OPERATION MANUAL

FM/AM SIGNAL GENERATOR

KSG4200

Fourth Edition

KIKUSUI ELECTRONICS CORPORATION

(KIKUSUI PART NO. Z1-477-520)

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.
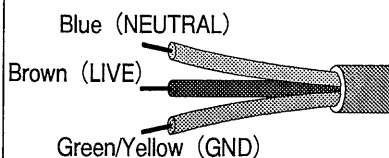
☐ AC power cable

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.
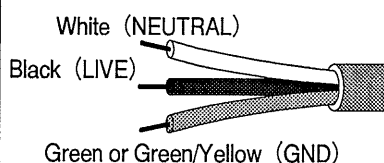
▬▬▬▬▬▬ WARNING ▬▬▬▬▬▬

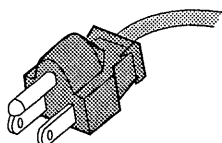· The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

☐ Without a power plug

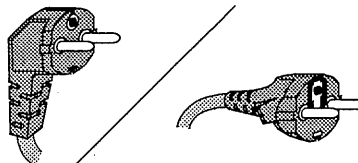Blue (NEUTRAL)
Brown (LIVE)
Green/Yellow (GND)

☐ Without a power plug

White (NEUTRAL)
Black (LIVE)
Green or Green/Yellow (GND)

☐ 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 _____

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1.   INTRODUCTION

1.1 General Description

The KSG4200 is an FM/AM signal generator that covers the frequency of
50kHz to 140MHz.   Since it generates highly stable signals
$(2×10^{-7}$/week) with the resolution of 100Hz by the use of Phase Lock
Loop (PLL), it is suitable for measuring various functions of the
receivers for FM and/or AM broadcasting.   It can be operated easily as
it adopts recall and numeric data entry methods.

The output level at open circuit ranges from -20.0dBµ to 132.0dBµ
(0.1µV to 4Vrms), and the resolution of output signal is 0.1dB.
As to the unit of output signal level, dBµ at loaded, EMF dBµ at open
circuit, or dBm can be selected by a unit key.   Further, the loss
caused by an additional item, such as a dummy antenna, can be offset.

Three modulation modes, namely, FM, AM, and FM-AM modes, are available.
The FM peak frequency deviation is 99.9kHz, and the maximum AM depth is
99.9%.   Both internal and external modulation is possible.

Since the KSG4200 gives a very low FM distortion rate of 0.05% or less
(for 1kHz modulation frequency and 75kHz deviation), it is suitable
forthe development of FM tuners and their adjustment on production
line.

The AM external modulation range is from 20Hz to 20kHz with very little
incidental FM; so the AM suppression ratio of an FM tuner can be
measured accurately.

A recall method (100 memory points) is used for operation, and numeric
data entry, increment key, rotary knob, and $\triangle$ key increase
operationality.
Simple pressing of numeric data entry keys can store any frequencies,
output levels, and modulation rates in memory, the rotary knob makes
the operator feel no difference from the same type of dial on
conventional signal generator, and the $\triangle$ display for frequency and
output level is very useful for difference measurement.
A remote control function is also provided for control of all
operations possible from the panel.

1.2 Features

(1) The carrier frequency can be specified with a 7-digit number, and the value of a desired digit (designated by cursor) can be changed continuously by a rotary knob. Also, the KSG4200 has the ▓Δ FREQ▓ (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), and it can be specified with a 4-digit number in units of 0.1dB. Also, an output level ON/OFF function is provided.

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

(4) Modulation preset keys are provided for AM 30%, FM 3.5kHz, 22.5kHz, and 75kHz to facilitate operation. ON/OFF of modulation can be specified for AM and FM independently of each other.

(5) The KSG4200 gives small modulation distortion, high S/N ratio, and good stereo characteristic.

(6) All the information displayed on panel can be memorized; 100 points of data can be stored in memory and recalled from it.

(7) The KSG4200 can be operated easily because all the operations are controlled by a microprocessor and specified values are displayed in digital mode.

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

(9) Data can be copied from the memory of one KSG4200 to that of another KSG4200 by the pressing of ▓DUMP▓ key.

(10) The panel operation can be done in remote control mode.

(11) The KSG4200 has a GP-IB interface.

2. SPECIFICATIONS

o Frequency (RF)

Range   : 50kHz to 140MHz

Resolution   : 100Hz

Display   : 7-digit readout, $\triangle$ FREQ dislay, and $\pm$ frequency
                       inversion function

Accuracy   : $\pm 2 \times 10^{-6}$

Stability   : $\pm 2 \times 10^{-7}$/week (48 hours after power-on)

o RF Output
  Range

Unit		For CW.FM	For 99.9% AM
EMF	dBμ	132dBμ	126dBμ
dBμ		126dBμ	120dBμ
50Ω	dBm	19dBm	13dBm

Unit		50k − 140MHz
EMF	dBμ	−20dBμ
dBμ		−26dBμ
50Ω	dBm	−133dBm

Unit: : Four types of units, namely, EMF dBμ for open-
                       circuit at 0dB = 1μV, dBμ for loaded-terminal
                       voltage and dBm for 50Ω output impedance.

Resolution   : 0.1dB

Display   : 4-digit readout that can be read directly in each
                       one of the three unit types $\triangle$ dB display and any
                       desired offset value display

The unit of EMF dBμ, abbreviated as dB, is applied to all the following
description:

Standard level: accuracy	At the output level of 126dB
	1) ± 1dB (RF ≧ 400kHz)
	2) ± 2dB (RF > 400kHz)

Attenuator accuracy: 1) ±1dB   (Output ≧ 20dB)

                              2) ±1.5dB (Output ≧ 0dB)

                              3) ±2dB   (Output < 0dB)

RF.ON/OFF   :   Output level can be turned ON/OFF by RF OFF key.

Output impedance   :   50Ω   BNC type connector.

VSWR   :   ≦1.2 (Output level = 60dB)

                       ≦1.5 (Other RF values and output levels)

Spurious signals   (Fundamental wave = 0dBc)

Harmonics   :   ≦ -30dBc   Output ≦ 126dB

Non-harmonics   :   ≦ -60dBc (RF ≦ 32.5MHz;

                            Measurement range ≦ 90MHz)

                ≦ -50dBc (RF ≧ 32.5MHz;

                            Measurement range ≦ 140MHz)

Residual modulation (S/N)

FM component   :   Demodulation band width = 300Hz to 15kHz;

                       De-emphasis = 50μs; 75kHz deviation

                       1) ≧ 87dB (RF = 75MHz to 110MHz)

                       2) ≧ 80dB (RF = 32.5MHz to 140MHz)

                       3) ≧ 70dB (Other RF values)

AM component   :   Demodulation band width = 50Hz to 15kHz;

                       30% depth ratio

                       1) ≧ 60dB (RF = 400kHz to 1.7MHz)

                       2) ≧ 55dB (Other RF values)

o   Modulation

FM/AM simultaneous   :   Selection can be made from the following
modulation   signalsources for FM and AM simultaneously:
                               1)   External
                               2)   Internal 400Hz
                               3)   Internal 1kHz

Internal modulation   :   400Hz and 1kHz; ±3%
frequency   (Tow frequencies are available)

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

Input voltage   :   3Vp-p approx.
requirement for   *Note: For the above input voltage, an error of*
external modulation   *±2% is allowed by HI-LO moniter*

[FM]

Maximum frequency deviation range and resolution

RF variable frequency	300k-3MHz	3-32.5,65-140MHz	32.5-65MHz	
Maximum frequency deviation range	0-30kHz	0-99.9kHz	0-49.9kHz	50-99kHz
Resolution	100Hz	100Hz	100Hz	1kHz

Note: When the value of RF is smaller than or equal to 300kHz,
the maximum frequency deviation is 10% of the RF value.

Display   :   3-digit readout

Accuracy   :   1)   ±5% of maximum frequency deviation
                            (RF > 3MHz)
                       2)   ±10% of maximum frequency deviation
                            (RF ≤ 3MHz)

External modulatrion frequency characteristics	:	20Hz to 100kHz; 1kHz reference ±1dB (RF = 75MHz to 110MHz) ±1.5dB (RF = Other than above values)
Separation	:	For Modulation frequency = 1kHz and Deviation = 75kHz 1) ≧ 55dB (RF 10.7±1MHz, 83±1MHz, 98±1MHz) 2) ≧ 50dB (RF 75MHz to 110MHz)
Distortion	:	For Demodulation band width = 300Hz to 15kHz, De-emphasis = 50μs, Modulation frequency = 1kHz, and Deviation = 75kHz 1) ≦ 0.05% (RF 10.7±1MHz, 75 to 110MHz) 2) ≦ 0.1% (Other RF values)
Incidental AM	:	For Modulation frequency = 1kHz and Deviation = 75kHz ≦ 0.5% (RF 10.7±1MHz, 75 to 110MHz)

[AM]

Settable	:	0 to 99.9%
Depth	:	0 to 80% Output ≦ 126dB
Resolution	:	0.1%
Display	:	3-digit readout
Accuracy	:	For 0 to 80% modulation 1) ≦ (Displayed value±5)% (RF 400kHz to 1.7MHz) 2) ≦ (Displayed value±10)% (Other RF values)
External modulation frequency characteristics	:	50Hz to 20kHz; 1kHz reference ±1dB (RF = 400kHz to 1.7MHz) 50Hz to 10kHz; 1kHz reference ±1dB (other RF values)

Distortion : For Demodulation band width = 50Hz to 15kHz,
Modulation frequency = 1kHz, and Depth = 30%

1) ≦ 0.3% (RF = 400kHz to 1.7MHz)
2) ≦ 1% (Other RF values)

Incidental FM : For Modulation frequency = 1kHz, Depth = 30% and
Output ≦ 126dB
≦ 75Hz

o Setting Functions : 1) The numeric keys and rotary knob (with cursor
designation) for specifying carrier frequency,
output level, modulation mode, and memory
2) Step keys for specifying carrier frequency,
output level, and modulation level
3) Preset keys for specifying 3.5kHz, 22.5kHz,
and 75kHz (for FM) and 30% (for AM)

o 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

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

o 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.

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

o Range Out (dummy antenna switching output):

"1" (5V MAX 50mA) for RF ≧ 35MHz
"0" (0V) for RF < 35MHz

—7—

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

o Backup Battery is provided.

o Power Source   : AC 100, 115, 215, 230V ±10%
                         (selected by a switch on rear panel)

   Frequency   : 50Hz/60Hz

   Power dissipation : Approx. 60VA

o Size and Weight

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

                         445(W) × 119(H) × 355(D) mm (Full envelope)
                         (17.52(W) × 4.69(H) × 13.98(D) in.)

   Weight   : Approx. 10 kg (22 lbs)

o Environmental Conditions (temperature and humidity)

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

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

o Accessories   : Ouptut cable (SA550)   1
                         Power supply cord   1
                         Fuse (1.5 A)   1
                         Fuse (0.8 A)   1
                         Operation manual   1

o Parallel Interface : Factory-installed option

                         *Note: GP-IB interface is not used together
                                with Parallel interface.*

3. PREPARATION FOR USE

3.1 Unpacking and Inspection

Before being shipped from the factory, the KSG4200 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 KSG4200, 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.

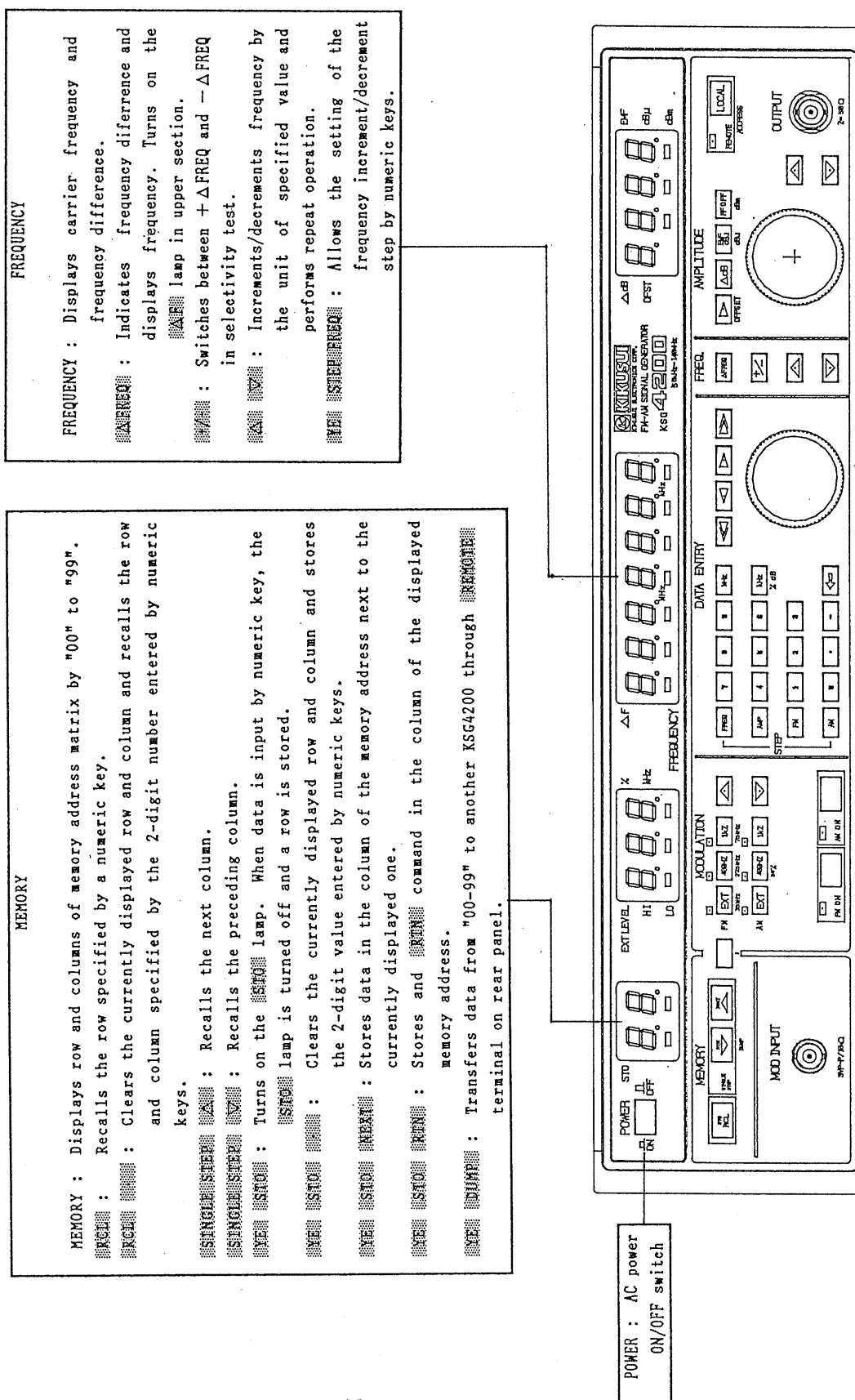| Setting Position	Center Voltage	Line Voltage Range	Fuse
A	100V	90 - 110V	1.5A
B	115V	104 - 126V	
C	215V	194 - 236V	0.8A
D	230V	207 - 253V	

