AM STEREO SIGNAL GENERATOR

KSG4000

OPERATION MANUAL

KIKUSUI

Part No. Z1-477-220, IB002072

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.

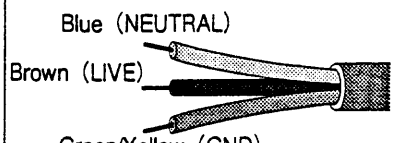
☐ AC power cable

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.

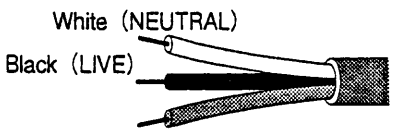
WARNING

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

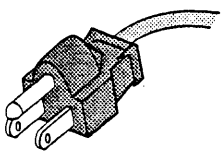
☐ Without a power plug



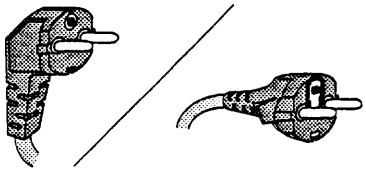
☐ Without a power plug



☐ 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

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1. INTRODUCTION

1.1 General Description

The KSG4000 is an AM signal generator that is disigned to meet a Motorola AM stereo system and employs a phase lock loop (PLL) including a reference quartz for high stablity of frequency.
GP-IB interface is employed as a standard configuration.

The output signal range, 200kHz to 2MHz, covers the AM broadcast frequency bandwidth, and the output level range is −20dBμ to 132dBμ (0.1μV to 4Vrms) open circuit (dBm setting posible). AM distortion, S/N ratio, stereo separation characteristics, etc. are all superb.

Also, extensive external control function provide still greater ease of opertion. The standard-equipped GP-IB interface in particular facilitayes expansion into system instrumentation.

Further more, variation of frequnency, output level and modulation can be freely combined, and up to 100 point (continuously or in blocks) may be stored and recalled. Up to 4 output level points may be independently stored and recalled.

Applications include resarch and development of AM stereo receivers and the like, as well as adjustments and testing on the assembly line, etc.

1.2 Features

(1) The carrier frequency can be specified with a 6-digit number, and the value of a desired digit (designated by cursor) can be changed continuously by a rotary knob. Also, the KSG4000 has the ΔFREQ (frequency difference) display function and the +/− function to check selectivity.

(2) The output level can be selected from a wide range of −20dBμ to 132dBμ (open-circuit), can be set to 3-digits in 1dB increments, and is also independently equipped with a 4 point memory function.

(3) The carrier frequency, output level can be incremented/decremented by the unit of a specified value.

(4) A preset key is attached for modulation, permitting one-touch setting of either AM 30% or 95%.

(5) The KSG4000 gives small modulation distortion, high S/N ratio, and good stereo characteristic.

(6) All the information displayed on panel can be memorized. It can be used separated into 10 blocks with 10 points each , or 100 continuous points and 4 output level points may be stored and recalled.

(8) Input data can be corrected immediately by the use of back space (⇦) key.

(7) The KSG4000 can be operated easily because all the operations are controlled by a microprocessor and specified values are displayed in digital mode.

(9) Data can be copied from the memory of one KSG4000 to that of another KSG4000 by the pressing of DUMP key.

(10) All panel operation are remote-controllable, including memory store/recall, frequncy, output level, percentage modulation setting, rotary knob, etc.

(11) Frequncy, output level, percentage modulation, memory, etc. GP-IB control is standard-equipped.

2. SPECIFICATIONS

○ Method	:	C-QUAM (Motorola) method
○ Frequency (RF)		
Range	:	200kHz to 2MHz
Resolution	:	10Hz
Display	:	6-digit readout, △FREQ display, and ±frequency inversion function
Accuracy	:	±50Hz
○ Output		
Range	:	dBμ −20dBμ to 132dBμ (0dB = 1μV) (0.1μV to 4Vrms) 50Ω dBm −133dBm to 19dBm
Unit	:	Two types of units, EMF dBμ for open-circuit at 0dB=1μV and dBm for 50Ω output imedance.
Resolution	:	1dB
Display	:	3-digit readout that can be read directly in each one of the two unit types
Memory	:	Four mutually independent point (A/B/C/D), with STORE/RECALL key
Standard level accuracy	:	±1dB (Output = 126dBμ)
Attenuator accuracy	:	±1dB (Output ≧ 20dB) ±1.5dB (Output ≧ −10dB) ±2dB (Output < −10dB)

Output impedance : 50Ω BNC type connector

VSWR : ≦ 1.2

Spurious signals : (Fundamental wave = 0dBc)

Harmonics ≦ −40dBc
non-harmonics ≦ −50dBc

Residual modulation : Demodulation band width = 50Hz to 10kHz
(S/N) RF = 200kHz to 1.9MHz

AM component : Ratio to MAIN 50% AM
≧ 65dB (≦ 0.03%)
PM component : Ratio to SUB 50% AM
≧ 46dB (≦ 0.25%)

○ Modulation

Modulation mode according to input signal

Expression	Input signal	Modulation mode
EXT L, R	External L, R signal	Stereo
Signal tone	Internal test tone	Stereo
	External test tone	MAIN,L,R,SUB
Pilot	Internal pilot signal	Stereo unmodulated

Internal modulation : 400Hz and 1kHz; ±3%
frequency

External modulation

1) Input : AF/L and R

2) Frequency : Modulation frequency 1kHz, modulation factor 50%
characteristics ① ±0.5dB 50Hz to 10kHz
② ±1dB 10kHz to 15kHz

3) External modulation: 10kΩ approx. (unbalance)
input impedance

4) Input voltage requirement for external modulation : 3Vp-p approx.

Note: For the above input voltage, an error of ±2% is allowed by HI-LO monitor.

Modulation factor

① L, R modulation (AM, PM modulation)

Range : 0 to 100%

Display : 2-digit readout

Resolution : 1%

Accuracy : ≦ (indicated value ±5)%

Distortion : At demodulation range: 50Hz to 10kHz
modulation frequency 1kHz
Modulation factor 50%, RF 200kHz to 1.9MHz
≦ 1%

② MAIN modulation (AM modulation)

Range : 0 to 100% (indicator goes up to 125%)

Display : 3-digit readout

Resolution : 1%

Accuracy : ≦ (indicated value ±5)% (At 0 to 99%)

Distortion : At demodulation range: 50Hz to 10kHz
modulation frequency 1kHz
Modulation factor 50%, RF 200kHz to 1.9MHz
≦ 0.2%

③ SUB modulation (PM modulation)

Range	:	0 to 100% (100% = ±45°)
Display	:	3-digit readout
Resolution	:	1%
Accuracy	:	≦ (indicated value ±5)% (At 0 to 99%)
Distortion	:	At demodulation range: 50Hz to 10kHz modulation frequency 1kHz Modulation factor 50%, RF 200kHz to 1.9MHz ≦ 1%
Separation	:	≧ 36dB 400Hz to 4kHz ≧ 26dB 100Hz to 7.5kHz
Crosstalk	:	At modulation frequency 1kHz, modulation factor 50% ≦ −40dB MAIN → SUB ≦ −46dB SUB → MAIN
Pilot		
Frequency	:	25Hz±1%
Modulation factor	:	0 to 10%
Display	:	3-digit readout
Resolution	:	0.1%
Accuracy	:	≦ (indicated value ±5)%
Negative peak clipper	:	ON/OFF switchable 95%±5% semi-fixed adjustable
○ Setting functions	:	1) The numeric keys and rotary knob (with cursor desgination) for specifying carrier frequency, output level, modulation mode, and memory

2) Step keys for specifying carrier frequency and output level

3) Preset keys for specifying 30% and 95% (for AM)

- Memory function : 1) 100 point for carrier frequency, output level, modulation level, modulation mode, etc.

  2) The memory can be used in blocks of 10 points or as a continuous space of 100 points

  3) Output level 4-point independent

- DUMP function : The contents of the 100-point memory can be transferred to the memory of the same model signal generator by DUMP key.

- Remote control : The carrier frequency, output level, and modulation mode can be stored/recalled, the carrier frequency and output level can be incremented/decremented by steps or continuously by rotary knob, modulation can be turned ON/OFF, etc.

- GP-IB Interface : SH0, AH1, T0, L1, SR0, RL1, PP0, DC1, DT0, C0

- Leakage Field Strength : The measurement of 0dB (1μV) is not affected.

- Backup battery is provided.

- Power requirements

  Line voltage : AC 100V, 115V, 215V, 230V; ±10% allowance (selectable by voltage selector plug on rear panel)

Line frequency : 50Hz/60Hz

Power dissipation : Approx. 50VA

○ Mechanical specifications

Dimensions of main frame : 430 (W) × 99 (H) × 300 (D) mm
(16.93 (W) × 3.90 (H) × 11.81 (D) in.)

Maximum dimensions : 445 (W) × 119 (H) × 355 (D) mm
(17.52 (W) × 4.69 (H) × 13.98 (D) in.)

Weight : Approx. 7.5kg (16.5 lbs)

○ Environmental Conditions (temperature and humidity)

Range to satisfy specifications : 5 to 35°C (41 to 95°F), 85% or less

Allowable range for operation : 0 to 40°C (32 to 104°F), 90% RH or less

○ Accessories

Output cable (SA550)	1
Power cable	1
Fuse 0.1A	1
Fuse 0.5A	1
Operation manual	1

○ Parallal Interface : Factory-installed option
(N.B. cannot be used together with GP-IB interface)

3. PREPARATION FOR USE

3.1 Unpacking and Inspection

Before being shipped from the factory, the KSG4000 goes through thorough mechanical and electrical examinations and inspections, and its correct operation is confirmed and guaranteed.

On receiving the instrument, inspect it for any damage that may have been caused during transportation. Should a damage be found, notify the Sales Office immediately.

3.2 Line Voltage and Fuse Selection

Select a voltage range from the table below by the voltage selection pulg on the rear panel of KSG4000, and the instrument can be used in the selected voltage range.

Before connecting the power supply cord to the instrument, verify that the voltage selection is matched to the power source. When the voltage range is changed, change the fuse also according to the table below.

Application of a voltage beyond the selected range will cause in complete operation or failure.

