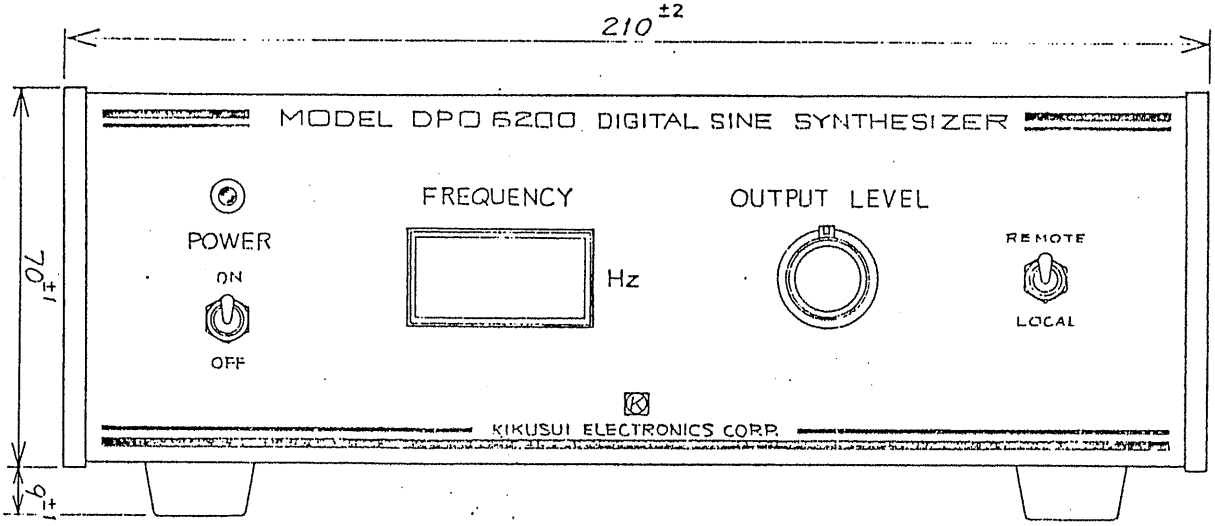
4. Program for increasing the output frequency from 45.0 to 499.9 Hz in 1-Hz steps, and repeating the cycle (with output voltage data 255):

```
10   '*  Operating Program 4          *
20  ''* V=255 45.0-499.9 Hz step 1 Hz *
30   PRINT @7; "K255V"
40   FOR F=450 TO 4999 STEP 10
50   IF F<=999 THEN F$="K0"+STR$(F)+"H"
60   IF F>=1000 THEN F$="K"+STR$(F)+"H"
70   PRINT @7; F$
80   NEXT F
90   GOTO 30
100  END
```

Unit: mm







MECHANICAL OUTLINE DRAWING