3.3 Surrounding Temperature/Humidity, Warm-up Time, and Installation Place
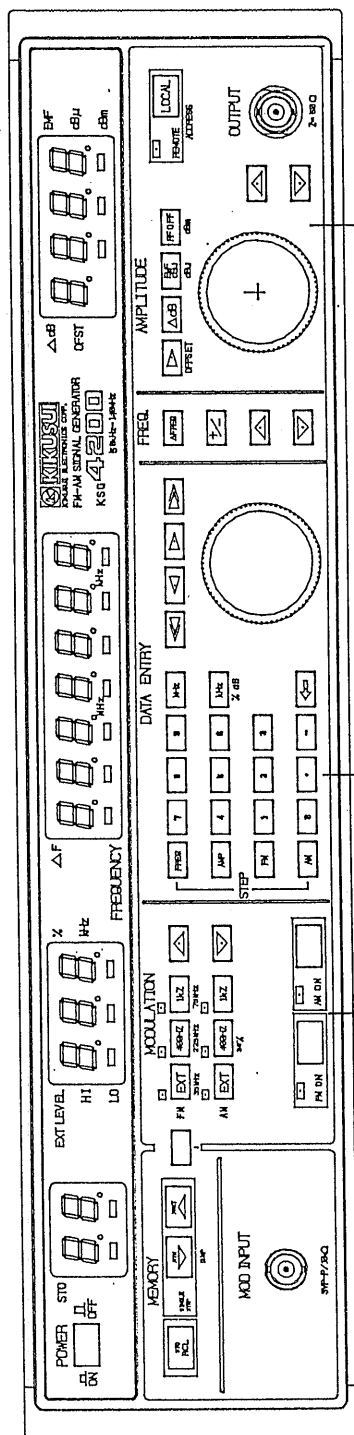
The KSG4200 operates correctly in temperatures from 0℃ to 40℃. If the instrument is used or placed under high temperature and humidity for a long time, failures will occur and the life of the instrument will be shortened.
The instrument requires the warm-up time of 30 minutes. Do not use the instrument near a strong magnetic field or electromagnetic waves.

4.1 Front Panel Features

FREQUENCY

FREQUENCY : Displays carrier frequency and frequency difference.

△FREQ : Indicates frequency difference and displays frequency. Turns on the △F lamp in upper section.

±△F : Switches between +△FREQ and −△FREQ in selectivity test.

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

STEP FREQ : Allows the setting of the frequency increment/decrement step by numeric keys.

MEMORY

MEMORY : Displays row and columns of memory address matrix by "00" to "99".

RCL : Recalls the row specified by a numeric key.

RCL : Clears the currently displayed row and column and recalls the row and column specified by the 2-digit number entered by numeric keys.

SINGLE STEP △ : Recalls the next column.

SINGLE STEP ▽ : Recalls the preceding column.

STO : Turns on the STO lamp. When data is input by numeric key, the STO lamp is turned off and a row is stored.

STO : Clears the currently displayed row and column and stores the 2-digit value entered by numeric keys.

STO NEXT : Stores data in the column of the memory address next to the currently displayed one.

STO RUN : Stores and RUN command in the column of the displayed memory address.

DUMP : Transfers data from "00-99" to another KSG4200 through REMOTE terminal on rear panel.

POWER : AC power ON/OFF switch

AMPLITUDE

AMPLITUDE : Displays RF output level by four digits.

◁▷ : Moves cursor.

ΔdB : Displays deviation of output level.

EMPH : Sets a unit.

ON/OFF : Turns ON/OFF output level.

LOCAL : Releases the instrument from remote control by GP-IB.

Rotary knob : Modifies the value at cursor position.

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

OUTPUT : BNC terminal for RF output. -20.0dBμ to 132.0dBμ at open circuit. The signal source impedance is 50Ω.

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

OFFSET : Displays the offset for dummy antenna, etc.

dBμ dBm : Sets a unit.

ADDRESS : Displays GP-IB address.

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.

FM : Allows the setting of FM deviation by numeric keys.

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

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

MHz kHz dBμ : Enter units.

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

◁▷ : Move cursor into block.

◁▷ : Move cursor within block.

Rotary knob : Modifies the value at cursor position.

MODULATION

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

MOD INPUT : External modulation input terminal for FM or AM single signal.

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

% : Indicates AM depth by the unit of 0.1%.

Hz : Indicates FM frequency deviation by the unit of 0.1kHz.

EXT FM/AM : Switches between external and internal modulation for FM and AM.

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

FM ON : Turns ON/OFF FM modulation.

AM ON : Turns ON/OFF AM modulation.

3.5kHz 22.5kHz 75kHz : Presets FM deviation at 3.5kHz, 22.5kHz, or 75kHz.

30% : Presets AM depth at 30%.

REMOTE : Connector to be used for controlling the front panel functions from external unit.

GP-IB : Connector to be used for controlling the instrument through GP-IB

RANGE OUTPUT : RCA type pin connector
The output signal is set to "1" (5V, 50mA) when carrier frequency is within the range from 35MHz to 140MHz; it is set to "0" when the carrier frequency is within the range from 50kHz to 35MHz. The output signals is used for switching output impedance and car radio dummy antenna.
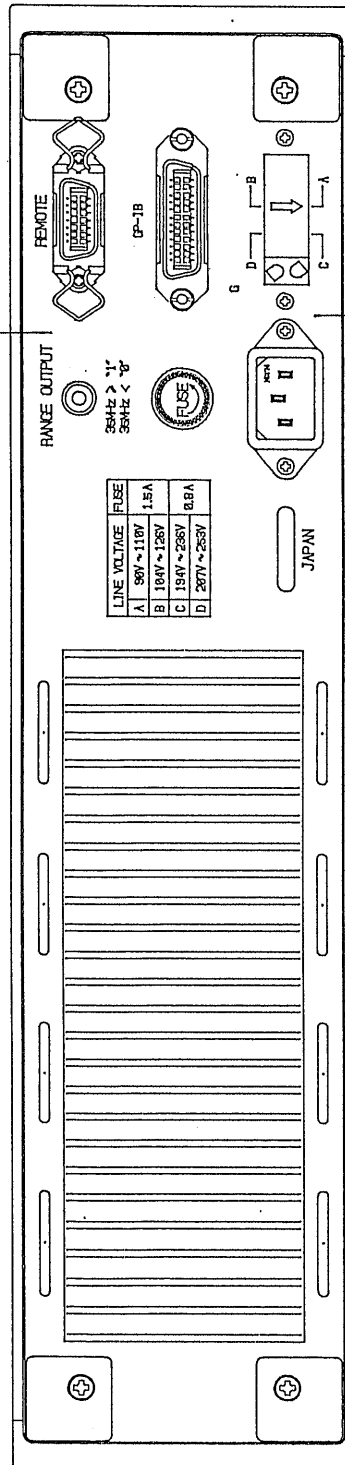
VOLTAGE SELECTOR: Selects voltage of the AC power source. Insert the plug to match the arrow to the AC line voltage.

AC connector : Plug for AC power source.

FUSE : Fuse for AC power source. Select the fuse that matches the AC line voltage.

LINE VOLTAGE		FUSE
A	90V~110V	1.5A
B	104V~126V	1.5A
C	194V~236V	0.8A
D	207V~253V	0.8A

4.3 Turning on the Power Supply

Connect the power supply cord 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.

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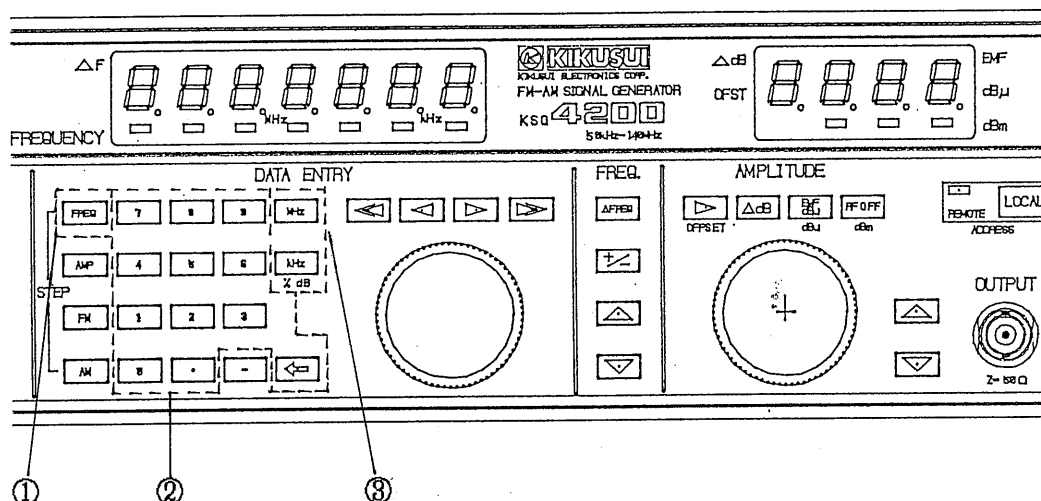
Press the ▓FREQ▓ key and enter a desired value by numeric keys (0~9, ·). Press keys in the order of ①, ②, and ③ in the above chart. If a key outside of the frame ┆ ┆ is pressed, the value found before the ▓FREQ▓ key was pressed is displayed.

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 7; a value of more than seven 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▓, ▓FM▓, or ▓AM▓ 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: 123.4567MHz is input.

| | ✕ ..... Undefined |
| | ⌣ ..... Turned off |

Key operation   FREQUENCY display

FREQ   ✕✕✕.✕✕✕.✕ Previous value

1   1 ⌣ ⌣ ⌣ ⌣ ⌣ ⌣

2   1 2 ⌣ ⌣ ⌣ ⌣ ⌣

3   1 2 3 ⌣ ⌣ ⌣ ⌣

.   1 2 3 . ⌣ ⌣ ⌣ ⌣

4   1 2 3 . 4 ⌣ ⌣ ⌣

5   1 2 3 . 4 5 ⌣ ⌣

6   1 2 3 . 4 5 6 ⌣

7   1 2 3 . 4 5 6 7

MHz   1 2 3 . 4 5 6 . 7

(b)   Example: 455kHz is input.

Key operation   FREQUENCY display

FREQ   1 2 3 . 4 5 6 . 7

4   4 ⌣ ⌣ ⌣ ⌣ ⌣ ⌣

5   4 5 ⌣ ⌣ ⌣ ⌣ ⌣

5   4 5 5 ⌣ ⌣ ⌣ ⌣

kHz   ⌣ ⌣ ⌣ 4 5 5 . 0

(c)   Example: 11MHz was to be input, but 12MHz was input by
                mistake.

Key operation   FREQUENCY display

FREQ   ⌣ ⌣ ⌣ 4 5 5 . 0

1   1 ⌣ ⌣ ⌣ ⌣ ⌣ ⌣

2   "2" was pressed   1 2 ⌣ ⌣ ⌣ ⌣ ⌣
      for "1" by mistake

⇐   1 ⌣ ⌣ ⌣ ⌣ ⌣ ⌣

1   1 1 ⌣ ⌣ ⌣ ⌣ ⌣

MHz   ⌣ 1 1 . 0 0 0 . 0

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: 85.7MHz was to be input, but an error was made
                during the input.

Key operation	FREQUENCY display
FREQ	⌣1 1.0 0 0.⌣
8	8⌣⌣ ⌣⌣⌣ ⌣
6 "6" was pressed for "5" by mistake	8 6⌣ ⌣⌣⌣ ⌣
·	8 6. ⌣⌣⌣ ⌣
7	8 6.7⌣⌣⌣ ⌣
⊖ Press twice	8 6⌣ ⌣⌣⌣ ⌣
⊖ Press twice	⌣1 1.0 0 0.0

If the ⊖ key is pressed before the key (MHz or kHz),
the previous frequency is displayed.

8	8⌣⌣ ⌣⌣⌣ ⌣
5	8 5⌣ ⌣⌣⌣ ⌣
·	8 5. ⌣⌣⌣ ⌣
7	8 5.7⌣⌣⌣ ⌣
MHz	⌣8 5.7 0 0.0

(e) Example: 11MHz was input for 1MHz by mistake.