Setting Position	Center Voltage	Line Voltage Range	Fuse
A	100V	90 - 110V	1.0A
B	115V	104 - 126V	
C	215V	194 - 236V	0.5A
D	230V	207 - 253V	

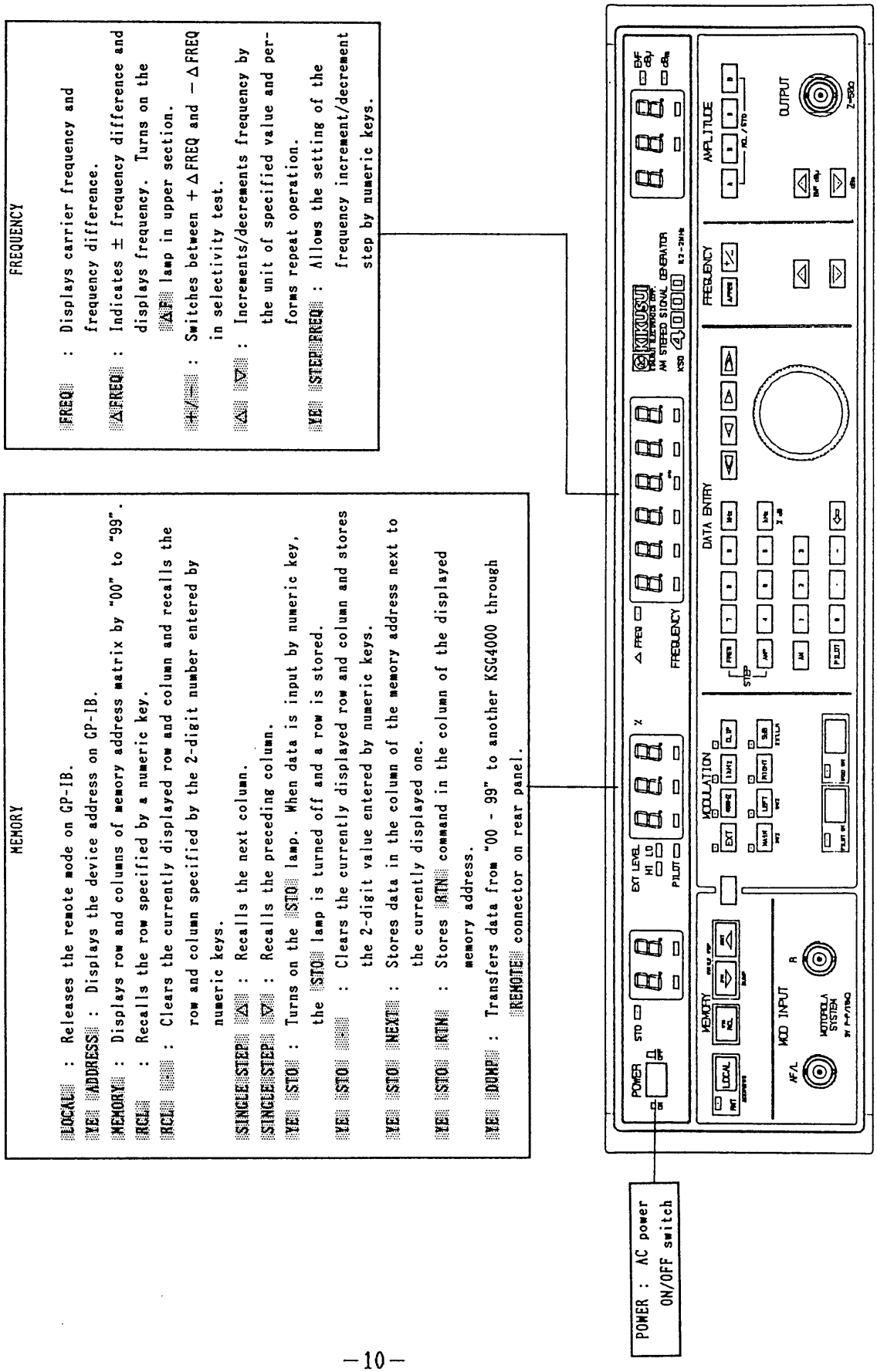
3.3 Surrounding Temperature/Humidity, Warm-up Time, and Installation Place

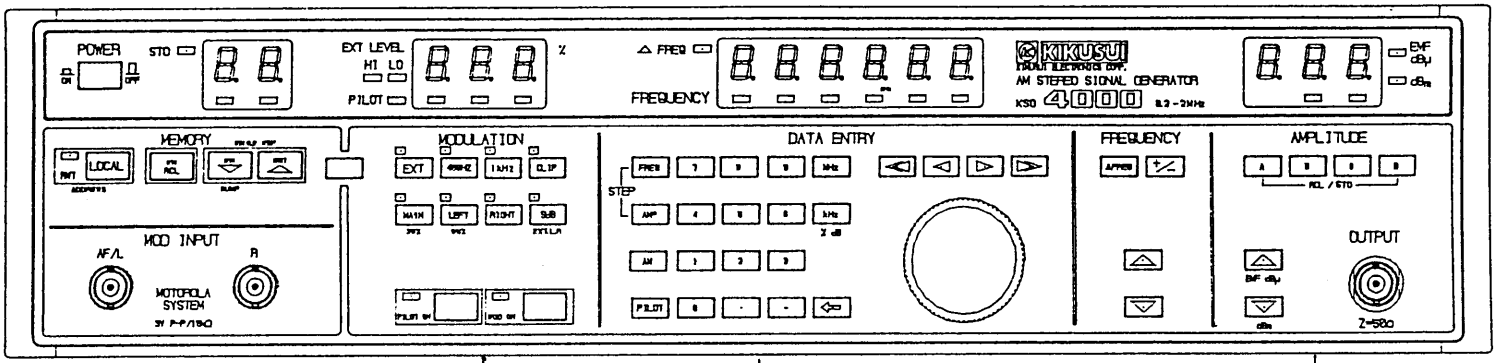
The KSG4000 operates correctly in temperatures from 0 to 40°C (32 to 104°F). If the instrument is used or placed under high temperature and humidity for a long time, failures will occur and the life of the instrument will be shortened.

The instrument requires the warm-up time of 30 minutes. Do not use the instrument near a strong magnetic field or electromagnetic waves.

4. OPERATION

4.1 Front Panel Features





MODULATION

MODULATION : Displays AM/PILOT modulation rate by three digits.

MOD INPUT AF/L : External modulation input connector for stereo single signal.

R : External modulation input connector for right signal of stereo modulation.

EXT LEVEL HI LO : Indicates external modulation input level range. The range is normal when HI LO is off.

EXT 400Hz,1kHz : Switches between external and internal modulation for AM.

CLIP : Restricts the negative peak modulation factor for AM.

MAIN,LEFT,RIGHT,SUB : selects signal mode for internal and external modulation.

MODULATION ON : Turns ON/OFF modulation.

PILOT ON : Turns ON/OFF the pilot signal.

YE 30%, 95% : Presets AM depth at 30% or 95%. Pilot modulation factor fecomes 4%.

YE EXT L/R : Set to the external input connector.

DATA ENTRY

DATA ENTRY : Keys to input numeric values directly and move cursor and rotary knob to modify displayed value.

FREQ : Allows the setting of frequency by numeric keys.

AMP : Allows the setting of output level by numeric keys.

AM : Allows the setting of AM depth by numeric keys.

PILOT : Allows the setting of PILOT modulation factor by numeric keys.

Numeric keys (0～9, ・, −) : Enter numeric values.

⇐ : Back space (BS) key. Correct data input error or displays center frequency when ΔFREQ function is used.

◁◁ ▷▷ : Move cursor into block.

◁ ▷ : Move cursor within block.

Rotary knob : Modifies the value at cursor position.

AMPLITUDE

AMPLITUDE : Displays RF output level by three digits.

A B C D : Recall keys for the independent 4-point memory.

△ ▽ : Increments/decrements amplitude by the unit of specified value and performs repeat operation.

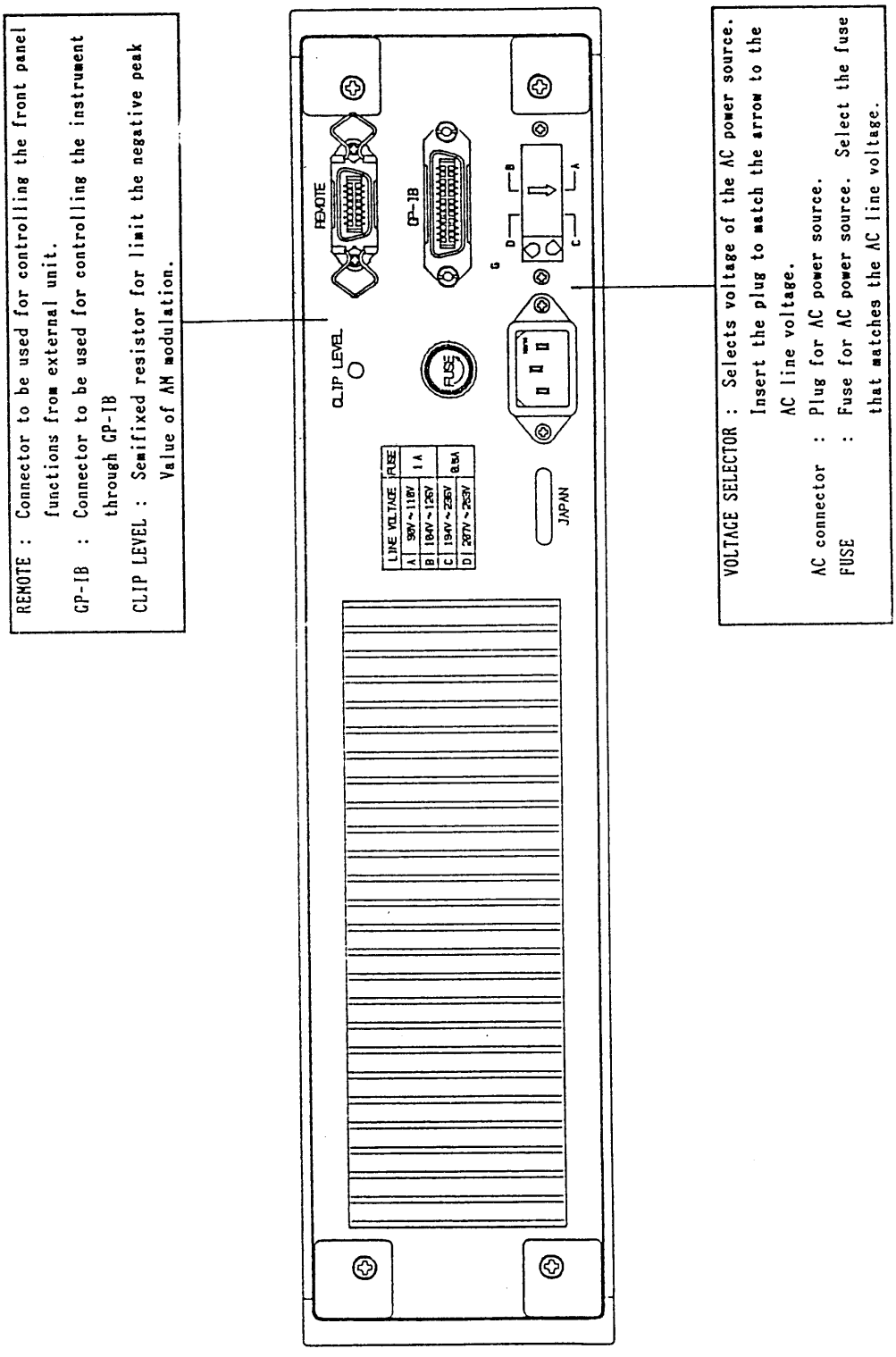
OUTPUT : BNC connector for RF output. −20dBμ to 132dBμ at open circuit. The signal source impedance is 50Ω.

YE A B C D : The store keys for the independent 4-point memory.

YE EMF dBμ,dBm : Sets a unit.

YE STEP AMP : Allows the setting of the output level increment/decrement step by numeric keys.

4.2 Rear Panel Features

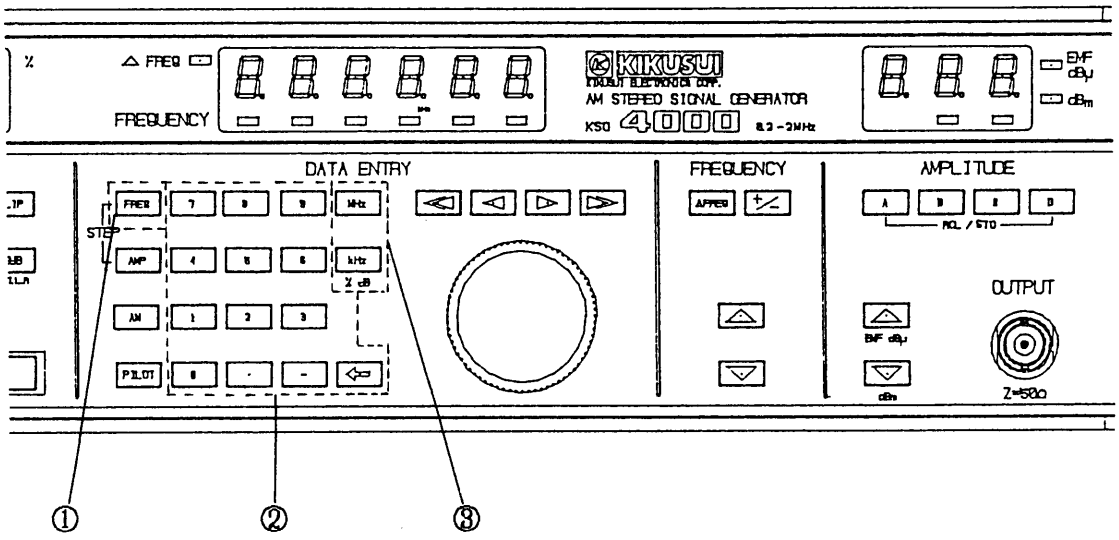


4.3 Turning on the Power Supply.

Connect the power cable to the power source of the selected voltage and press the POWER switch. All the LEDs on front panel come on and then the status found before the power was turned off is displayed.(Exiept HI·LO indicators).

4.4 Setting Frequency

4.4.1 Setting frequency by numeric keys



Press the FREQ key and enter a desired value by numeric keys (0～9, ·). Press keys in the order of ①, ②, and ③ in the above chart. If a key outside of the frame [ ] is pressed, the value found before the FREQ key was pressed is displayed.

Press the MHz or kHz key on completion of the numeric key entry, and the specified value is displayed in the [FREQUENCY] section correctly. The maximum number of digits for the input value is 6; a value of more than six digits is not accepted.
When pressing a numeric key by mistake, press the FREQ key again and enter the desired value by numeric keys or correct the value of the particular digit by the ⇦ (back space) key.
If the AMP, AM, or PILOT key has not been pressed after the unit key (MHz or kHz) is pressed, a different frequency can be set only by the numeric keys and unit key without the necessity of pressing the FREQ key.

(a) Example: 1234.56kHz is input.

× ..... Undefined

␣ ..... Turned off

Key operation		FREQUENCY display	
①	FREQ	××××.××	Previous value
②	1	1␣␣␣ ␣␣	
③	2	12␣␣ ␣␣	
④	3	123␣ ␣␣	
⑤	4	1234 ␣␣	
⑥	.	1234.␣␣	
⑦	5	1234.5␣	
⑧	6	1234.56	
⑨	kHz	1234.56	

Press keys in the order of ① to ⑨ in the above chart, the display is shown in the column on the right.

(b) Example: 455kHz is input.

Key operation	FREQUENCY display
FREQ	1234.56
4	4␣␣␣ ␣␣
5	45␣␣ ␣␣
5	455␣ ␣␣
kHz	␣455.00

(c) Example: 1.1MHz was to be input, but 1.2MHz was input by mistake.

Key operation		FREQUENCY display
FREQ		␣455.00
1		1␣␣␣ ␣␣
.		1.␣␣␣␣␣
2	"2" was pressed for "1" by mistake	1.2␣␣␣␣
⇦		1.␣␣␣␣␣
1		1.1␣␣␣␣
MHz		1100.00

If a numeric key is pressed by mistake as in the above example, the character of the pressed key can be deleted by the pressing of ⇦ key. If the ⇦ is pressed continuously, all the displayed characters are deleted and the previous value is displayed.

(d) Example: 2MHz was input for 1MHz by mistake.

Key operation	FREQUENCY display
FREQ	1100.00
2	2␣␣␣ ␣␣
MHz	2000.00
1	1␣␣␣ ␣␣
MHz	1000.00

If an error is found after the unit key is pressed as in the above example, the correct frequency can be input without pressing the FREQ key again.

4.4.2 Rotary knob

The rotary knob increases or decreases the value of the digits at and above the cursor position in the [FREQUENCY] display section. If the cursor is not found in the [FREQUENCY] display section, bring it into the section by the ◁◁ or ▷▷ key; to move the cursor within the section, use the ◁ or ▷ key.
There is no need to set the MHz or kHz unit keys when making setting with the Rotary knob.

(a) Example: To change frequency from 1000kHz to 1002kHz
The mark "_" denotes the cursor position

Key operation		FREQUENCY display
		1000.00
◁	Press once	1000.00
	Turn the rotary knob clockwise by two steps	1002.00

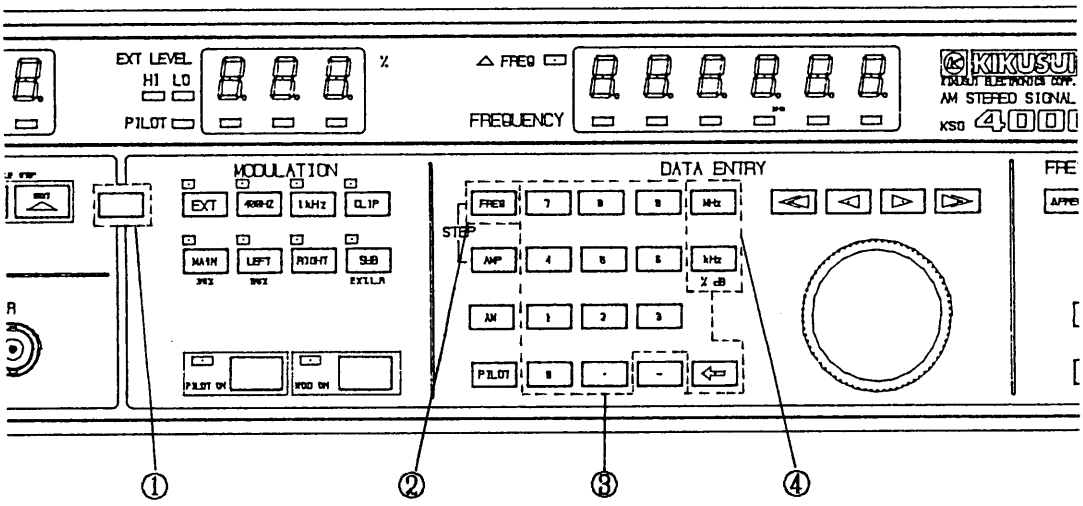
(b) Example: To change frequency from 1002kHz to 802kHz

Key operation		FREQUENCY display
		1002.00
◁	Press twice	1002.00
	Turn the rotary knob counterclockwise by two steps	␣802.00

4.4.3 Setting frequency step for △ and ▽ keys

Set a desired step value (minimum 10Hz) for the [FREQUENCY] △ and ▽ keys, and the frequency can be incremented or decremented by the unit of that value.

In setting the value, the cursor position in the [FREQUENCY] display section may be ignored.



Input the step value in the order of ①, ②, ③, and ④ shown in the above chart.

The YE key in the explanation below means the yellow key of number ①. This key functions as a shift key; the function of a yellow key on the panel pressed after the YE key is different from that of the same key pressed without YE key.

(a) Example: To set 9kHz for △ and ▽ keys when carrier frequency is 1MHz.

Key operation		FREQUENCY display
FREQ		␣802.00
1		1␣␣␣ ␣␣
MHz		1000.00
YE STEP FREQ		1000.00
9		9␣␣␣ ␣␣
kHz		1000.00
△	Press once	1009.0

Keep pressing the △ or ▽ key in the [FREQUENCY] section, and the repeat function is applied to keep increasing or decreasing the frequency by the unit of 9kHz.

4.4.4 Frequency difference [ΔFREQ] and [+/−] keys

The [ΔFREQ] function, to check the value of change in frequency, is useful for measuring the band width of a receiver.

When the [ΔFREQ] key is pressed, the [ΔF] indicator in the [FREQUENCY] display section is turned on and the frequency difference (ΔFREQ) is displayed.

(a) Example: To set 10kHz for [△] [▽] keys when the center frequncy is 1000kHz.

Key operation	FREQUENCY display	
[YE]	×××× ××	
[STEP FREQ]	×××× ××	
[1]	1␣␣␣ ␣␣	
[0]	10␣␣ ␣␣	
[kHz]	×××× ××	
[FREQ]	×××× ××	
[1]	1␣␣␣ ␣␣	
[0]	10␣␣ ␣␣	
[0]	100␣ ␣␣	
[0]	1000 ␣␣	
[kHz]	1000.00	
[ΔFREQ]	␣␣␣0.00	ΔF indicator comes on
[FREQUENCY] [▽]	−␣10.00	Carrier frequency 990kHz
[⇦]	␣␣␣0.00	

If the operator keeps pressing the [△] or [▽] key in the [FREQUENCY] section, the repeat function is applied and the frequency keeps increasing or decreasing by the unit of 10kHz.
If the [⇦] key is pressed in the above example, the carrier frequency returns to the initial value (center value).

(b) Example: 1000kHz is set currently.

Key operation		FREQUENCY display	
		1000.00	
ΔFREQ			
		␣␣␣0.00	ΔF indicator comes on.
◁	Press three times	␣␣␣0.00	
	Turn the rotary knob counter-clockwise by five steps	−␣50.00	Carrier frequecy 950kHz
ΔFREQ			
		␣950.00	

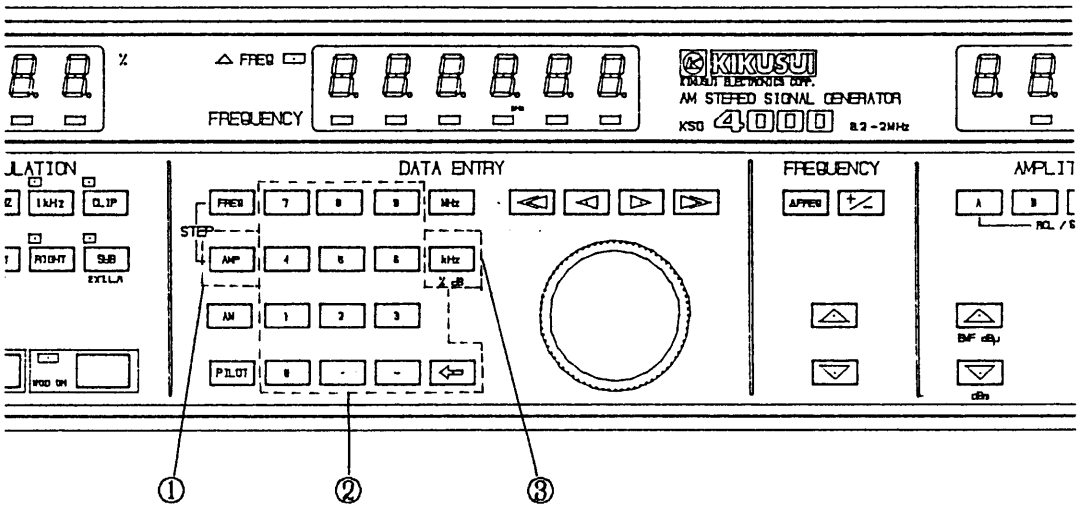
To release the ΔFREQ function, press the ΔFREQ key again. In the above example, the carrier frequency effective after the release is 950kHz.

(c) Example: Using +/− key after modification of 1000kHz by ΔFREQ

Key operation	FREQUENCY display	
FREQ	1000.00	
ΔFREQ	␣␣␣0.00	ΔF indicator comes on
2	2␣␣␣ ␣␣	
0	20␣␣ ␣␣	
kHz	␣␣20.00	Carrier frequency 1020kHz
+/−	−␣20.00	Carrier frequency 980kHz
ΔFREQ or FREQ	␣980.00	

4.5 Setting Output Level

4.5.1 Setting output level by numeric keys



Press the AMP key and enter a desired value by numeric keys (0～9, −).
Press keys in the order of ①, ②, and ③ in the above chart.
If a key outside of the frame [ ] is pressed, the value displayed before the AMP key was pressed is displayed again.

After entering a value by numeric keys, press the dB (kHz) key. Then, the value is displayed in the [AMPLITUDE] section correctly.