Key operation	FREQUENCY display
FREQ	⌣8 5.7 0 0.0
1	1⌣⌣ ⌣⌣⌣ ⌣
1	1 1⌣ ⌣⌣⌣ ⌣
MHz	⌣1 1.0 0 0.0
1	1⌣⌣ ⌣⌣⌣ ⌣
MHz	⌣⌣1.0 0 0.0

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 andabove the cursor position in the [FREQUENCY] display section. If thecursor 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 100MHz to 100.02MHz

The mark "_" denotes the cursor position

Key operation		FREQUENCY display
		1 0 0 . 0 0 0 . 0
◁	Press once	1 0 0 . 0 0 0 . 0
Turn the rotary knob clockwise by two steps		1 0 0 . 0 2 0 . 0

(b) Example: To change frequency from 100.02MHz to 98.02MHz

Key operation		FREQUENCY display
		1 0 0 . 0 2 0 . 0
◁	Press twice	1 0 0 . 0 2 0 . 0
Turn the rotary knob counterclockwise by two steps		⌣ 9 8 . 0 2 0 . 0

4.4.3 Setting frequency step for [△] and [▽] keys

Set a desired step value (minimum 100Hz) 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.
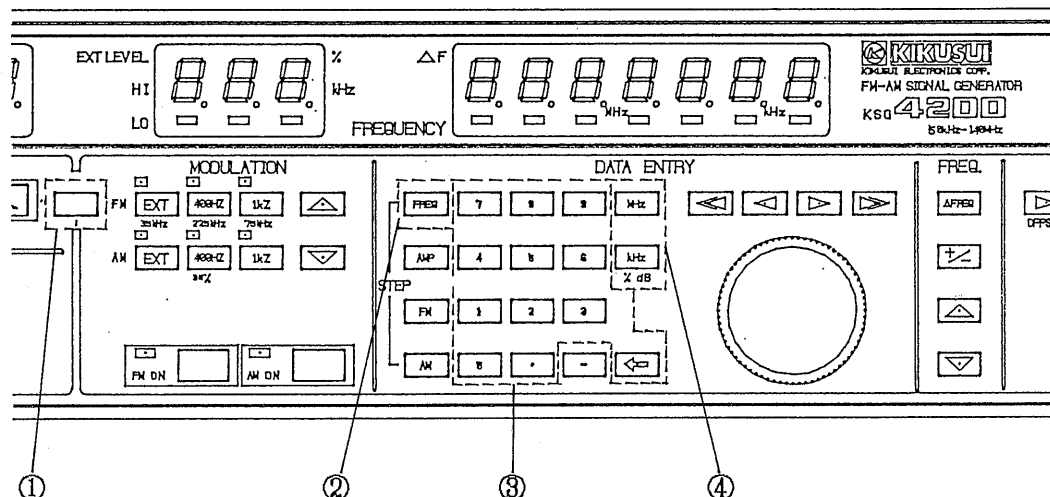
Input the step value in the order of ①, ②, ③, and ④ shown in
the above chart.
The [YE] key in the explanation below means the yellow key of
number ①. This key functions as a shift key; the function of a
yellow key on the panel pressed after the [YE] key is different
from that of the same key pressed without [YE] key.

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

Key operation	FREQUENCY display
[YE]	⌣⌣1.0 0 0.0
[STEP FREQ]	⌣⌣1.0 0 0.0
[9]	9⌣⌣ ⌣⌣⌣ ⌣
[kHz]	⌣⌣1.0 0 0.0
[△] Press once	⌣⌣1.0 0 9.0

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: 100MHz is set currently.

Key operation	FREQUENCY display	
▨TC▨ ▨STEP FREQ▨	××× ××× ×	
▨1▨	1 ⌣⌣ ⌣⌣⌣ ⌣	
▨0▨	1 0 ⌣ ⌣⌣⌣ ⌣	
▨0▨	1 0 0 ⌣⌣⌣ ⌣	
▨kHz▨	××× ××× ×	
▨FREQ▨	××× ××× ×	
▨1▨	1 ⌣⌣ ⌣⌣⌣ ⌣	
▨0▨	1 0 ⌣ ⌣⌣⌣ ⌣	
▨0▨	1 0 0 ⌣⌣⌣ ⌣	
▨MHz▨	1 0 0 . 0 0 0 . 0	
▨ΔFREQ▨	⌣⌣⌣ 1 0 0 . 0	ΔF indicator comes on
[FREQUENCY] ▨▽▨	− ⌣⌣ 1 0 0 . 0	Carrier frequency 99.9MHz
▨⊖▨	⌣⌣⌣ ⌣⌣ 0 . 0	

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 100kHz. If the ▨⊖▨ key is pressed in the above example, the carrier frequency returns to the initial value (center value).

(b) Example: 100MHz is set currently.

Key operation   FREQUENCY display
                                  1 0 0 . 0 0 0 . 0
[△FREQ]   ⌣⌣⌣ ⌣⌣0 . 0   △F indicator
                                                  comes on

[◁]   Press three   ⌣⌣⌣ ⌣⌣0 . 0
             times

(rotary   Turn the rotary   − ⌣5 . 0 0 0 . 0   Carrier
 knob)   frequecy
             knob counter-   95 MHz
             clockwise by
             five steps

[△FREQ]   ⌣9 5 . 0 0 0 . 0

To release the △FREQ function, press the [△FREQ] key again.
In the above example, the carrier frequency effective after
the release is 95MHz.

(c) Example: Using [＊/−] key after modification of 100MHz by
               △FREQ

Key operation   FREQUENCY display
                                  1 0 0 . 0 0 0 . 0
[△FREQ]   ⌣⌣⌣ ⌣⌣0 . 0   △F indicator
                                                  comes on

       [2]   2 ⌣⌣ ⌣⌣⌣ ⌣
       [0]   2 0 ⌣ ⌣⌣⌣ ⌣
       [0]   2 0 0 ⌣⌣⌣ ⌣
       [kHz]   ⌣⌣⌣ 2 0 0 . 0   Carrier
                                                  frequency
                                                  100.2MHz

       [＊/−]   − ⌣⌣ 2 0 0 . 0   Carrier
                                                  frequency
                                                  99.8MHz

[△FREQ] or   ⌣9 9 . 8 0 0 . 0
[FREQ]

−19−

4.5 Setting Output Level

4.5.1 Setting output level by numeric keys
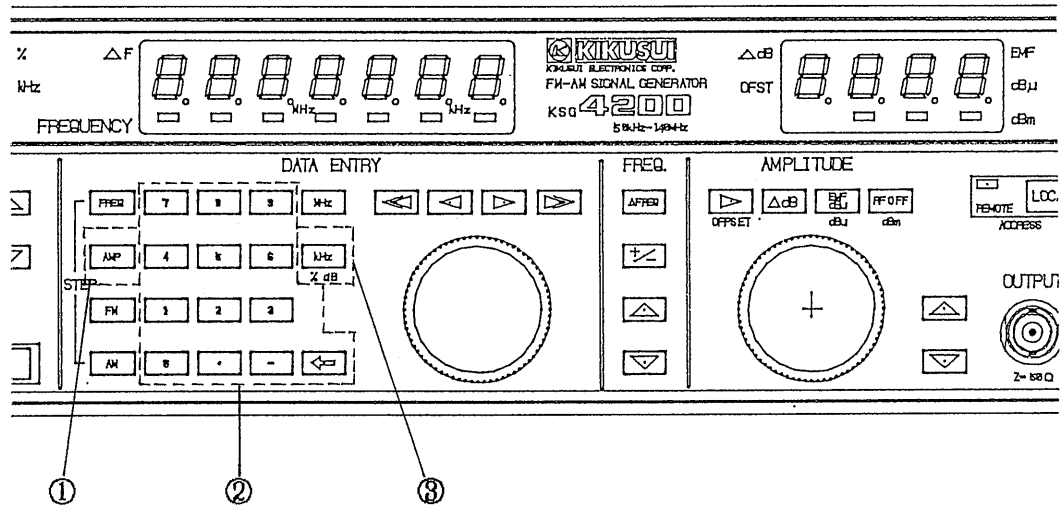
Press the ░AMP░ key and enter a desired value by numeric keys
(0～9, · , −).
Press keys in the order of ①, ②, and ③ in the above chart.
If a key outside of the frame [_____] is pressed, the value
displayed before the ░AMP░ key was pressed is displayed again.
After entering a value by numeric keys, press the ░dB░ (░kHz░)
key. Then, the value is displayed in the [AMPLITUDE] section
correctly.

(a) Example: To set 10dB

Key operation	AMPLITUDE display	
░AMP░	×××.×	..... Previous value
░1░	1 ⌣⌣ ⌣	
░0░	1 0 ⌣ ⌣	
░dB░	⌣1 0 . 0	

(b) Example: To set −5dB

Key operation	AMPLITUDE display
░AMP░	⌣1 0 . 0
░−░	− ⌣⌣ ⌣
░5░	− 5 ⌣ ⌣
░dB░	−⌣5 . 0

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

(c) Example: 120dB was to be set, but an error was made during
the setting (Unit = EMF dBμ)

     Key operation   AMPLITUDE display

       [AMP]   − ⌣ 5 . 0

       [1]   1 ⌣⌣ ⌣

       [3] "3" was pressed for 1 3 ⌣ ⌣
           "2" by mistake

       [⇐]   1 ⌣⌣ ⌣

       [2]   1 2 ⌣ ⌣

       [0]   1 2 0 ⌣

       [dB]   1 2 0 . 0

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 [▷] key for moving the cursor. Turn the rotary knob
clockwise, and the output level will increase; turn it
counterclockwise, and the output level will decrease.
There is no need to press the [dB] ([kHz]) key when making
setting with the Rotary knob.

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

                       The mark "_" denotes the cursor position
     Key operation   AMPLITUDE display
                         ⌣ 4 <u>6</u> . 0

       [▷] Press twice

                         ⌣ 4 <u>6</u> . 0

        Turn the rotary   ⌣ <u>6</u> 6 . 0
        knob clockwise by
        two steps

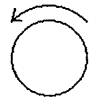(b) Example: To change output level from 66dB to 60dB

Key operation   AMPLITUDE display

                                            ⌣6̲ 6 . 0

▷ Press once   ⌣6 6̲ . 0
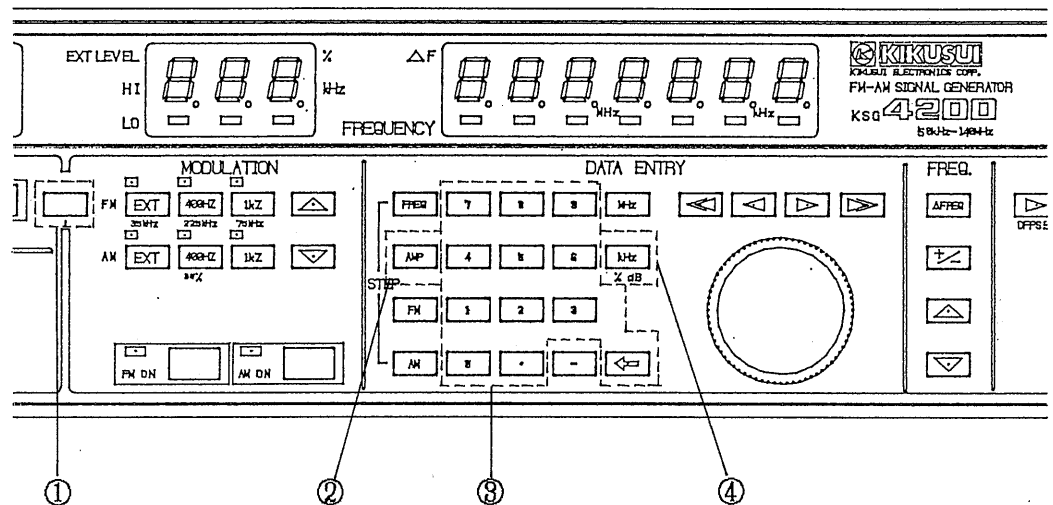
Turn the rotary   ⌣6 0̲ . 0
knob counterclock-
wise by six steps

4.5.3 Setting output level step for △ and ▽ keys

Set a desired step value (minimum 0.1dB) 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 46dB

Key operation   AMPLITUDE display

YE STEP AMP   ⌣4 6 . 0

2   2 ⌣⌣ ⌣

dB   ⌣4 6 . 0

△ Press once   ⌣4 8 . 0

To change the output level continuously by the step of 2dB,
keeppressing the [AMPLITUDE] △ or ▽ key. When the key
remains pressed, a repeat function is applied.

4.5.4 Setting offset value

The offset function is used for compensating the gain in amplifier and loss in dummy antenna and cable.

To set an offset value for the output level, press the █AMP█ key, numeric keys (█0~9█,█.█-█) and █YE█ █OFFSET█. When █YE█ █OFFSET█ is pressed, the offset output level is displayed.

(a) Example: To give −6dB offset to 100 EMF dBµ

Key operation	AMPLITUDE display	
█AMP█	1 0 0 . 0	
█-█	− ⌣ ⌣ ⌣	
█6█	− 6 ⌣ ⌣	
█YE█ █OFFSET█	1 0 0 . 0	
█YE█ █OFFSET█	⌣ 9 4 . 0	OFST indicator is turned on

To release offset

█YE█ █OFFSET█	1 0 0 . 0	OFST indicator is turned off

4.5.5 Output level difference █Δ dB█ key

The Δ dB function, to check the value of change in output level, is useful for measuring the band width of a receiver and attenuation characteristic of a filter.

Note that the █Δ dB█ indicator in the [AMPLITUDE] section is turned on when the █Δ dB█ key is pressed.

(a) Example: The current output level is 54 EMF dBμ.

Key operation		AMPLITUDE display	
		⌣54.0	
△dB		⌣⌣0.0	△dB indicator is turned on
(rotary knob)	Turn the rotary knob counterclockwise by 16 steps	−16.0	
△dB		⌣38.0	To release the △dB function, press △dB again.

4.5.6 RF OFF key

When the RF OFF key is pressed, the RF output signal is turned off and "OFF" is displayed in the [AMPLITUDE] section.

4.5.7 Setting unit key

(a) EMF dB : Open circuit voltage −20dB to 132dB

Press the EMF dBμ key, and the EMF dBμ indicator in the [AMPLITUDE] section is turned on.

(b) dBμ: Loaded voltage −26dB to 126dB

Press the YE dBμ key, and the dBμ indicator in the [AMPLITUDE] section is turned on.

(c) dBm: Power indication −133dBm to 19dBm

Press the YE dBm key, and the dBm indicator in the [AMPLITUDE] section is turned on.

4.5.8 Unit of output level

The units of output level used for the KSG4200 are as follows:

(a) EMF dBμ (open-circuit voltage)

The voltage e_0 in the above chart is normalized by "0dBμ = 1μVrms".

(b) dBμ (loaded voltage)

The voltage e_1 in the above chart is normalized by "0dBμ = 1μVrms".

(c) dBm (power indication)

The power consumed by R2 in the above chart is normalized by

"0dBm = $\sqrt{1mW \times 50\Omega}$ = 0.2236V rms".

4.6 Setting the Modulation

4.6.1 YE key

a) Press YE 30%, and the AM depth is set to 30%.

b) Press YE 3.5kHz, and the FM peak frequency deviation is set to 3.5kHz.

c) Press YE 22.5kHz, and the FM peak frequency deviation is set to 22.5kHz.

d) Press YE 75kHz, and the FM peak frequency deviation is set to 75kHz.

4.6.2 Setting modulation source

Press a modulation source switching key, and the corresponding indicator is turned on.
Keys ① and ② turn ON/OFF FM and AM respectively. Each time the key is pressed, the relevant modulation is turned on and off alternately.
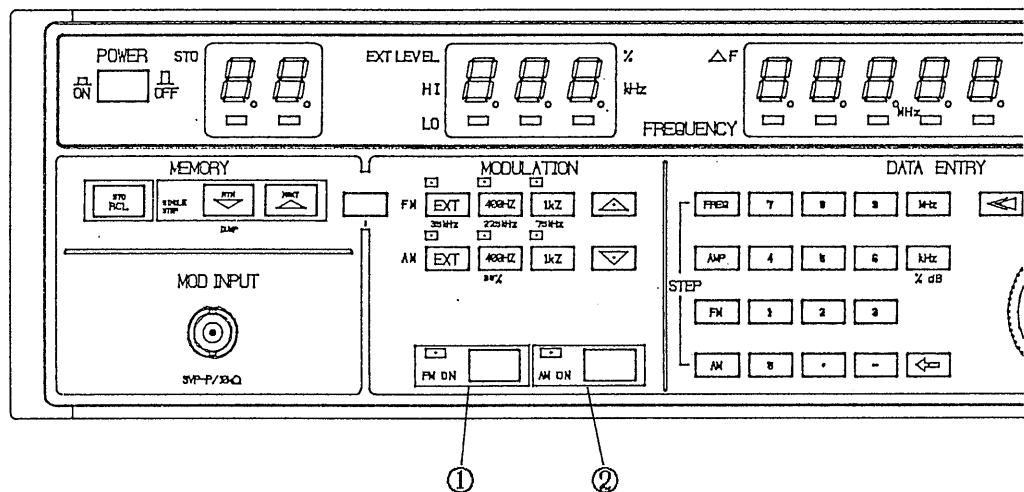
(a) Example: 75kHz deviation is to be set for 400Hz internal FM
              source

          Key operation   MODULATION display

              ▓FM 400Hz▓   ▓400Hz▓ indicator is on

                                  ××.× ... Previously set value

                  ▓FM▓   ▓kHz▓ indicator is on

                  ▓7▓   7 ◡ ◡

                  ▓5▓   7 5 ◡

                ▓kHz▓   7 5 . 0

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

     The modulation is terminated when key ① or ② is pressed
     and the FM ON indicator is turned off. At this time, 0.0kHz
     is displayed in the [MODULATION] section.

4.6.3 Setting modulation by numeric keys
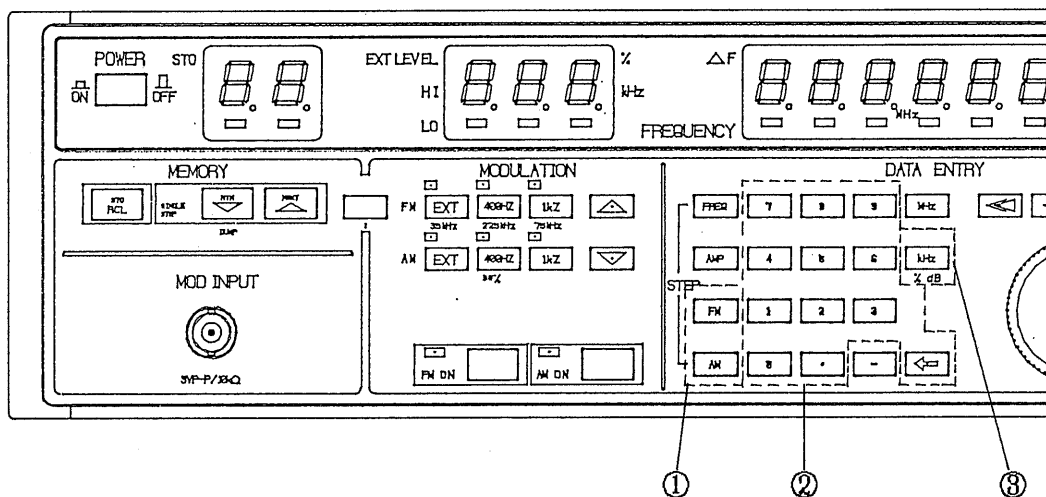
Press keys in the order of ①, ②, and ③ in the above chart.

First, press the ▓FM▓ or ▓AM▓ key in [DATA ENTRY] section, and
the previously set modulation factor is displayed with unit in
the [MODULATION] section.
Enter a desired value with numeric keys (▓0~9▓▓). After
entering the value, press ▓kHz▓ for FM and ▓%▓ (▓kHz▓) for AM.
Then, the value is displayed in the [MODULATION] section with the
specified unit.

Any value may be input by the numeric keys, but the following relationship between carrier frequency and FM deviation range and resolution must be observed:

Carrier frequency	Deviation range	Resolution
50kHz ～ 2.99999MHz	0～30kHz	100Hz
3.0MHz ～ 32.4999MHz	0～99.9kHz	100Hz
32.5MHz ～ 64.9999MHz	0～50kHz	100Hz
32.5MHz ～ 64.9999MHz	51～99kHz	1kHz
65.0MHz ～ 140MHz	0～99.9kHz	100Hz

The maximum AM depth is 99.9% and minimum depth is 0.1%.

(a) Example: To set FM 25kHz

Key operation	MODULATION display
FM	××.×.... Previously set value "kHz" is displayed as unit
2	2 ᵕ ᵕ
5	2 5 ᵕ
kHz	2 5 . 0

(b) Example: To set AM 30% after the above operation

| Key operation	MODULATION display
AM	××.×.... Previously set value "%" is displayed as unit
3	3 ᵕ ᵕ
0	3 0 ᵕ
%	3 0 . 0

4.6.4 Flashing in [MODULATION] section

If the FM deviation specified by the user is not within the range determined by carrier frequency, an error is reported in one of the three ways described below and the modulation cannot be executed.
When this happens, set the deviation again within the allowable range.

(1) The frequency deviation value cannot be entered when it is changed to a value beyond the allowable range.

(2) The value displayed in the [MODULATION] section flashes when it is not within the allowable range because the carrier frequency has been changed.

(3) The kHz unit indicator flashes when the AM indicator in the [MODULATION] section is on for (2).

For example, when the carrier frequency is 4.5 MHz and FM deviation is 50kHz, the value "50" is displayed in the [MODULATION] section. If the carrier frequency is reduced to 2.99999MHz or lower, the value "50" flashes in the [MODULATION] section and theoutput signal is not modulated.

4.6.5 Rotary knob

The rotary knob can modify the FM deviation and AM depth by increasing or decreasing the value of the digit at the cursor position in [MODULATION] section. When the cursor is not found in the [MODULATION] 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 FM deviation from 25kHz to 35kHz
           (when carrier frequency is 3MHz or higher)

                              The mark "_" denotes cursor
                                             position
     Key operation   MODULATION display
        [FM]
                                 2 5̲ . 0
      [◁]   Press once   2̲ 5 . 0

             Turn the rotary
      ⟳   knob clockwise   3̲ 5 . 0
             by one step

(b) Example: To change AM depth from 30% to 25%
     Key operation   MODULATION display
        [AM]   3̲ 0 . 0
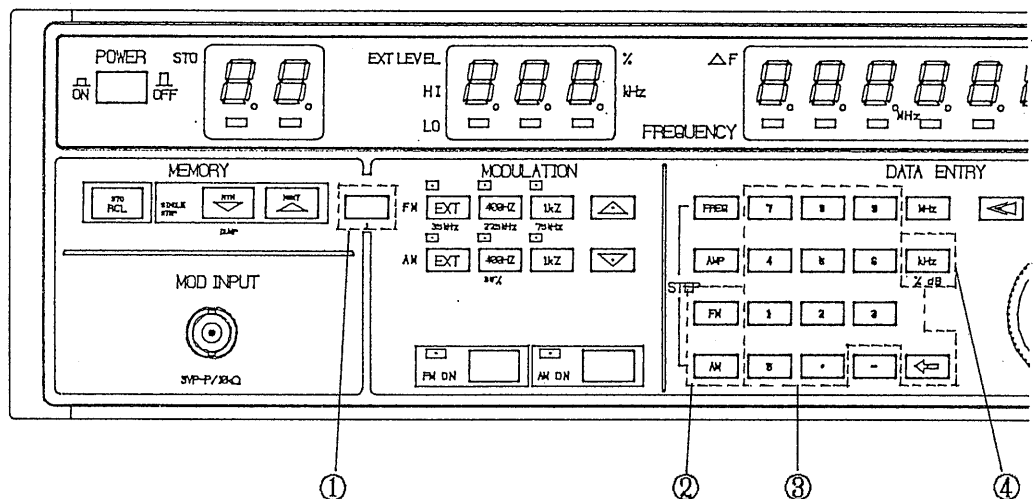   [▷]   Press once   3 0̲ . 0

             Turn the rotary
      ⟲   knob counter-   2 5̲ . 0
             clockwise by
             five step

4.6.6 Setting modulation step for [△] and [▽] keys

Set a desired step value (minimum 0.1kHz or 0.1%) for the
[MODULATION] [△] and [▽] keys, and the modulation 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 2.5kHz as FM step

        Key operation   MODULATION display
        ▓YE▓ ▓STEP▓FM▓   7 5 . 0   kHz
             ▓2▓   2 ⌣ ⌣
             ▓.▓   2 . ⌣ ⌣
             ▓5▓   2 . 5 ⌣
             ▓kHz▓   7 5 . 0
             ▓△▓ Press once   7 7 . 5

To increment or decrement the FM deviation continuously by
the unit of the specified value, keep pressing the
[MODULATION] ▓△▓ or ▓▽▓ key. When the key remains
pressed, a repeat function is applied. The AM depth can be
incremented/decremented in the same way as FM deviation.

4.6.7 External modulation signal connection and setting

(1) Connection and setting method

     Connect the external modulation signal source to ▓MOD▓
     ▓INPUT▓ 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.

(2)   Setting range
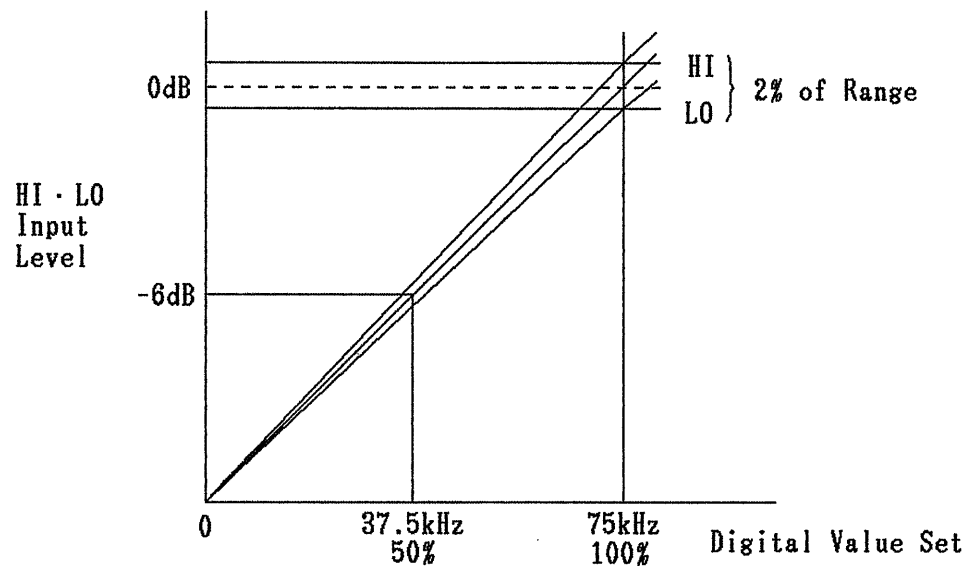
The above chart shows the relationship between modulation
and input level. When the input level is adjusted to the
range of :HI: and :LO:, it is set within the error range of
±2%.   The modulaion is converted into a digital value
internally on the basis of this input level. Whether the
input signal is 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.
For example, after setting the input level within the range
of :HI: and :LO: and the FM peak frequency deviation to
75kHz, attenuate the input level by −6dB.
Then, 75kHz remains displayed but the actual peak freauency
deviation is reduced to 37.5kHz. At this time, the :LO:
lamp is turned on, but modulation is done correctly at the
peak freauency deviation of 37.5kHz.
When the input level is set within the range of :HI: and
:LO:, the :HI: and :LO: lamps are turned off, but when
the :MAIN:, :LEFT:, :RIGHT:, and :SUB: switches of the
stereo signal generator are manipulated, the :HI: and :LO:
lamps may be turned on alternately.
Since the range of :HI: and :LO: is very narrow, the :HI:
and :LO: lamps may be turned on alternately but that does not
mean a serious error.