(a) Example: To set 79dB

Key operation	AMPLITUDE display
AMP	××× .... Previous value
7	7␣␣
9	79␣
dB	␣79

(b) Example: To set −5dB

Key operation	AMPLITUDE display
AMP	␣79
−	−␣␣
5	−5␣
dB	−␣5

The AMP key need not be pressed if an output level is to be set immediately after another output level.

(c) Example: 46dB was to be set, but an error was made during the setting (Unit = EMF dBμ)

Key operation		AMPLITUDE display
AMP		−␣5
4		4␣␣
9	"9" was pressed for "6" by mistake	4 9␣
⇦		4␣␣
6		4 6␣
dB		␣4 6

If an error is made during the setting by numeric keys, correct the error by the ⇦ key. If an error is found after the dB key is pressed, enter the correct value by numeric keys again.
If an output level higher or lower than the maximum or minimum value allowed for the specified unit is set, the [AMPLITUDE] section displays the previous value.

4.5.2 Rotary knob

The rotary knob increases or decreases the value of the digits at and above the cursor position in the [AMPLITUDE] section. Use the ◁ or ▷ key for moving the cursor. Turn the rotary knob clockwise, and the output level will increase; turn it counter-clockwise, and the output level will decrease.

(a) Example: To change output level from 46dB to 66dB (Unit = EMF dBμ)

The mark "_" denotes the cursor position

Key operation		AMPLITUDE display
		␣4 6
◁	Press once	␣4 6
	Turn the rotary knob clockwise by two steps	␣6 6

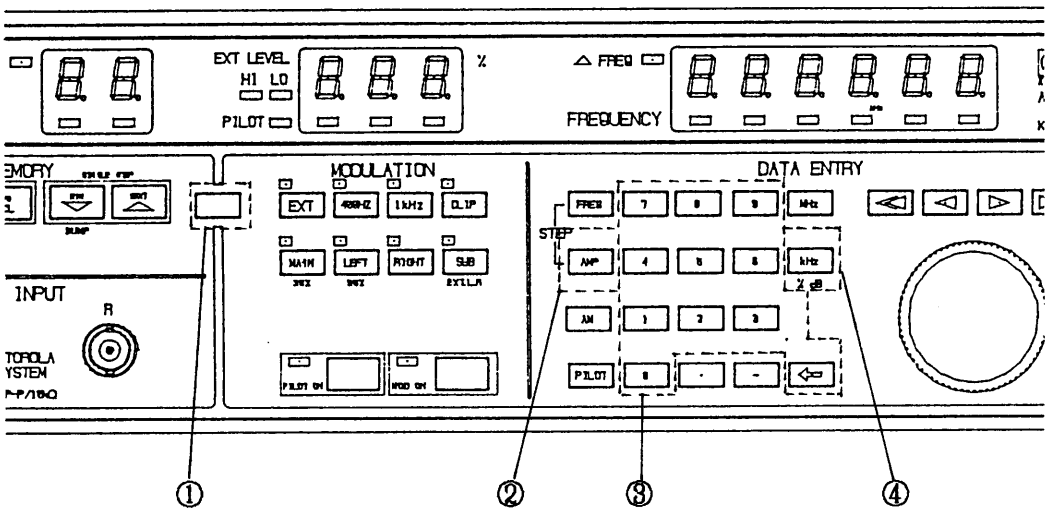
(b) Example: To change output level from 66dB to 60dB

Key operation		AMPLITUDE display
		␣66
▷	Press once	␣66
	Turn the rotary knob counterclock-wise by six steps	␣60

There is no need to press the dB (kHz) key when making setting with the Rotary knob.

4.5.3 Setting output level step for △ and ▽ keys

Set a desired step value (minimum 1dB) for the [AMPLITUDE] △ and ▽ keys, and the output level can be incremented or decremented by the unit of that value.



Press keys in the order of ①, ②, ③, and ④ in the above chart.

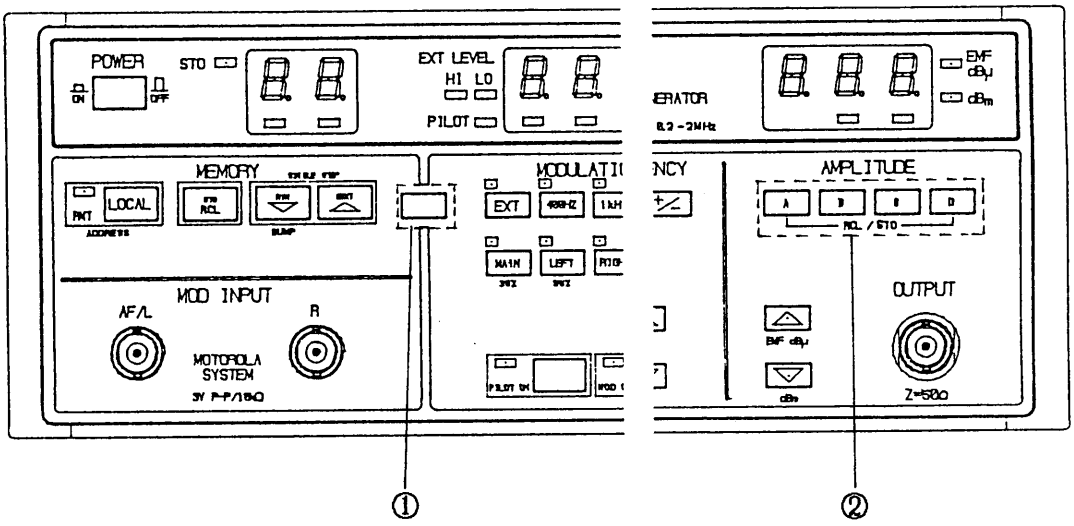
(a) Example: To set 2dB for △ and ▽ keys when the output level is 60dB

Key operation		AMPLITUDE display
YE STEP AMP		␣60
2		2␣␣
dB		␣60
△	Press once	␣62

To change the output level continuously by the step of 2dB, keep pressing the [AMPLITUDE] △ or ▽ key.

When the key remains pressed, a repeat function is applied.

4.5.4 Use of independent 4-Point memory



In addition to the main memory, four memory areas corresponding to keys A to D in section ② in the above chart are provided to contain values of output level only.

To store the currently displayed value of output level, press the YE key in section ① and one of the keys A to D in section ② in this order. The value is stored into the memory area corresponding to the key in section ② that has been pressed. That is, the key A to D are used as memory addresses. To recall the stored value, press one of the keys A to D that corresponds to the are a containing the value.

These four memory areas do not affect the main memory at all.

4.6 Setting the Modulation

4.6.1 YE key

(a) Setting of AM modulation 30% and PILOT modulation 4% with YE 30%.

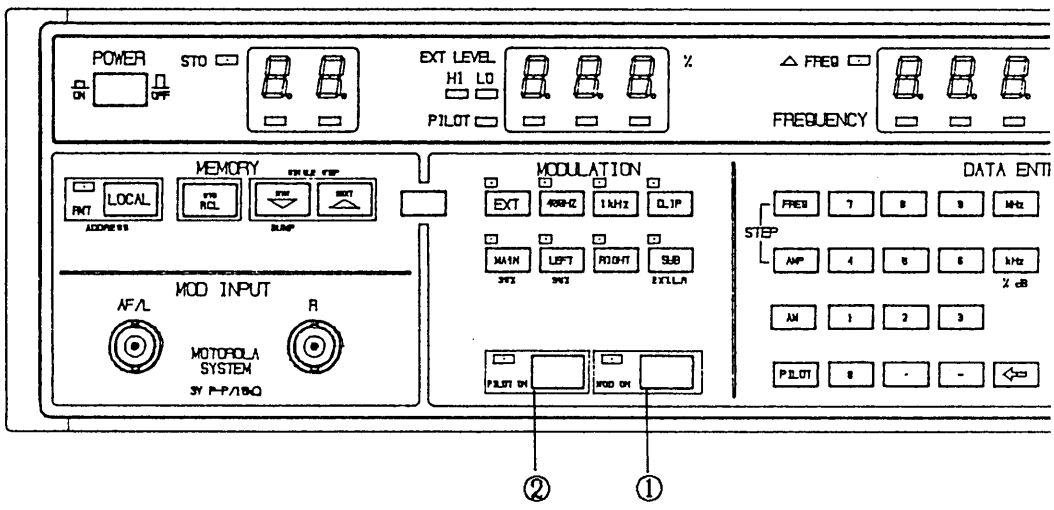
(b) Setting of AM modulation 95% and PILOT modulation 4% with YE 95%.

(c) Setting of stereo modulation external input L,R connectors with YE EXT LR.

4.6.2 Setting the modulation source

Press a modulation source switching key, and the corresponding indicator is turned on.

Key ① turn ON/OFF modulation source of AM and PM. key ② turn ON/OFF the modulation of PILOT. Each time the key is pressed, the relevant modulation is turned on and off alternately.



(a) Example: 60% depth is to be set for 400Hz internal AM source

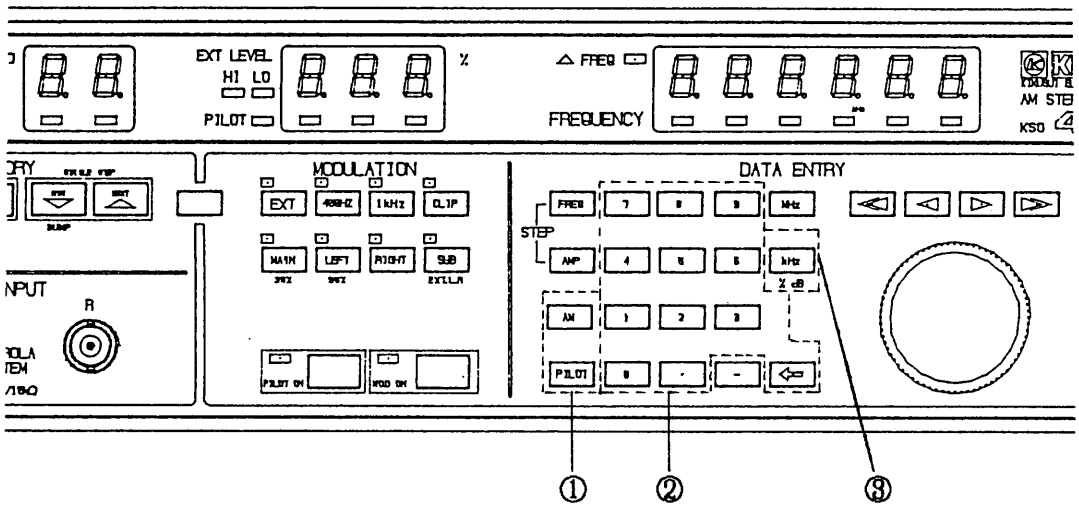
Key Operation	Modulation Display	
400Hz		400Hz lights.
AM	×××	Previous value
6	6␣␣	
0	60␣	
%	␣60	

(b) Example: The modulation is to be turned off.

The modulation is terminated when key ① or ② is pressed and the ON indicator is turned off.

At this time, 0% or 0.0% is displayed in the [MODULATON] section.

4.6.3 Setting modulation by numeric keys



Press keys in the order of ①, ②, and ③ in the above chart.

First, press the AM keys in [DATA ENTRY] section, and the previously set modulation factor is displayed with unit in the [MODULATON] section.

Enter a desired values with numeric keys (0~9, ·). After entering the value, press % (kHz). Then, the value is key is displayed in the [MODULATON] section with the specified unit.

Any desired values may be specified by numeric keys (0~9, ·), but the maximum AM depth and pilot level are 125% and 10% respectively, and the resolution 1% and 0.1%. When the pilot modulation factor is displayed, the pilot indicator is turned on.

(a) Example: To set AM 30%.