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 address    2-digit 7-segment display
     00   01   02   03   04   05   06   07   08   09
     10                                            .
     20                                            .
     30                                            .
     40                                            .
     50                                            .
     60                                            .
     70                                            .
     80                                            .
     90  . . . . . . . . . . . . . . . . . .  99
```

Basically, the recall operation means to call the row number by the [RCL] key and numeric key ([0]~[9]) and to call the column number by the [MEMORY] [△] key.

Also, a memory row and column can be called directly by the entry ofa 2-digit number by numeric keys ([0]~[9]) after clearing the [MEMORY] display by the [RCL] and [ ] kyes.

When repeating the recall operation continuously, it is only necessary to press the [RCL] key the first time.

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 explained in Section 4.7.2:

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

                                                       MEMORY display

[RCL] key, [ ] 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 times   "85"

(d) Example: To recall memory address "56" directly

   Press the ▓RCL▓ and ▓▓▓▓ keys, and the [MEMORY] display is
   cleared. Press the numeric keys ▓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 functions specified on front panel can be stored in
the memory addresses allocated in the form of a matrix as
described in Section 4.7.1, but <u>the step values of carrier
frequency, output level, and modulation factor, ΔFREQ function,
and RF ON/OFF function</u> cannot be stored.
The basic store operation is to set data such as carrier
frequency, output level, modulation level, and modulation type
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 number by numeric keys after
clearing the [MEMORY] display by ▓YE▓ and ▓▓▓▓.

(a) Example: To store 1MHz carrier frequency, 76 EMF dBμ
            output level, 1kHz internal modulation source,
            and 30% AM depth into memory address"10"

   ① ▓FREQ▓   ×××.×××.×
      ▓▓▓▓   1 ⌣⌣ ⌣⌣⌣ ⌣
      ▓MHz▓   ⌣⌣1.0 0 0.0

   Besides the above method, the carrier frequency may be set
   by the rotary knob or [FREQUENCY] ▓▲▓ or ▓▼▓ key.

② ▨AMP▨   ××× ×
   ▨7▨   7 ⌣⌣ ⌣
   ▨6▨   7 6 ⌣ ⌣
   ▨dB▨   ⌣7 6 . 0

Besides the above method, the output level may be set by
the rotary knob or [AMPLITUDE] ▨△▨ or ▨▽▨ key.

③ ▨AM▨, ▨1 kHz▨   ×× . ×
   ▨YE▨, ▨30%▨   3 0 . 0 %

Besides the above method, the modulation level and mode may
be set by numeric keys (▨0∼9▨) and modulation mode key.
Aftere setting 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▨, and ▨░▨.
   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 ▨░▨ key 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 addresses as "10" → "11" → "12"
→ "13" → "10" →"11"

Key operation   MEMORY display

     RCL 1 △ Press   "13"
            three times

     YE STO RTN   "14"   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 RTN key

The following two methods are available:

(1) Display "19" by RCL   "19"
     RCL . 1 9
     Press YE STO ▽   "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   "19"
            five times)
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 the 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 operation:
Display column number "9" in [MEMORY] section and press ▓YE▓, ▓STO▓, and ▓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:

→ "30" → "31" → . . . → "39" → "40" → "41" → . . . → "49" ⌐

4.7.6 How to release ▓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 continous 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 KSG4200

1) The 100-point memory data can be copied to another unit of KSG4200.

2) Memory data copying method

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

   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 KSG4200 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.
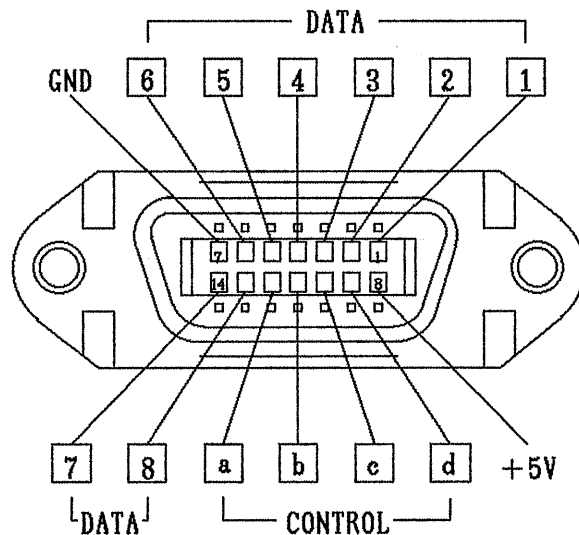
Figure 5-1

[Explanation of terminals]

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

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

The DATA terminals are used for connecting a bus to the rear panel of the KSG4200. 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 ░░░ - ░░░ 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
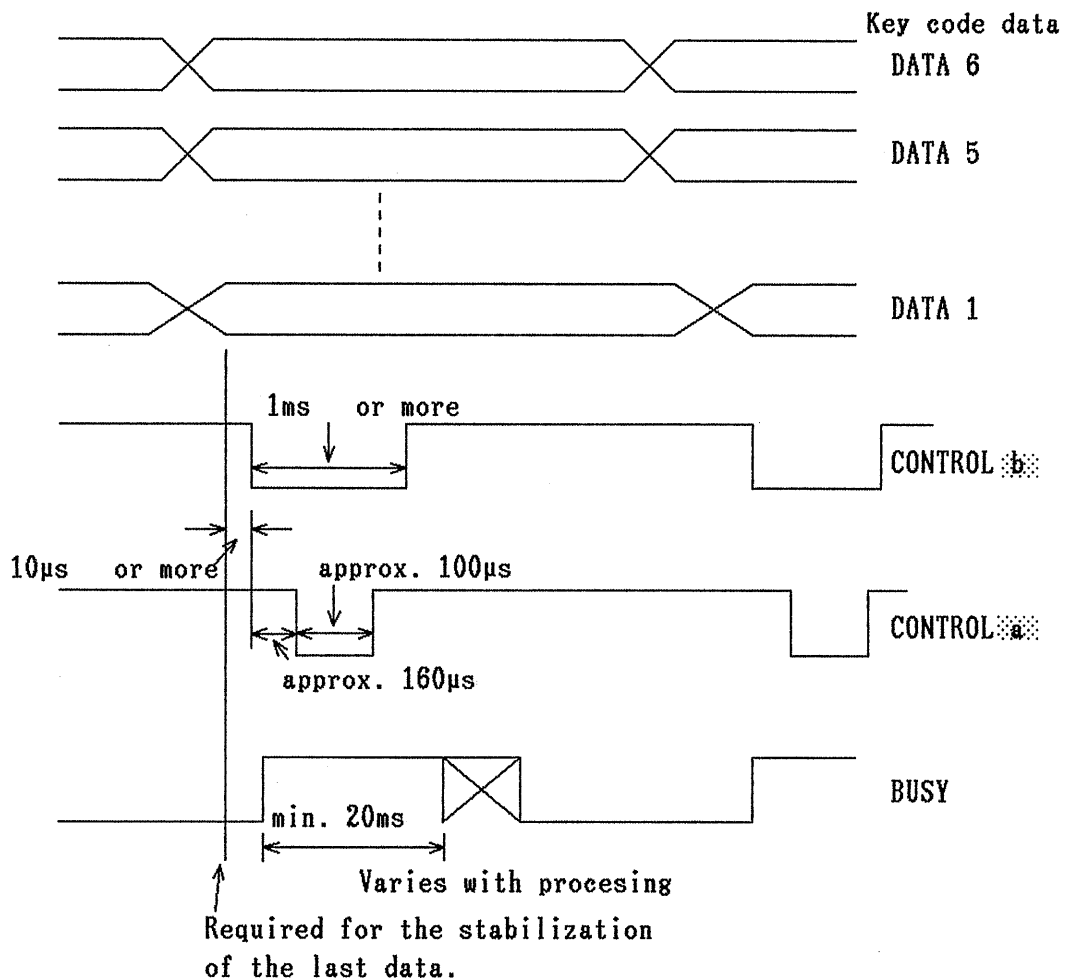
Figure 5-2

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 10μs or longer.

Then, set CONTROL ▓b▓ to "0" for 1ms or longer as shown in Figure 5-2.

Approximately 160μs after CONTROL ▓b▓ falls, CONTROL ▓a▓ is set to "0" for approximately 100μs.

During this period of approximately 100μs , 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 160μs), 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 is equivalent to pressing the panel key corresponding to the code.

Table 5-1

Key name	DATA 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
FM EXT	0	0	1	0	0	1
FM 400Hz	0	0	1	0	1	1
FM 1kHz	0	0	1	1	0	0
AM EXT	0	1	1	1	0	0
AM 400Hz	0	1	1	1	0	1
AM 1kHz	0	1	1	1	1	0
MODULATION △	1	0	1	0	1	0
MODULATION ▽	0	1	1	1	1	1
FM ON	0	0	1	1	1	0
AM ON	0	0	1	1	1	1
DATA ENTRY FREQ / STEP FREQ	0	1	0	0	1	0
DATA AMP / STEP AMP	0	1	0	0	1	1
DATA FM / STEP FM	0	1	0	1	0	0
DATA AM / STEP AM	0	1	0	1	0	1
DATA 0	1	1	0	0	0	0
DATA 1	1	1	0	0	0	1
DATA 2	1	1	0	0	1	0

(cont'd)

Table 5-2

Key name	MSB		← Key Code →			LSB
DATA 3	1	1	0	0	1	1
DATA 4	1	1	0	1	0	0
DATA 5	1	1	0	1	0	1
DATA 6	1	1	0	1	1	0
DATA 7	1	1	0	1	1	1
DATA 8	1	1	1	0	0	0
DATA 9	1	1	1	0	0	1
DATA	1	0	1	1	1	0
DATA	1	0	1	1	0	1
DATA ⇔	0	0	1	0	0	0
DATA MHz	0	1	0	1	1	0
DATA kHz 、 % 、 dB	1	0	0	1	0	1
DATA ≪◁	0	1	0	1	1	1
DATA ◁	1	1	1	1	0	0
DATA ▷	1	1	1	1	1	0
DATA ▷▷	0	1	1	0	0	0
DATA Rotary knob UP	0	0	0	0	0	0
DATA Rotary knob DOWN	0	0	0	0	0	1
FREQUENCY △ 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 CURSOR ▷	1	0	0	0	0	1
AMPLITUDE △ dB	1	0	0	0	1	0
AMPLITUDE EMF dBμ	1	0	0	0	1	1
AMPLITUDE RF OFF	1	0	0	1	0	0
AMPLITUDE △	1	0	0	1	1	0
AMPLITUDE ▽	1	0	0	1	1	1
AMPLITUDE Rotary knob UP	0	0	0	0	1	0
AMPLITUDE Rotary knob DOWN	0	0	0	0	1	1

5.2.4 Setting frequency by remote control (example)

The frequency of 82.5MHz is to be set.

1) Set the FREQ code "010010" according to the panel key code table (Table 5-1).

2) Send CONTROL ▓▓ which is set to "0" for 1ms or longer as shown in Figure 5-2 (input data timing).

3) Set the data "82.5" according to the code table and send CONTROL ▓▓ signal as shown in Figure 5-3.
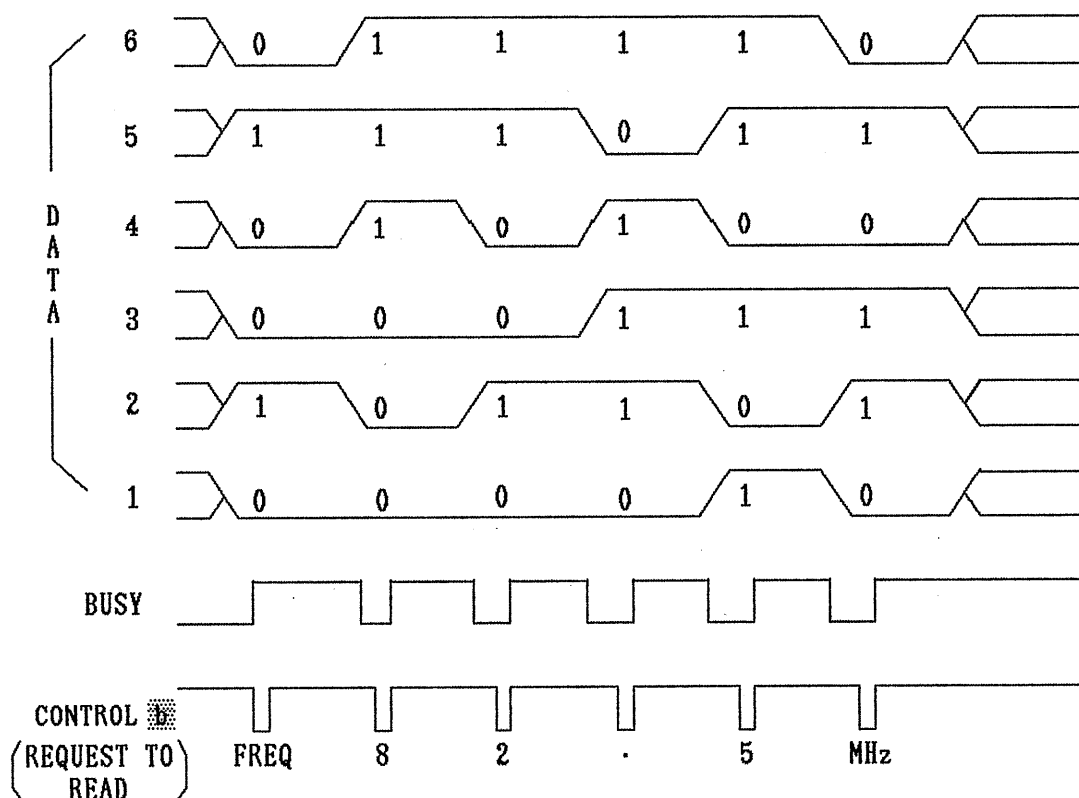
Figure 5-3

4) Finally, send "010110" for "MHz" with CONTROL ▓▓ signal, and the data transmission is completed.

5) When the signal generator receives the last data, namely, "010110" for "MHz" and CONTROL ▓▓, 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.

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

The chattering prevention circuit is omitted.
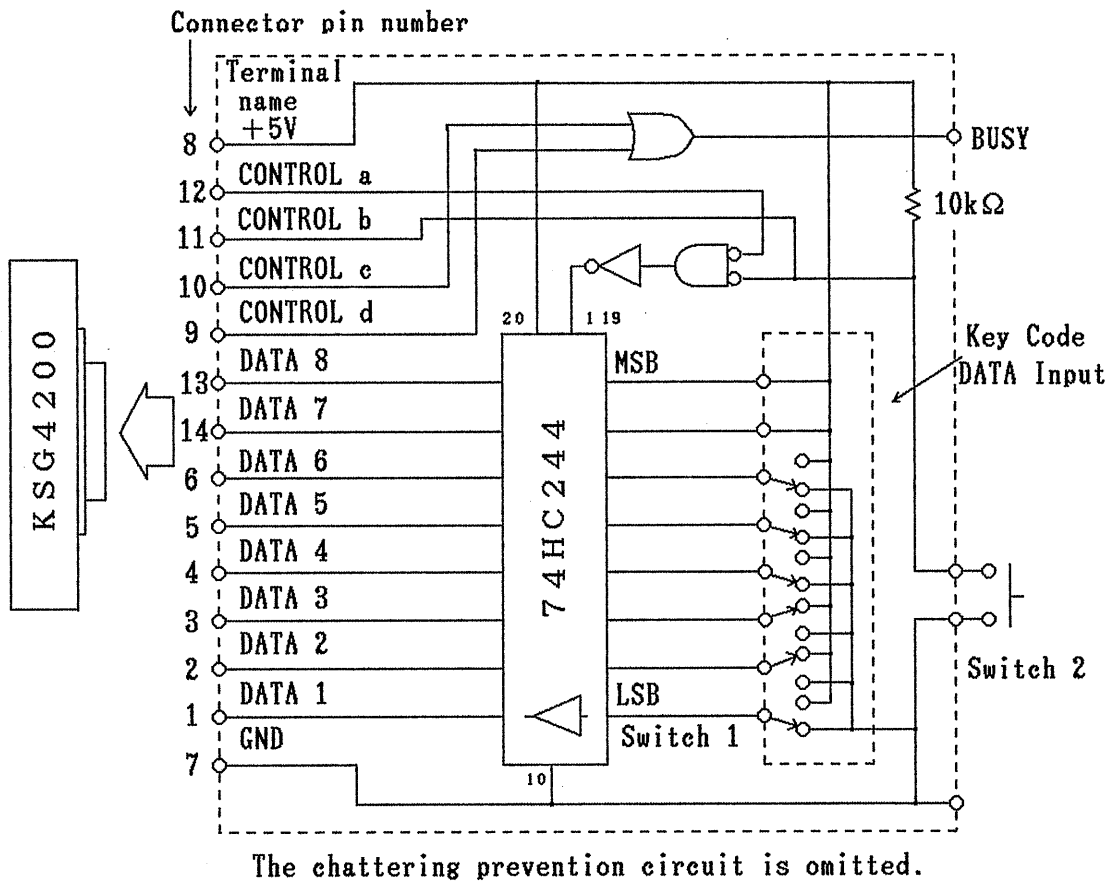
Figure 5-4

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 160µs 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 KSG4200 during the period of approximately 100µs 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 inremote 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 ▓ to "0" for more than 1ms.

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.
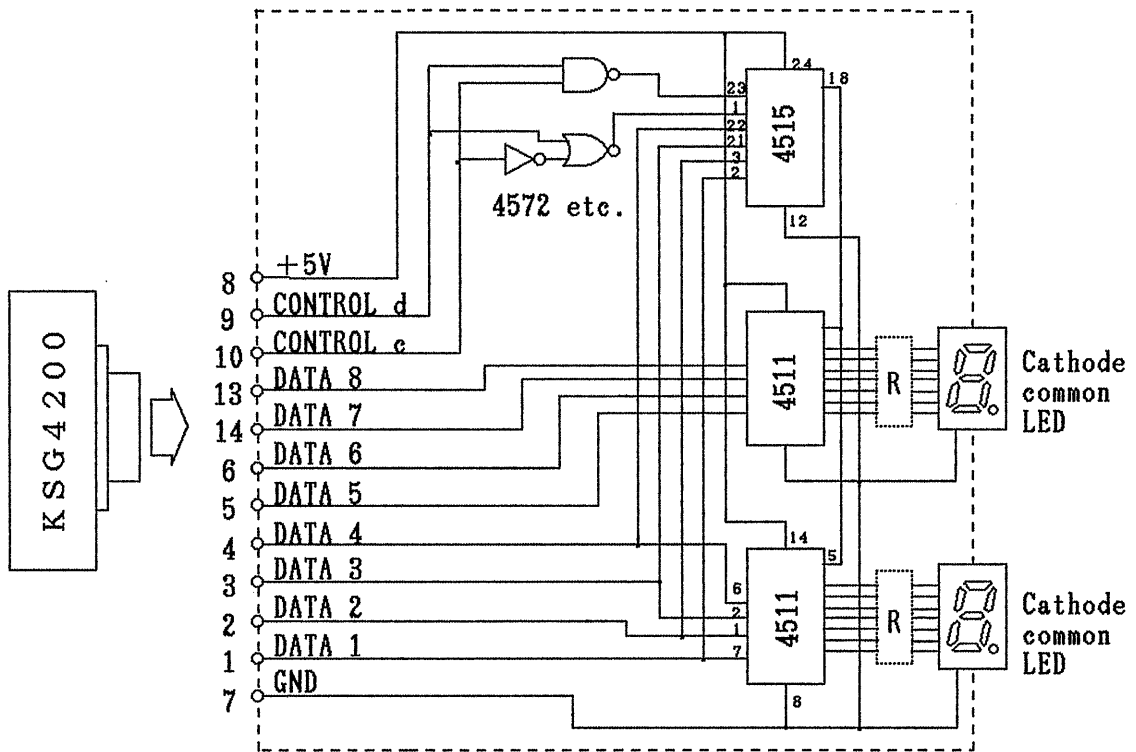
Figure 5-5

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. OUTPUT IMPEDANCE AND DUMMY ANTENNA SWITCHING SIGNAL

6.1 "RANGE OUTPUT" RCA Pin Connector

When the carrier frequency is within the range from 35.0000MHz to 140MHz, the output signal is set to "1" (5V, 50mA); when it is within the range from 10kHz to 34.9999MHz, the output signal is set to "0".

The output signal can be used as the control signal of an output impedance switch, dummy antenna for car radio, etc.
The current of 50mA is used for driving two reed relays.

7. BACKUP BATTERY AND INITIALIZING CPU

The KSG4200 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 the surrounding temperature, humidity, and storage conditions. After about five years, the discharge capability of the battery is reduced to approximately 90% of the initial capability. The battery is fully usable in this state, but when it becomes unusable, replace it with CADNIC BACKUP 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 five 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 the aluminum sash case, pull out the PC board, and replace the battery with a new one.

After replacing the battery, insert the PC board into the aluminum sash case and fasten the two screws. Then, turn on the power switch and initialize the CPU by pressing the initial set button.

8. GP-IB
(General Purpose Interface Bus)

8.1 Introduction

8.1.1 General description
The KSG4200 has a GP-IB interface, and it can be controlled by the IEEE 488 standard interface bus.

8.1.2 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.

8.2 Performance
8.2.1 Interface functions
SH0: No source handshake
AH1: Complete acceptor handshake
T0 : No Talker function
L1 : Basic listener, listen only mode
LE0: No extnded listener capability
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

8.2.2 Electrical specifications related to interface system
Compiles to IEEE Std 488-1975.

8.3 Operation Procedure

8.3.1 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 8.3.2.

3) Connect the GP-IB cable when the power is off.

8.3.2 Address setting method

The address of the KSG4200 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 8-1 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 8-1 shows how S2 is set for address "07".

S 2

'0'   ON   Device address setting valu

'1'   1 2 3 4 5 6 $2^0 + 2^1 + 2^2 = 7$
                               (1) (2) (3)
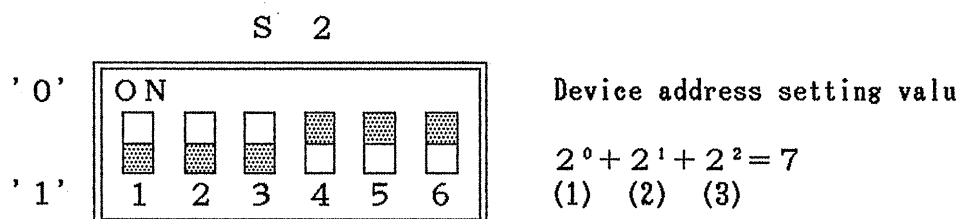
Figure 8-1

Table 8-1

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
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

The DIP-SW is set to "07" at the factory

DIP SW

1 = OFF   0 = ON

8.3.3 Available control command and bus line commands

Table 8-2

Control command 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.

8.3.4 Program code table

Set the measuring conditions for KSG4200 with the codes listed in Table 8-3.

Table 8-4 list the codes in alphabetical order, and Table 8-5 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 8-3 GP-IB Function Setting Method

Item	Program code	Data	Unit
Carrier frequency			
Carrier frequency	FR	○○.○	HZ, KZ, MZ
Output level unit			
EMF dBμ	EM	---	---
dBμ	DU	---	---
dBm	DM	---	---
Output level	AP	○○.○	DB
Output level OFF	R0	---	---
Output level ON	R1	---	---
Modulation			
AM depth	AM	○○.○	PC
AM depth	AM	○○.○	%
Amplitude modulation OFF	AMS5	---	---
FM peak frequency deviation	FM	○○.○	KZ
Frequency modulation OFF	FMS5	---	---
External modulation ON	S1AM, S1FM	---	---
Modulation signal source 400Hz	S2AM, S2FM	---	---
Modulation signal source 1kHz	S3AM, S3FM	---	---
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 8-4 GP-IB Program Codes

Alphabetical order

Program code	Explanation		Remarks
AM	Amplitude modulation		Function mode
AP	Output level		Function mode
DB	Unit	dB	Unit
DU	Output	dBµ	Function mode
DM	Output	dBm	Function mode
EM	Output	EMF dBµ	Function mode
FM	Frequency modulation		Function mode
FR	Carrier frequency		Function mode
HZ	Hz		Unit
KZ	kHz		Unit
MZ	MHz		Unit
PC	Modulation in percent		Unit
RC	Memory recall		Function mode
R0	Output level OFF		Function mode
R1	Output level ON		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
S5	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 8-5 GP-IB Program Code

Classified by function

Function	Program code
Carrier frequency	FR
Output level	AP
EMF dBμ	EM
dBμ	DU
dBm	DM
Output level OFF	R0
Output level ON	R1
Modulation	
Amplitude modulation	AM
Frequency modulation	FM
External modulation ON	S1
Int. modulation 400Hz	S2
Int. modulation 1kHz	S3
Modulation OFF	S5
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

8.3.5 Basic data setting method

100MHz carrier frequency, EMF 120 dBμ output level, 1kHz internal modulation frequency, and 75kHz FM peak frequency deviation are to be set.
In the following examples, HP9816 is used:

Example 1:   OUTPUT 707;"FR100MZ,EMAP120DB,S3FM75KZ"
              Output   Frequency   Output   FM deviation
              command data   level data data

                                Normally, CRLF or EOI is sent.

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

              OUTPUT 707;"FR100MZ"
              OUTPUT 707;"EMAP120DB"
              OUTPUT 707;"S3FM75KZ"

Example 3:   To set the carrier frequency at 88.2MHz
              a) "FR88.2MZ"

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 100dBμ
              a) "DU,AP100DB"   b) "DU" , "AP100DB"

Example 6:   To set the output level at —3.5dBm
              a) "DM,AP—3.5DB"   b) "DM" , "AP—3.5DB"

Example 7:   To set the internal modulation frequency at
              400Hz and AM depth at 30%
              a) "S2AM30%"   b) "S2AM30PC"

Example 8:   To set external FM deviation 75kHz
              a) "S1FM75KZ"   b) "S1FM" , "FM75KZ"

              Note: S1 only is invalid.

Example 9: To turn off modulation
           a) "AMS5"   b) "FMS5"

Example 10: To recall memory address "36"
           a) "RC36"

Example 11: To store data at memory address "36"
           b) "ST36"
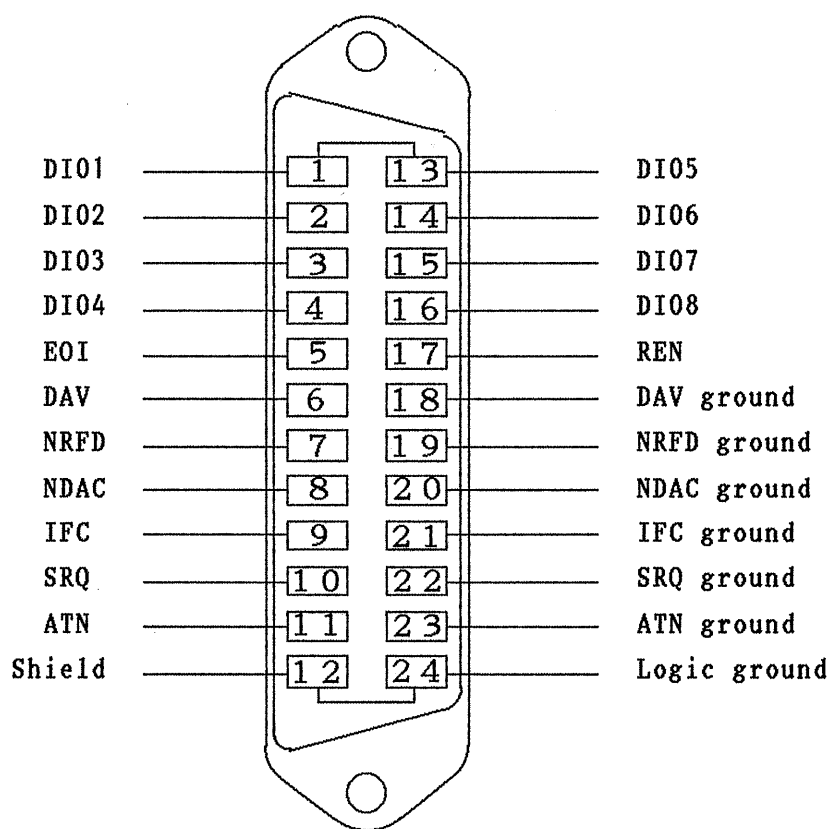

8.3.6 Connector pin allocation diagram

DIO1	1	13	DIO5
DIO2	2	14	DIO6
DIO3	3	15	DIO7
DIO4	4	16	DIO8
EOI	5	17	REN
DAV	6	18	DAV ground
NRFD	7	19	NRFD ground
NDAC	8	20	NDAC ground
IFC	9	21	IFC ground
SRQ	10	22	SRQ ground
ATN	11	23	ATN ground
Shield	12	24	Logic ground

Figure 8-2

8.3.7 Reference (program example)

An example of a program for HP 9816 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    Fm=75                                75kHz
70    Fmstep=-5                            -5kHz
80    CLEAR Dev                            Clear selected device
90    WAIT 2
100   OUTPUT Dev;"R1"                      Output ON
110   FOR N=0 TO 9
120       Freq=Frequency+Freqstep*N
130       Lev=Level+Levelstep*N
140       Fmlev=Fm+Fmstep*N
150       OUTPUT Dev;"FR";Freq/1.E+6;"Mz"  Set frequency
160       OUTPUT Dev;"EMAP";Lev;"dB"       Set output level
170       OUTPUT Dev;"AMS5"                Turn off AM modulation
180       OUTPUT Dev;"S2FM";Fmlev;"kz"     Set 400Hz internal
                                           modulation frequency and
                                           FM deviation

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
```