Key Operation	Modulation Display
AM	××× ···· Previous value
3	3␣␣
0	30␣
%	␣30

(b) Example: To set PILOT 10%

Key Operation	Modulation Display
PILOT	××.× ···· Previous value
1	1 ␣ ␣
0	1 0 ␣
%	1 0.0

4.6.4 Rotary knob

The rotary knob can modify AM depth by increasing or decreasing the value of the digit at the cursor position in [MODULATON] section. When the cursor is not found in the [MODULATON] section, bring it into the section by the ◁ or ▷ key; when it is found in the section, move it by the ◁◁ or ▷▷ key.

After changing the modulation factor by the rotary knob, the unit key (kHz or %) need not be pressed.

(a) Example: To change AM depth from 30% to 25%.

The mark "_" denotes cursor position.

Key Operation		Modulation Display
AM		␣3 0
▷	Press once.	␣3 0
	Turn the rotary knob 5 steps counterclockwise.	␣2 5

(b) Example: To change PILOT depth from 10% to 4%.

Key Operation		Modulation Display
PILOT		1 0.0
◁	Press once.	1 0.0
	Turn the rotary Knob 6 steps counterclockwise.	␣4.0

4.6.5 External modulation signal connection and setting

(1) Connection and setting method

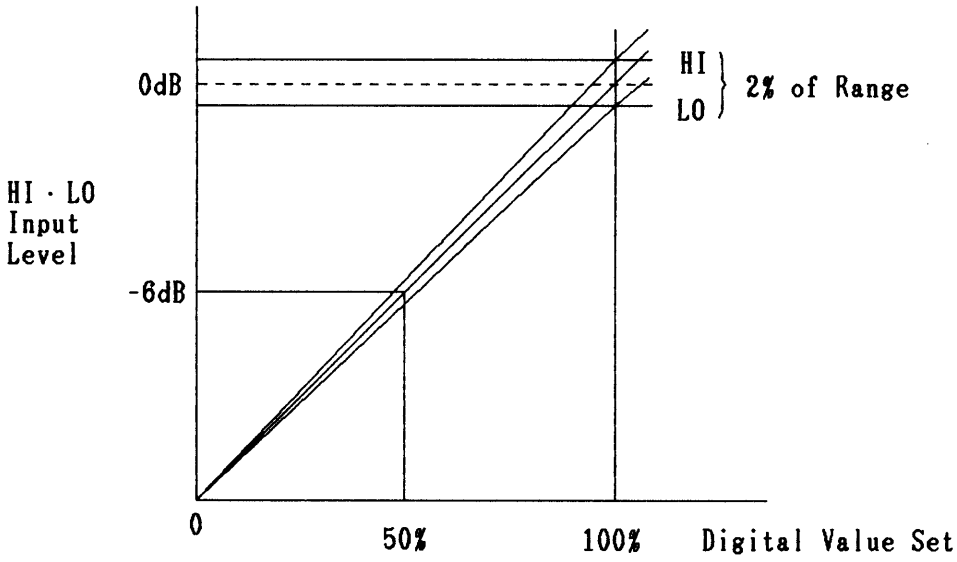
Connect the external modulation signal input connector to MOD INPUT, AF/L R on the front panel. The input impedance is approximately 10kΩ, and appropriate input level is about 3Vp-p.

The appropriate input level range is obtained when both HI and LO of EXT LEVEL are turned off. Adjust the level of external modulation signal source to the range that turns off both HI and LO. When the level of external modulation signal source is too low, LO is turned on; when it is too high, HI is turned on. The external modulation signal source level need not be adjusted each time the modulation is modified.

During stereo modulation, the AF/L connector becomes either the single signal input or the left signal (LEFT) input.

The R connector becomes the right signal (RIGHT) input during stereo modulation.

(2) Setting range



The above chart shows the relationship between modulation and input level.

When the input level is adjusted to the range of HI and LO, it is set within the error range of ±2%. The modulation is converted into a digital value internally on the basis of this input levels.

Whether the input signal is a composite wave signal or single wave signal, the instrument checks if the peak of the signal is within the range of HI and LO and the modulation is proportioned to the input level as shown in the above chart.
If, for example, after setting the input level in the HI, LO range, and setting the indicator to 60%, if the input level is cut −6db, percentage modulation becomes 30% = 50% with the indicator in the 60% = 100% mode. At this time the LO lamp illuminates, but normal 30% modulation is obtained.

4.6.6 Setting the negative peak clipper

When the panel CLIP key is pressed, the indicator illuminates and the negative peak clipper switches on. Clip level is factory set to 95%, but it is adjustable between 90% to 100%. Clip level can be adjusted by the rear panel CLIP LEVEL adjustor with a screwdriver. It is set while monitoring this unit's OUTPUT waveform on an oscilloscope.

4.7 Memory

4.7.1 Memory recall method

Memory addresses are allocated in a matrix of 10 raws and 10 columns (100 points in total).
The following is the memory address allocation diagram:

Memory addresses: 2-digit, 7-segment display.

00	01	02	03	04	05	06	07	08	09
10									.
20									.
30									.
40									.
50									.
60									.
70									.
80									.
90	.	.	.	.	.	.	.	.	.

Basically, the recall operation means to call the row number by the RCL key and numeric keys (0～9) and to call the columns number by the Memory △ key.
Also, a memory row and column can be called directly by the entery of a 2-digit number by numeric keys (0～9) after clearing the [MEMORY] display by the RCL and · keys.
In the following examples, it is assumed that the carrier frequency, output level, modulation mode, etc., are set as explained in Section 4.4 to 4.6 and that they are stored in memory by the operation explined in Section 4.7.2.

(a) Example: To recall memory address "10".

	Memory display
RCL key, 1 key.	"10"

(b) Example: To recall memory address "43".

RCL key, 4 key
Press [MEMORY] △ key three times. "43"

(c) Example: To recall memory address "85".
RCL key, 8 key
Press [MEMORY] △ key five time. "85"

When two or addresses are to be recall continuously, the RCL key need not be pressed for the second and subsequent addresses.

(d) Example: To recall memory address "56" directly.
Press the RCL and . keys. and the [MEMORY] display is cleaed. Press the numeric key 5 and 6, and "56" is displayed.
When the address "78" is to be called subsequently, omit pressing the RCL key and simply press the . key. When the [MEMORY] display is cleared by the . key, press the numeric keys 7 and 8. Then, "78" is displayed.

4.7.2 Memory store method

Most of the function specified on front panel can be stored in the memory addresses allocated in the from of a matrix as described in Section 4.7.1, but the step values of carrier frequency, output level, and ΔFREQ function cannot be stored.
The basic store operation is to set data such as carrier frequency, output level, and modulation mode and press YE, STO, numeric key, and [MEMORY] △ in this order. Also, the data can be stored directly into a row and column by entering a 2-digit numbre by numeric keys after clearing the [MEMORY] display by YE and ..

(a) Example: To store 1000kHz carrier frequency, 66 EMF dBμ output level, 1kHz internal modulation source, and 75kHz FM into memory address "10"

①	FREQ	××××.××
	1	1␣␣␣␣␣ ← Cursor
	MHz	1000.00

Besides the above method, the carrier frequency may be set by the rotary knob or [FREQUNCY] △ or ▽ key.

②	AMP	××× 6␣␣ 66␣ ␣66
	6	
	6	
	dB	

Besides the above method, the output level may be set by the rotary knob, the independent 4-point memory A to D key or [AMPLITUDE] △ or ▽ key.

③	1kHz	×××
	LEFT	×××
	YE 30%	␣30

Besides the above method, the modulation level and mode may be set by numeric keys (0～9) and modulation mode key.
Aftere settings the above data, press YE, STO, and 1.
Then, the data is stored into memory address "10".

(b) Example: To store different data into memory address "13".

		Memory display
①	RCL 1 △ (Press △ twice).	"12" is displayed
②	Set carrier frequency, output level, modulation mode, etc.	
③	Press YE STO △	"13" is displayed

The data set by step ② is stored into memory address "13".

(c) Example: To store data into memory address "45".

① Set carrier frequency, output level, modulation mode, etc.
② Clear [MEMORY] display by YE, STO, ..
③ Press numeric keys 4 and 5, and the data set by step ① is stored.

Note 1: When data is to be stored continuously, the YE, STO, and . keys must not be omitted.

Note 2: The RTN key explained in Section 4.7.3 cannot be used in the direct store method.

4.7.3 Storing data into a part of memory row
(Setting RTN key)

(a) Example: To shift memory address as "10" → "11" → "12" → "13" → "10" → "11".

key Operation	Memory Display
RCL 1 △ Press three times.	"13"
YE STO RTN	"13" RTN command is stored

[How to use the function]

RCL 1	"10" (First memory address)
△	"11" (Second memory address)
△	"12" (Third memory address)
△	"13" (Fourth memory address)
△	"10" (Returns to first memory address)

4.7.4 How to release the RTN key
The following two method are available:

(1) Display "19" by RCL "19"
RCL . 1 9
Press YE STO RTN "19"
By the above operation, all the ten columns become available as they were before the RTN key was pressed.

(2) Display "13" by RCL, "13"
RCL 1, and △ keys (Press three times)
Press YE STO △ "14" RTN command is stored
.. at "14"
..
..
..
..
YE STO △ (Press five times) "19"
Each time the △ key is pressed, the RTN command is sent to the next column, and finally, all the ten columns become available as they were before RTN key was pressed.

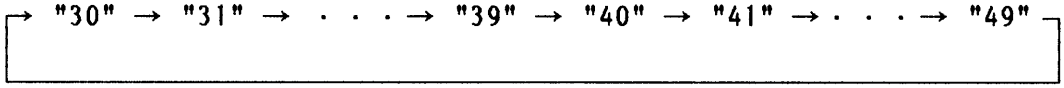
4.7.5 Recalling more than ten columns continuously
(Setting NEXT key)

Normally, up to ten memory columns (00-09,10-19,...,90-99) can be recalled at a time, but more than ten columns can be recalled continuously by the following operations:
Display column number "9" in [MEMORY] section and press YE, STO NEXT keys; then, another ten columns can be recalled without specifying the next row number.

(a) Example: To recall memory addresses 30−49 continuously

Key Operation	Memory Display
×	"39" Previous value
YE	"39"
STO	"39" STO LED comes on
NEXT	"40" STO LED comes off

The memory addresses are recalled as follows:



4.7.6 How to release the NEXT key
Display the memory address ("09", "19"... or "89") at which the function is to be released, and press the YE, STO and RTN keys in this order.

(a) Example: To reset the continuous recall of memory addresses 30-49
(to recall 30-39 and 40-49 separately)

Key Operation	Memory Display
×	"39" Previous value.
YE	"39"
STO	"39" STO LED comes on.
RTN (▽)	"39" STO LED comes off.

4.7.7 Copying memory data to another KGS4000

(1) The 100-point and the output level 4-point memory data can be copied to another unit of KSG4000.

(2) Memory data copying method

① Turn on the power for the local and remote signal generator.

② Connect the remote control terminals on rear panel of the local signal generator to those of remote signal generator, using DUMP cable.

③ Press YE DUMP (▽), and the copying is started.

Note: The DUMP cable uses an amphenol-type 14-pin connector. Among the 14 pins, numbers 8 - 10 are unconnected, but all other are connected.

Optional DUMP cable Model SA510

5. REMOTE CONTROL

5.1 General Discription

5.1.1 Outline

The KSG4000 has a 14-pin connector for remote control.

5.2 Operation Procedure

5.2.1 Explanation of Remote Control Connector

Figure 5-1 shows the connector pin allocation on the rear panel.