9. ACCESSORIES

(Optional)

9.1 SA100 Test Loop

1) Performance

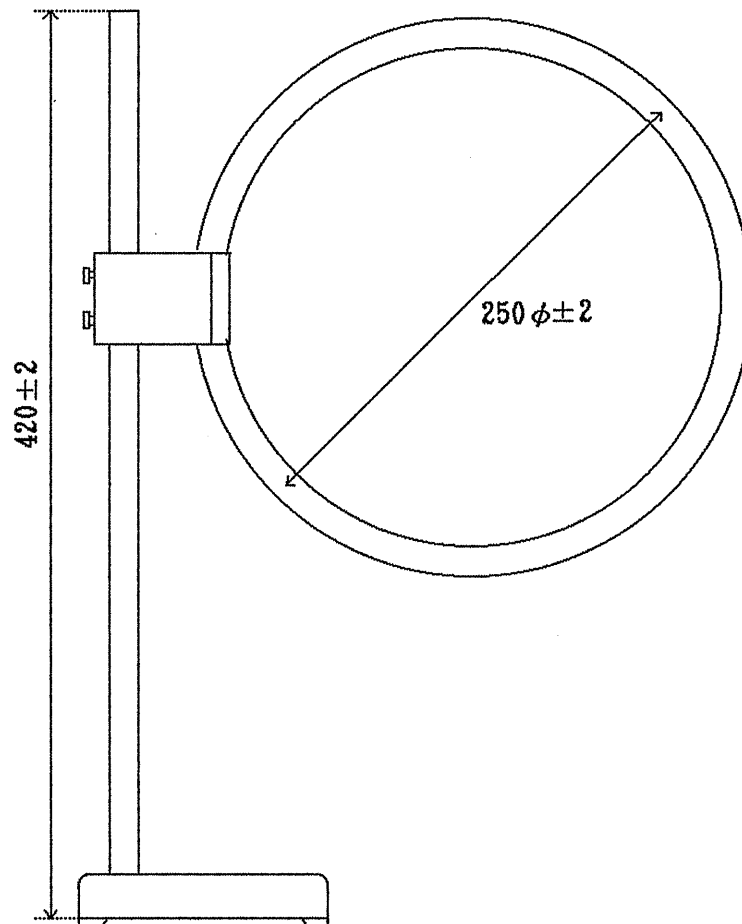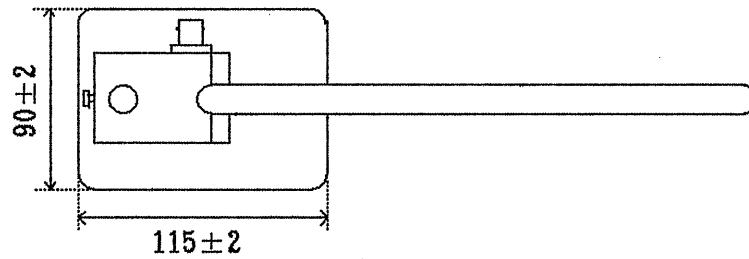|	
Frequency range	100kHz to 30MHz
Migration length	Vertical Approx. 250mm, Horizontal 360°
Input coaxial cable	50Ω
Test Loop	Diameter 250mm, 0.8φ 1 Turn

Figure 9-1. Outline drawing

9.2 SA150 Band Splitting Filter

1) Performance

Input frequency range	DC to 130MHz
Input/output impedance	50Ω (BNC-J type connector)
VSWR input/output	1.2 or less
Output frequency range	AM: DC to 30MHz
	FM: 75MHz to 130MHz
Insertion loss	0.5dB or less

Figure 9-2

Figure 9-3

SA150 Band splitting filter
Typical characteristics
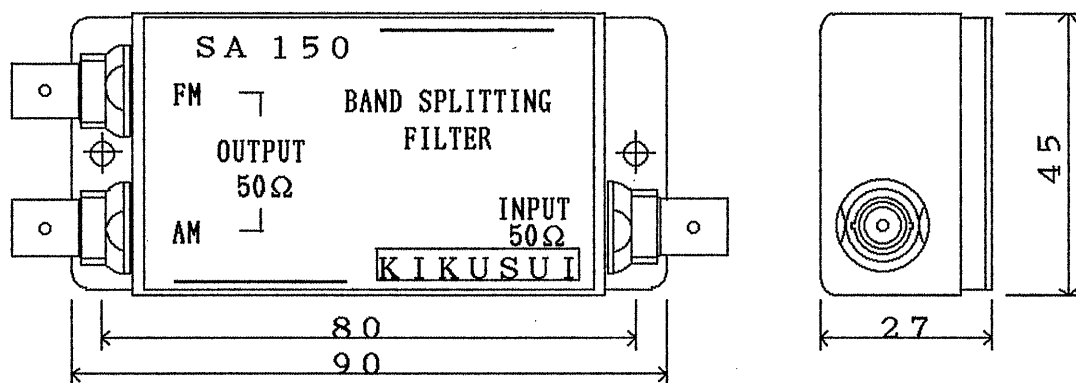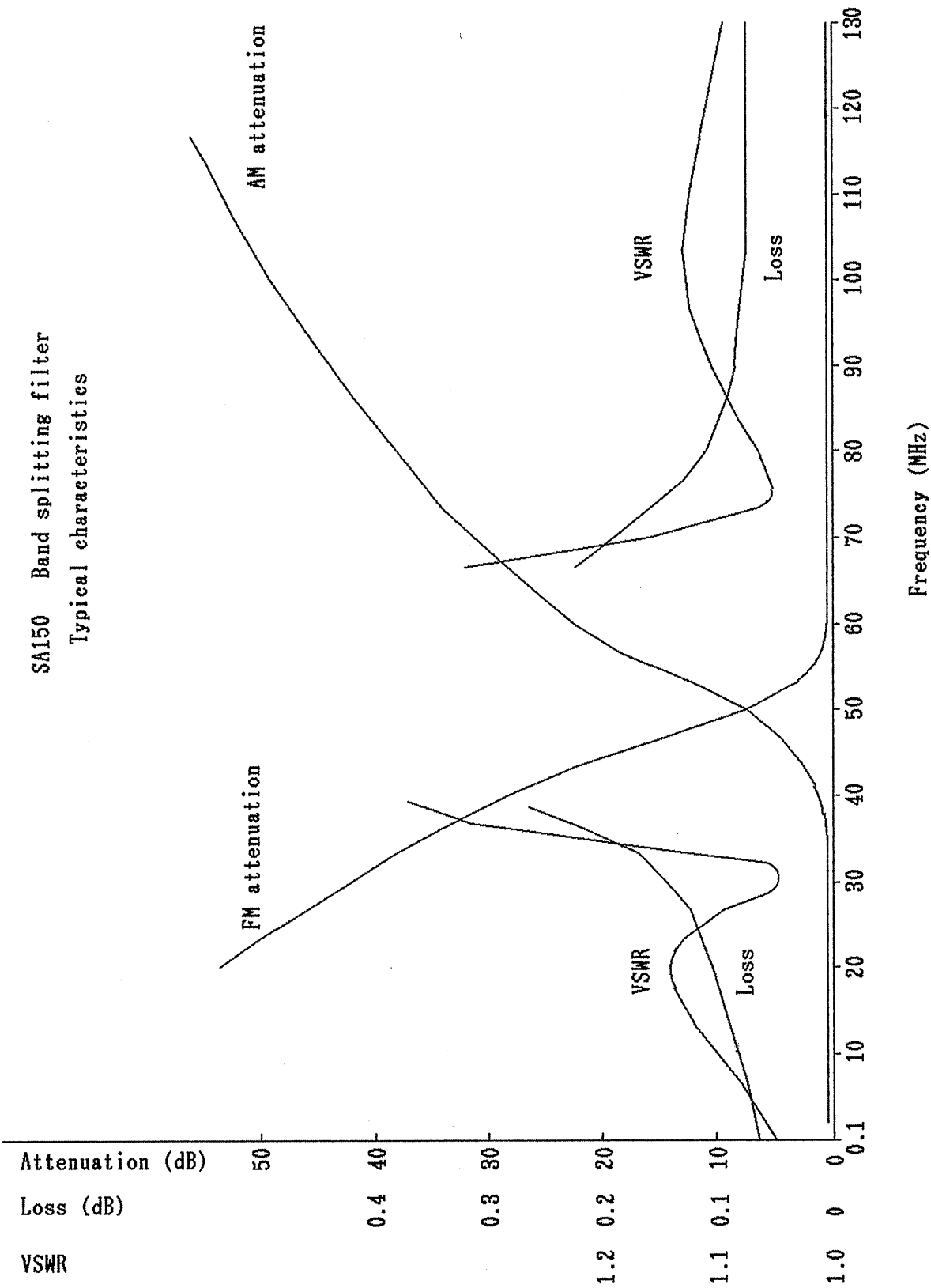
2) SA150 application example

The SA150 outputs separate signals by the combination of HPF and
LPF.

The RANGE OUTPUT control signal output from the rear panel of
KGS4200 need not be used.

Figure 9-4 shows an example application of the SA150.

The SA150 can be used with little error when the input signal
frequencyis less than 30MHz or between 75MHz and 110MHz; the error
increases in other ranges.   (See Figure 9-2 for the external
appearance and Figure 9-3 for typical characteristics.)
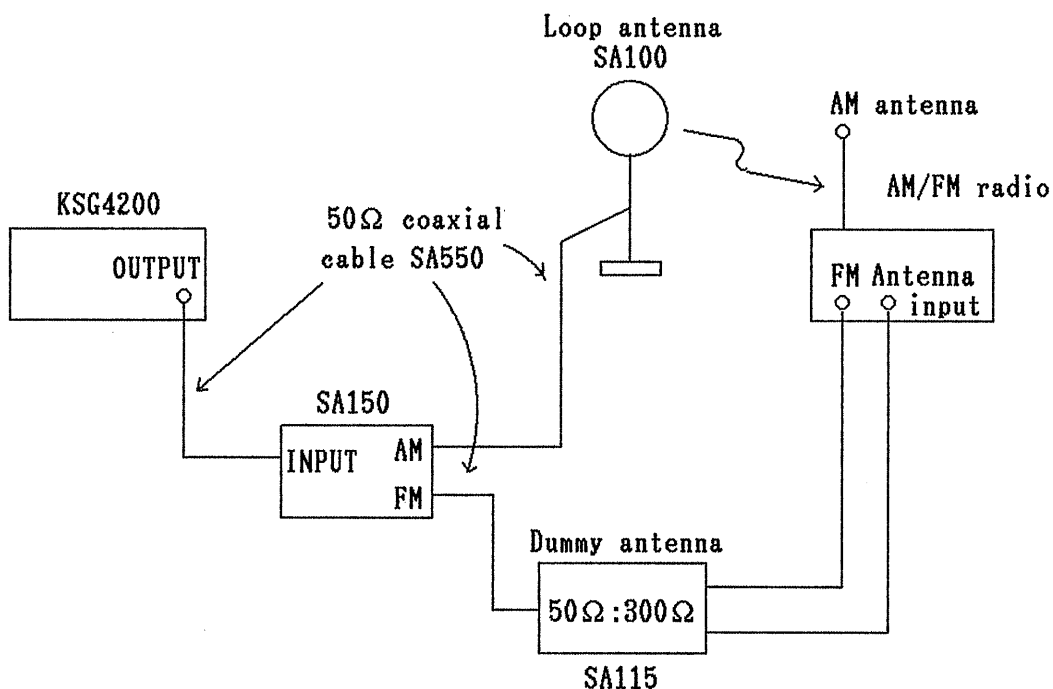
Figure 9-4

9.3 SA151 and SA152 Dummy Antennas for Car Radios

The SA151 and SA152 dummy antennas comply with JIS C6102-1988, and they are used for testing car radios.