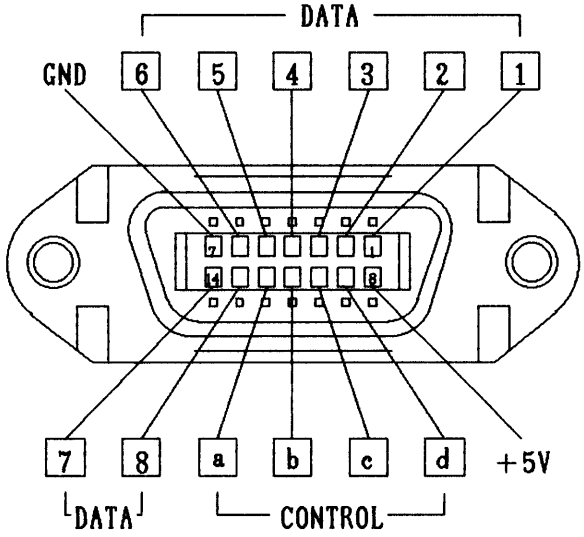


Figure 5-1

[Explanation of terminals]

In the following explanation, "1" and "0" correspond to the high and low levels of TTL respectively.

1) DATA terminals 1 - 8 (Pins 1 - 6, 13, and 14)

The DATA terminals are used for connecting a bus to the rear panel of the KSG4000. Since the bus is bidirectional, it can be used for both input and output.

Note: Since the DATA terminals are bidirectional bus, the signal generator does not function if data "0" or "1" is applied to the lines of DATA 1 - 8 directly.

2) CONTROL terminals a and b (Pins 11 and 12)

a DATA STROBE output terminals (Pin 12)
Normally, "1" is output from this terminal. When data is read, "0" is output from it.

b REQUEST TO READ input terminals (Pin 11)
Normally, "1" is input to this terminals. When data read is requested, "0" is input to it.

3) CONTROL terminals c and d (Pins 9 and 10)

c and d Display control output terminals
When "1" is output from either of these terminals (c or d), data is being processed.

That is, the logical sum of the signals output from c and d is the BUSY signal to external instrument.

4) +5V (Pin 8)

Power source for remote control (max. 100mA; equivalent to the power for turning on 2-digit LEDs)

5) GND (Pin 7)

5.2.2 Input data timing

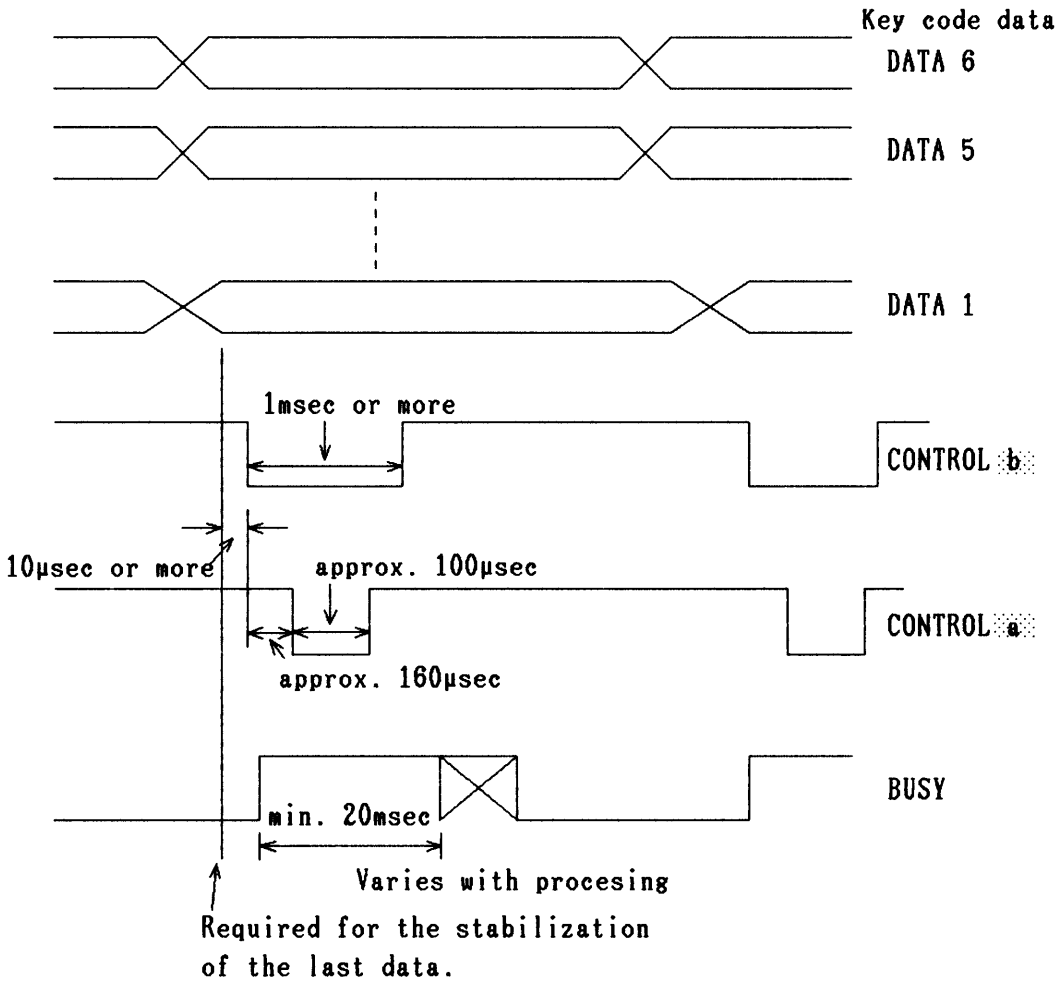


Figure 5-2

When the BUSY signal is "0", set the key code data (DATA1-6), and after the last data of DATA1-6 is established, wait for 10μsec or longer. Then, set CONTROL b to "0" for 1msec or longer as shown in Figure 5-2.
Approximately 160μsec after CONTROL b falls, CONTROL a is set to "0" for approximately 100μsec.
During this period of approximately 100μsec, the key code data that have been set are read processed.

After CONTROL b falls and before CONTROL a falls (that is, during the period of approximately 160μsec), the BUSY signal rises to "1" to indicate that the key code data are being processed.
Enter the next key code data after the BUSY signal is set to "0".

5.2.3 Panel key code table

All the panel keys are expressed in codes. So, setting one of the key codes listed below (table 5-1) and sending it with CONTROL b is equivalent to pressing the panel key corresponding to the code.

Table 5-1

Key Name	Key Code Input Pin Number					
	6	5	4	3	2	1
	MSB	← Key Code →				LSB
LOCAL	1	0	1	1	1	1
MEMORY RCL / STO	0	0	0	1	0	0
MEMORY ▽ / RTN	0	0	0	1	1	1
MEMORY △ / NEXT	0	0	0	1	1	0
YE (Yellow Key)	0	1	1	0	1	1
MODULATION EXT	0	0	1	0	0	1
MODULATION 400Hz	0	0	1	0	1	1
MODULATION 1kHz	0	0	1	1	0	0
CLIP	1	0	1	0	1	0
MAIN	0	1	1	1	0	0
LEFT	0	1	1	1	0	1
RIGHT	0	1	1	1	1	0
SUB	0	1	1	1	1	1
MODLATION ON	0	0	1	1	1	1
PILOT ON	0	0	1	1	1	0
DATA ENTRY FREQ / STEP FREQ	0	1	0	0	1	0
DATA ENTRY AMP / STEP AMP	0	1	0	0	1	1
DATA ENTRY AM	0	1	0	1	0	0
DATA ENTRY PILOT	0	1	0	1	0	1
DATA ENTRY 0	1	1	0	0	0	0
DATA ENTRY 1	1	1	0	0	0	1
DATA ENTRY 2	1	1	0	0	1	0
DATA ENTRY 3	1	1	0	0	1	1
DATA ENTRY 4	1	1	0	1	0	0
DATA ENTRY 5	1	1	0	1	0	1
DATA ENTRY 6	1	1	0	1	1	0

(cont'd)

Table 5-1

Key Name	MSB	← Key Code →				LSB
DATA ENTRY 7	1	1	0	1	1	1
DATA ENTRY 8	1	1	1	0	0	0
DATA ENTRY 9	1	1	1	0	0	1
DATA ENTRY ·	1	0	1	1	1	0
DATA ENTRY −	1	0	1	1	0	1
DATA ENTRY ⇦	0	0	1	0	0	0
DATA ENTRY MHz	0	1	0	1	1	0
DATA ENTRY kHz , % , dB	1	0	0	1	0	1
DATA ENTRY <◁	0	1	0	1	1	1
DATA ENTRY <	1	1	1	1	0	0
DATA ENTRY >	1	1	1	1	1	0
DATA ENTRY ▷>	0	1	1	0	0	0
DATA ENTRY Rotary knob UP	0	0	0	0	0	0
DATA ENTRY Rotary knob DOWN	0	0	0	0	0	1
FREQUENCY Δ FREQ	1	1	1	1	0	1
FREQUENCY +/−	1	0	1	0	0	1
FREQUENCY △	0	1	1	0	0	1
FREQUENCY ▽	0	1	1	0	1	0
AMPLITUDE RCL A/STO A	1	0	0	0	0	1
AMPLITUDE RCL B/STO B	1	0	0	0	1	0
AMPLITUDE RCL C/STO C	1	0	0	0	1	1
AMPLITUDE RCL D/STO D	1	0	0	1	0	0
AMPLITUDE △	1	0	0	1	1	0
AMPLITUDE ▽	1	0	0	1	1	1

5.2.4 Setting frequency by remote control (example)

The frequency of 450kHz is to be set.

1) Set the FREQ code "010010" according to the panel key code table (Table 5-1).
2) Send CONTROL b which is set to "0" for 1msec or longer as shown in Figure 5-2 (input data timing).
3) Set the data "450" according to the code table and send CONTROL b signal as shown in Figure 5-3.

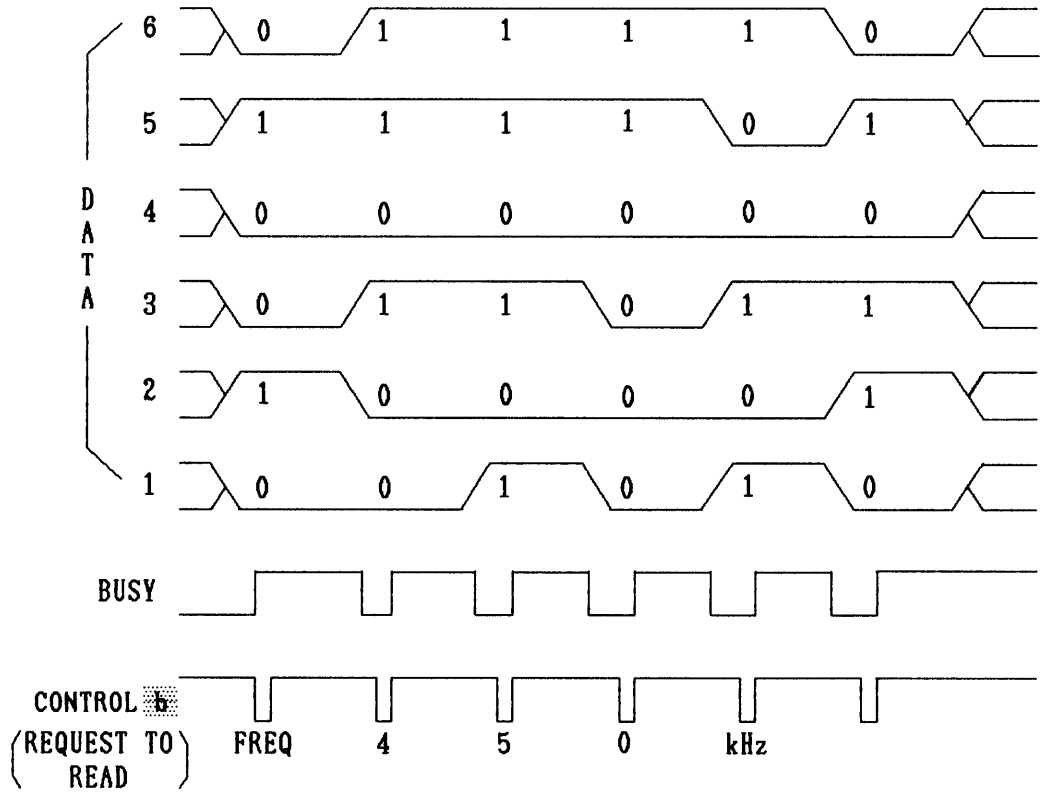
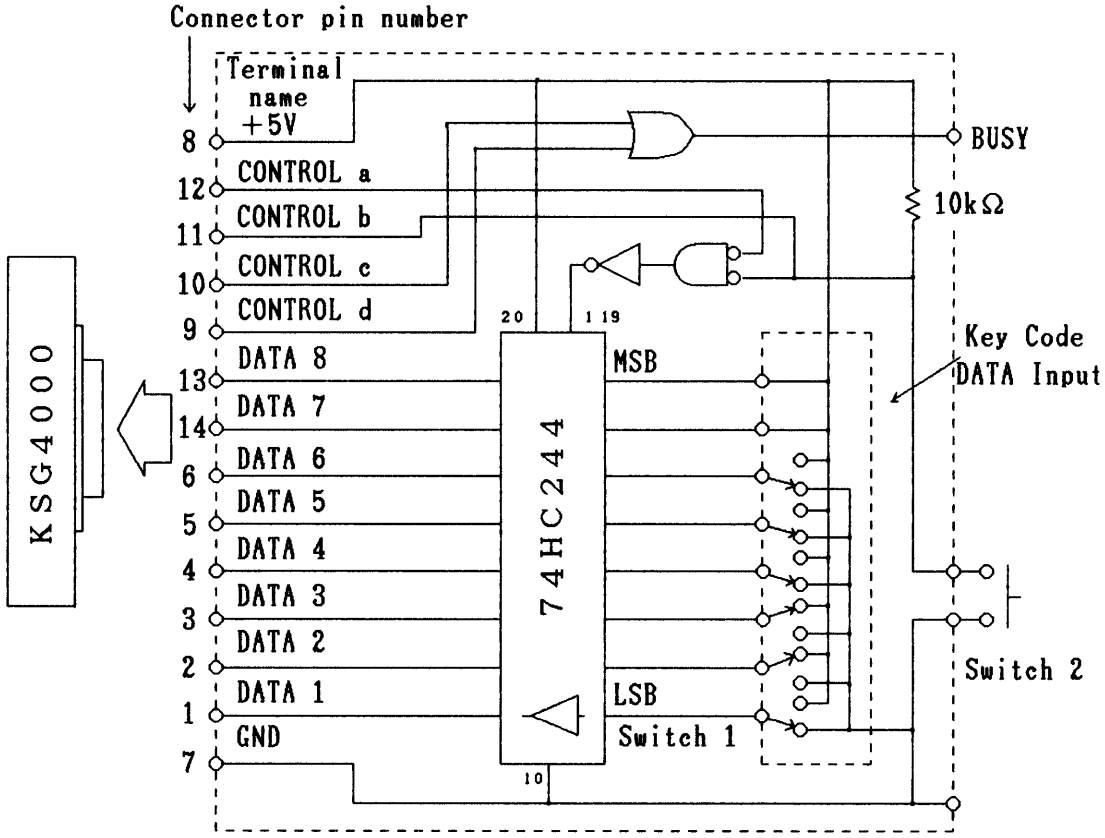


Figure 5-3

4) Finally, send "100101" for "kHz" with CONTROL b signal, and the data transmission is completed.
5) When the signal generator receives the last data, namely, "100101" for "kHz" and CONTROL b, it starts processing the specified frequency.

5.2.5 Remote Control circuit diagram example and operation.

Since the data lines of the remote control connector are bidirectional bus lines, it is recommended to use the circuit shown in Figure 5-4 when controlling the signal generator from a remote unit.



The chattering prevention circuit is omitted.

Figure 5-4

Figure 5-4 shows the remote control circuit that increments the memory address by one each time the switch is pressed.

Set the data of MEMORY RCL △ on Key Code Data Input Switch 1 according to the key code table (Table 5-1) and set CONTROL b to "0" (Press Switch 2). Then, approximately 160μsec later, CONTROL a is set to "0" and Enable A and B (pins 1 and 19) of 74HC244 are set to "0". The data is sent to the KSG4000 during the period of approximately 100μsec when CONTROL a is "0"

If other key code data of the key code table is set on Switch 1, the function of the corresponding key on the front panel can be controlled in remote mode.

When using a computer for the external remote control on the basis of function shown in Figure 5-4, be sure to confirm that the BUSY signal is set to "0" before setting CONTROL b to "0" for more than 1msec.

Note: Since the control terminals (DATA terminals) are assigned to eight bits, the fixed data "1" is sent for the 7th and 8th bits (pins 14 and 13) through 74HC244.

5.2.6 Memory Display output circuit example

Figure 5-5 shows an example circuit.

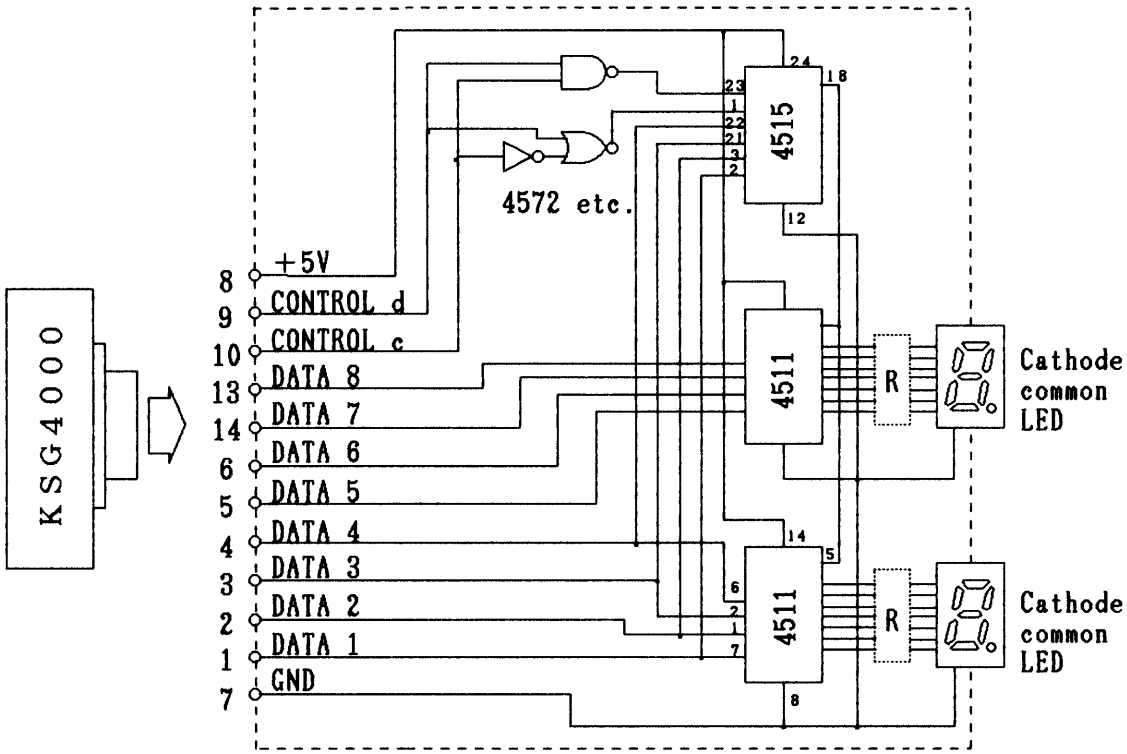


Figure 5-5

Since the remote control terminal has a bidirectional bus structure, it can output the same data displayed in the [MEMORY] section of the signal generator through the circuit shown in Figure 5-5. In addition to being displayed on a remote device, the data in the [MEMORY] section can be used for a process if the CMOS 4511 is replaced by a latch circuit.

If the circuit in Figure 5-4 is connected to that in Figure 5-5 by the connector section in parallel, the user can not only control the signal generator from a remote unit but also display the data in [MEMORY] section on a remote unit or check the data on the signal generator by a remote unit.

6. BATTERY BACKUP AND INITIALIZING CPU

The KGS4000 uses a memory backup battery, and the battery may discharge all its electricity when the signal generator is not used for a long time.
Turn on the power for the signal generator having a charging circuit, and fully charge the battery.
The memory backup battery is greatly affected by surrounding temperature, humidity, and storage conditions. After about five years, discharge capability of the battery is reduced to approximatly 90% of the initial capability. The battery is fully usable in this state, but when it becomes unusable, replace it with CADNIC BAKUP N-SB3 of Sanyo Electric Co. or GB 50H-3X of Japan Storage Battery Co..Ltd.

[Battery position and replacement method]

Remove the top panel of the instrument, and thee aluminum sash cases are found.
Among these cases, the one attached to the left side of the instrument contains the CPU printed circuit board, and the battery is mounted on this board.

Remove two screws from the left side, take out aluminum sash case, pull out the PC board, and replace the battery with a new one.

When the battery replacement is finished , turn the power switch to ON, press the initial set push-button switch once to initialize the CPU.
Then the replace the aluminum sash case and replace the two screws.

7. GP-IB

(General Purpose Interface Bus)

7.1 Introduction

7.1.1 General description

The KSG4000 has a GP-IB interface, and it can be controlled by the IEEE 488 standard interface bus.

7.1.2 Features

1) The functions of the signal generator can be controlled by the IEEE 488 standard interface bus.

2) The remote mode can be verified by the REMOTE indicator.

3) The signal generator can be set in local mode at any time by the pressing of LOCAL key. In the local mode, manual operation on the front panel is allowed. (In local lockout mode, however, the manual operation is not allowed.)

4) The device address assigned to the signal generator can be displayed in the AMPLITUDE section.

7.2 Performance

7.2.1 Interface functions

SH0: No source handshake
AH1: Complete acceptor handshake
T0 : No Talker function
L1 : Basic listener, listen only mode
SR0: No service request capability
RL1: Complete remote/local capability
Local lockout capability
PP0: No parallel poll capability
DC1: Complete device clear capability
Select device clear capability
DT0: No device trigger capability
C0 : No controller capability

7.2.2 Electrical specifications related to interface system

Compiles to IEEE Std 488-1975.

7.3 Operation Procedure

7.3.1 Preparation for use

Turn on the power and check the device address of the signal generator on GP-IB.

1) Press the LOCAL key after the YE key, and device address "07" is displayed in the [AMPLITUDE] section.
2) To change the device address, turn off the power and set a new address according to the address setting method explained in Section 7.3.2.
3) Connect the GP-IB cable when the power is off.

7.3.2 Address setting method

The address of the KSG4000 is set at "07" when the instrument is delivered from the factory.

The address switch is mounted on the CPU board in the signal generator. To set a new address, remove the top panel and shield board and manipulate the address switch S2 on the PC board 90-SIG-90101 found in the left aluminum sash case viewed from the front panel.

The address "07" can be changed to a desired address.

Remove the two screws on the right side the aluminume sash case.

The aluminum sash case can be taken out. Lift the case, and pull out the case.

After setting the address, put the board back to its original position.

a) Table 7-1 lists the values of S2 and corresponding addresses.
b) When a switch of S2 is set to ON, the corresponding bit is set to the level of "0".
c) Figure 7-1 shows how S2 is set for address "07".

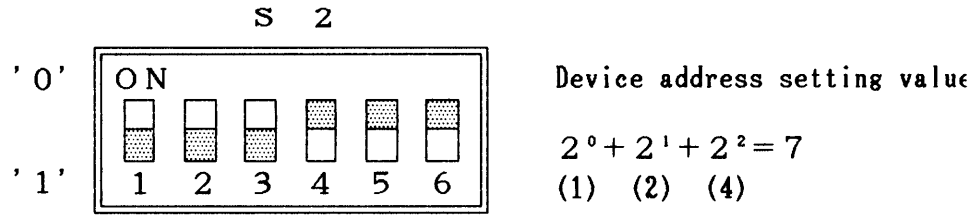


Figure 7-1

Table 7-1

Listener address	Address switch	
Device number	1 2 3 4 5 6	
00	0 0 0 0 0 0	
01	1 0 0 0 0 0	
02	0 1 0 0 0 0	
03	1 1 0 0 0 0	
04	0 0 1 0 0 0	
05	1 0 1 0 0 0	
06	0 1 1 0 0 0	
07	1 1 1 0 0 0	The DIP-SW is set to "07" at the factory
08	0 0 0 1 0 0	
09	1 0 0 1 0 0	
10	0 1 0 1 0 0	
11	1 1 0 1 0 0	
12	0 0 1 1 0 0	
13	1 0 1 1 0 0	
14	0 1 1 1 0 0	
15	1 1 1 1 0 0	
16	0 0 0 0 1 0	
17	1 0 0 0 1 0	
18	0 1 0 0 1 0	
19	1 1 0 0 1 0	
20	0 0 1 0 1 0	
21	1 0 1 0 1 0	
22	0 1 1 0 1 0	
23	1 1 1 0 1 0	
24	0 0 0 1 1 0	
25	1 0 0 1 1 0	
26	0 1 0 1 1 0	
27	1 1 0 1 1 0	
28	0 0 1 1 1 0	
29	1 0 1 1 1 0	
30	0 1 1 1 1 0	
Listen only	* * * * * 1	

DIP SW

1 = OFF 0 = ON

7.3.3 Available control command and bus line commands

Table 7-2

Control commad and bus line command (for hp BASIC)	Explanation
OUTPUT	pecifies the listener address and sends program data.
REMOTE	Turns on the REMOTE indicator (red) and prepares for receiving data when the listener adrress is specified. If the LOCAL key on the front panel is pressed in this state, the REMOTE indicator is turned off and the signal generator is set in local mode to enable manual operation on the front panel.
LOCAL LOCKOUT	Disables manual operation on all the devices on GP-IB. The LOCAL LOCKOUT command is an universal command.
LOCAL	Turns off the REMOTE indicator and sets the signal generator in local mode to allow manual operation on the front panel.
CLEAR	Sets the signal generator in the same state as the initial power-on state.

Note: Since the bus line commands vary with the computer to be used, refer to the instruction manual of the specific computer to be used.

7.3.4 Program code table

Set the measuring conditions for KSG4000 with the codes listed in Table 7-3.
Table 7-4 list the codes in alphabetical order, and Table 7-5 gives the function setting methods. See these tables also.
When creating a control program, arrange the program codes in the same order as the corresponding functions that would be specified on the panel.

Table 7-3 GP-IB Function Setting Method

Item	Program code	Data	Unit
Carrier frequency	FR	○○.○	HZ,KZ, MZ
Output			
EMF dBμ	EM	---	---
dBm	DM	---	---
Output level	AP	○○.○	DB
Modulation			
AM depth	AM	○○.○	PC
AM depth	AM	○○.○	%
Amplitude modulation OFF	AMS4	---	---
PILOT modulation factor	PL	○○.○	%
PILOT OFF	P0	---	---
PILOT ON	P1	---	---
External modulation ON	S1AM	---	---
Modulation signal source 400Hz	S2AM	---	---
Modulation signal source 1kHz	S3AM	---	---
Stereo MAIN	M1	---	---
Stereo LEFT	M2	---	---
Stereo RIGHT	M3	---	---
Stereo SUB	M4	---	---
EXT L/R	M5	---	---
Clipper OFF	C0	---	---
Clipper ON	C1	---	---
Memory control			
Memory recall	RC	○○	---
Memory store	ST	○○	---

Note 1: The mark "---" means an optional item.

2: The mark "○○" means than the data may be specified with one digit up to the maximum number of digits.

3: Data must be expressed in integers or real numbers; it must not be expressed in E format.

4: Alphabetic characters may be expressed in small letters.

Table 7-4 GP-IB Program Codes

Alphabetical order

Program code	Explanation	Remarks
AM	Amplitude modulation	Function mode
AP	Output level	Function mode
C0	Clipper OFF	
C1	Clipper ON	
DB	Output dB	Unit
DM	Output dBm	Function mode
EM	Output EMF dBμ	Function mode
FR	Carrier frequency	Function mode
HZ	Hz	Unit
KZ	kHz	Unit
M1	Stereo MAIN	Modulation mode
M2	Stereo LEFT	Modulation mode
M3	Stereo RIGHT	Modulation mode
M4	Stereo SUB	Modulation mode
M5	EXT L/R	External Modulation mode
MZ	MHz	Unit
P0	PILOT OFF	
P1	PILOT ON	
PC	Modulation in percent	Unit
PL	Modulation PILOT	Function mode
RC	Memory recall	Function mode
S1	External modulation ON	Modulation signal source switching
S2	Internal modulation 400Hz	Modulation signal source switching
S3	Internal modulation 1kHz	Modulation signal source switching
S4	Modulation OFF	Modulation signal source switching
ST	Memory store	Function mode
0 - 9	Numeric value	Data
−	Minus sign	Data
.	Decimal point	Data
%	Modulation in percent	Unit

Table 7-5 GP-IB Program Code

Classified by function

Function	Program code
Carrier frequency	FR
Output	AP
EMF dBμ	EM
dBm	DM
Modulation	
Amplitude modulation	AM
PILOT modulation	PL
External modulation ON	S1
Int. modulation 400Hz	S2
Int. modulation 1kHz	S3
Modulation OFF	S4
Stereo MAIN	M1
Stereo LEFT	M2
Stereo RIGHT	M3
Stereo SUB	M4
EXT L/R	M5
PILOT OFF	P0
PILOT ON	P1
Clipper OFF	C0
Clipper ON	C1
Data	
Numeric value	0 - 9
Minus sign	−
Decimal point	.
Unit	
MHz	MZ
kHz	KZ
Hz	HZ
dB	DB
%	PC or %
Memory	
Memory recall	RC
Memory store	ST

7.3.5 Basic data setting method

1MHz carrier frequency, EMF 120dBμ output level, 1kHz internal modulation frequency, and AM depth 95% are to be set.
In the following examples, HP9816 is used:

Example 1: OUTPUT 707; "FR1MZ, EMAP120DB, S3AM95%"

Output command	Frequency data	Output level data	AM modulation data

Normally, CRLF or EOI is sent.

Example 2: To send the above data items one by one

```
OUTPUT 707; "FR1MZ"
OUTPUT 707; "EMAP120DB"
OUTPUT 707; "S3AM95%"
```

Example 3: To set the carrier frequency at 455kHz
a) "FR455KZ"

Example 4: To set the output level at 120 EMF dBμ
a) "EM, AP120DB" b) "EM" , "AP120DB"

Example 5: To set the output level at -3.5dBm
a) "DU, AP-3.5DB" b) "DU" , "AP-3.5DB"

Example 6: To set the internal modulation frequency at 400Hz and AM depth at 30%
a) "S2AM30%" b) "S2AM30PC"

Example 7: To set external modulation and depth at 95%
a) "S1AM95%" b) "S1AM" , "AM95%"
Note : S1 only is invalid.

Example 8: To turn off modulation
a) "AMS4"

Example 9: To recall memory address "36"

a) "RC36"

Example 10: To store data at memory address "36"

a) "ST36"

7.3.6 Connector pin allocation diagram

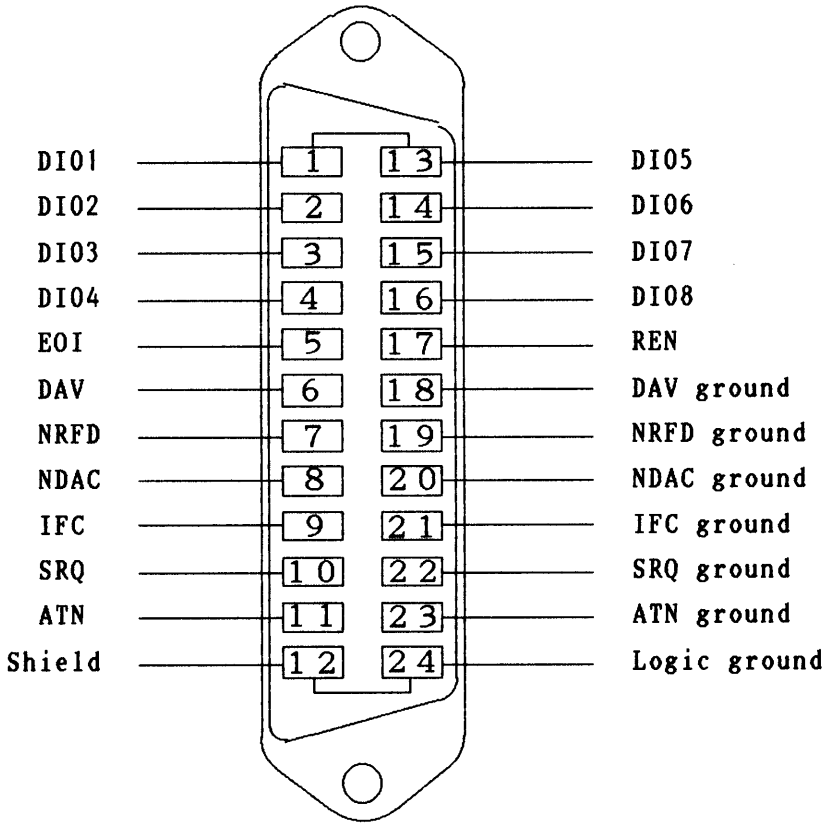


Figure 7-2

7.3.7 Reference (Program example)

An example of a program for HP9816 is given below. This program is to set the data of frequency, output level, and modulation factor, to store the data into the signal generator, and to recall the data from it. This program is just for reference, and it may not be the best one. Since the program description method varies with the system to control the signal generator, code the program in the most suitable way for the system.

```
10    Dev=707                          Interface select code
                                       * 100 + Device address
20    Frequency=100*1.E+6              100000000Hz
30    Freqstep=10*1.E+6                10000000Hz
40    Level=120                        120dB
50    Levelstep=-10                    -10dB
60    Am=95                            95%
70    Fmstep=-5                        -5%
80    CLEAR Dev                        Clear selected device
90    WAIT 2
100   OUTPUT Dev;"P0"                  PILOT OFF
110   FOR N=0 TO 9
120     Freq=Frequency+Freqstep*N
130     Lev=Level+Levelstep*N
140     Amlev=Am+Amstep*N
150     OUTPUT Dev;"FR";Freq/1.E+6;"MZ"  Set frequency
160     OUTPUT Dev;"EMAP";Lev;"DB"       Set output level
170     OUTPUT Dev;"AMS4"                Turn off AM modulation
180     OUTPUT Dev;"S2AM";Amlev;"PC"     Set 400Hz internal
                                         modulation frequency and
                                         AM depth
190     OUTPUT Dev;"ST";N                Store data into memory
200   NEXT N
210   FOR N=0 TO 9                       Recall data from memory
220     OUTPUT Dev;"RC";N
230   WAIT 2
240   NEXT N
250   END
```

AM STEREO SIGNAL GENERATOR **KSG4000** **OPERATION MANUAL**