Switching between AM and FM dummy antennas is done automatically by the RANGE OUTPUT control signal from the rear panel of KSG4200.

SA151: AM output impedance = 80Ω
        FM output impedance = 75Ω
           (Loaded type)
SA152: AM output impedance = 80Ω
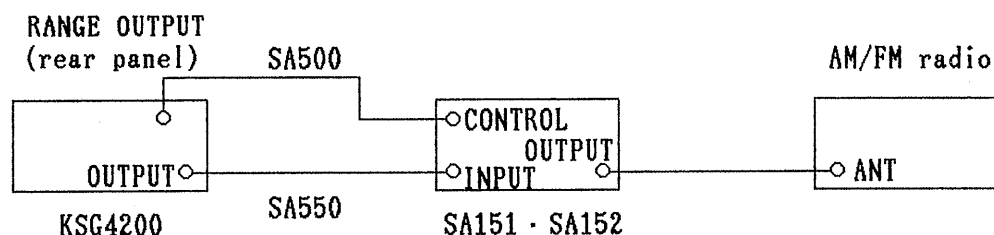   FM output impedance = 75Ω
           (Open-circuit type)

RANGE OUTPUT
(rear panel)   SA500   AM/FM radio

|_____| |_oCONTROL |_____|
| o | | OUTPUT| | |
| OUTPUTo_____|_____|_oINPUT   o_____|_o ANT |
|_____| |_____||_____|

KSG4200   SA550   SA151 · SA152

Figure 9-5. Connection Example

9.3.1 SA151 dummy antenna for car radio (loaded type)

1) Performance

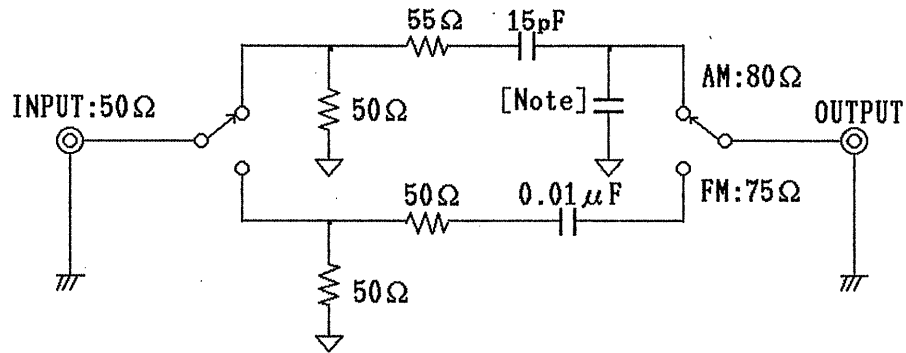|	
Input frequency range	50kHz to 200MHz
Input impedance	50Ω (BNC-J type connector)
VSWR	1.2 or less
Output impedance	AM: 80Ω
	FM: 75Ω
Control signal	AM: 0V
	FM: 5V, 50mA or less
Control terminal	Audio pin connector (RCA type)
Accessory	SA500 (Single-core shielded cable with RCA type pin plugs at both ends. Length = 0.8m)

2) Dummy antenna circuit diagram

Figure 9-6

Note: Adjust the load capacitance to 60pF including the antenna cable capacitance for car radio. (Actually, a 30pF capacitor is mounted.)
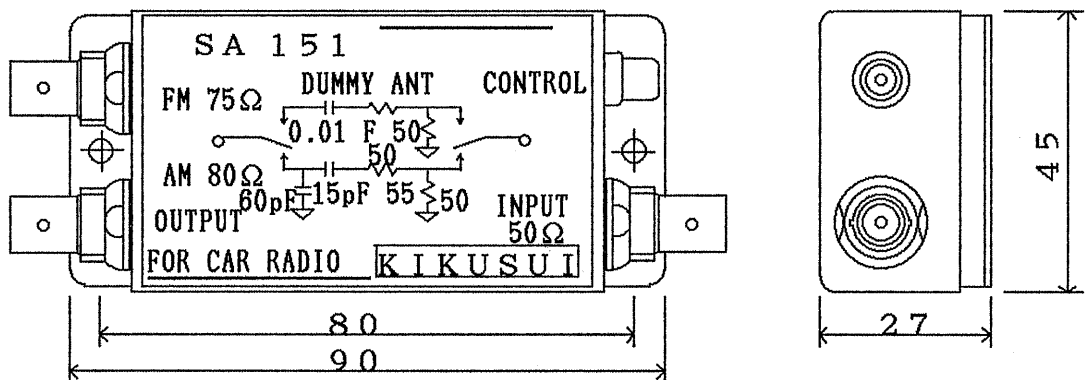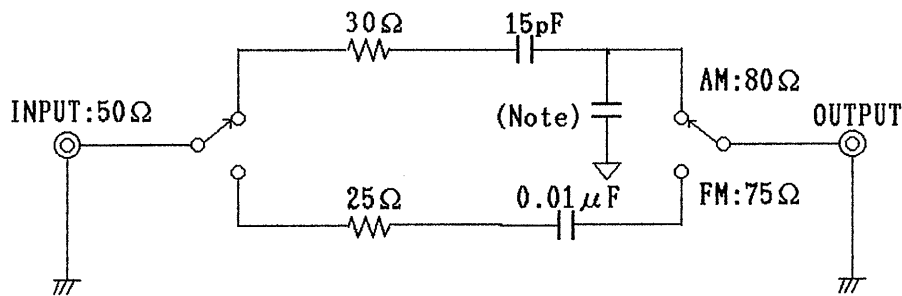
3) Outline drawing

Figure 9-7

9.3.2 SA152 dummy antenna for car radio (open-circuit type)

1) Performance

Input frequency range	50kHz to 200MHz
Input impedance	50Ω (BNC-J type connector)
VSWR	1.2 or less
Output impedance	AM: 80Ω
	FM: 75Ω
Control signal	AM: 0V
	FM: 5V, 50mA or less
Control terminal	Audio pin connector (RCA type)
Accessory	SA500 (Single-core shielded cable with RCA type in plugs at both ends. Length = 0.8m)

2) Dummy antenna circuit diagram

Figure 9-8

Note: *Adjust the load capacitance to 60pF including the antenna cable capacitance for car radio. (Actually, a 30pF capacitor is mounted.)*

3) Outline drawing
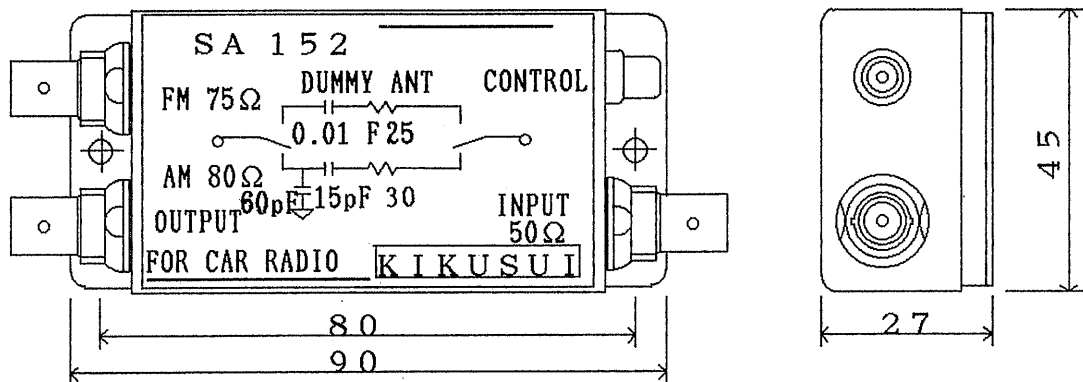
Figure 9-9

9.4 SA153 Output Switch and SA154 Output Impedance Switch

The SA153 is used for a test loop antenna in AM band and for a 50Ω : 300Ω dummy antenna in FM band. The SA154 is used for a test loop antenna in AM band and for a 75Ω : 300Ω dummy antenna in FM band.
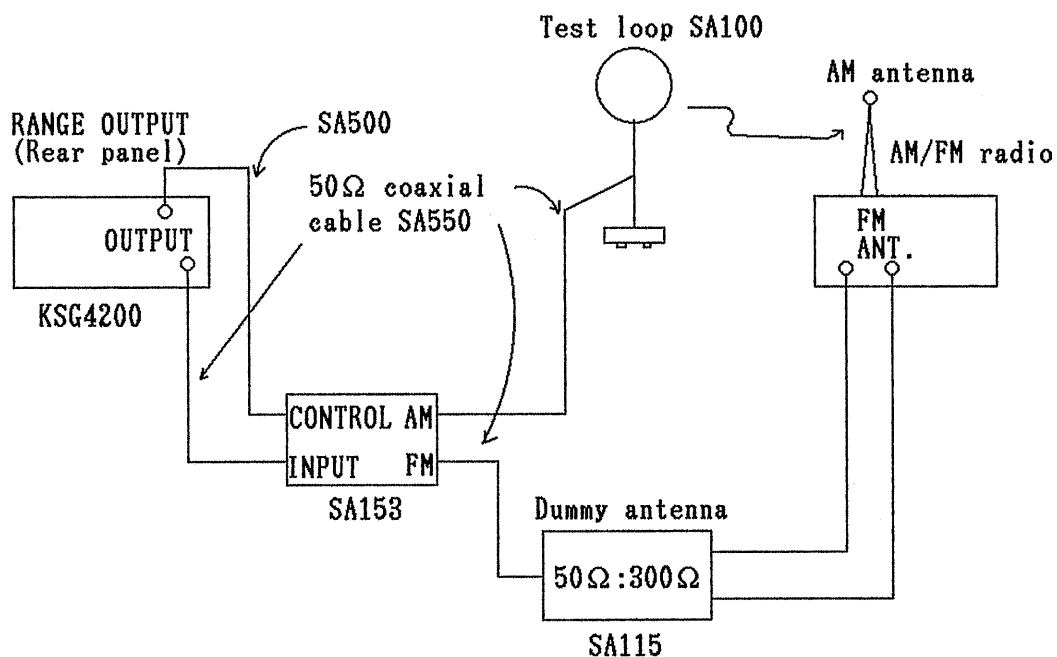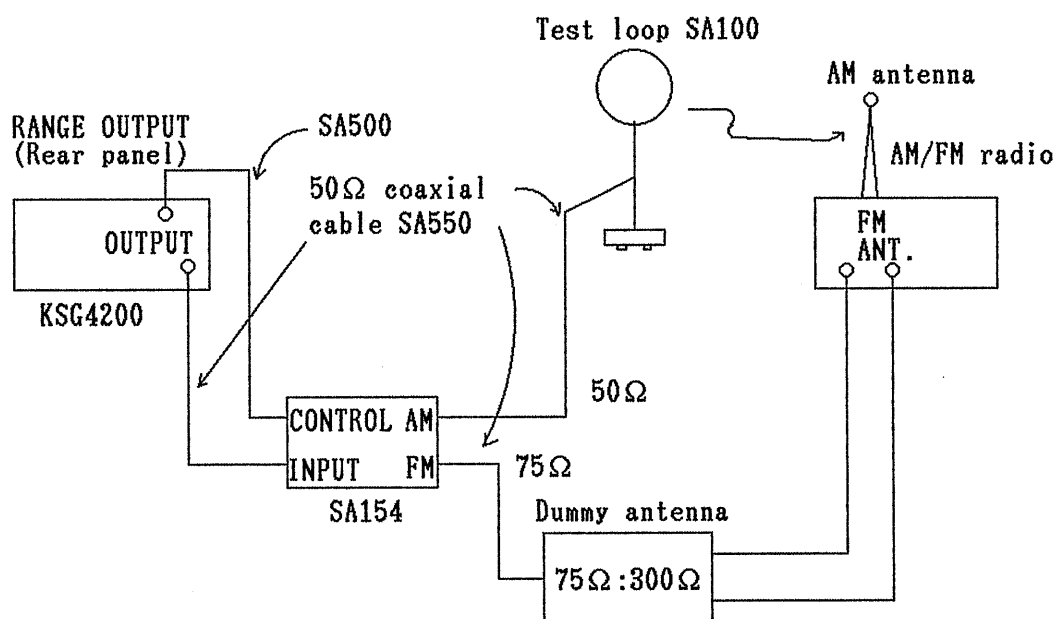

Figure 9-10. SA153 connection diagram

Figure 9-11. SA154 connection diagram

1) Performance (SA153 Output Switch and SA154 Output Impedance Switch)

Input frequency range DC to 200MHz
Input impedance   50Ω   (BNC-J type connector)
VSWR   1.2 or less
Output impedance
    SA153   AM: 50Ω (for test loop)
                       FM: 50Ω (for 50Ω : 300Ω dummy antenna)
    SA154   AM: 50Ω (for test loop)
                       FM: 75Ω (for 75Ω : 300Ω dummy antenna)
Control signal   AM: 0V
                       FM: 5V, 50mA or less
Control terminal   Audio pin connector (RCA type)
Accessory   SA500 (single-core shielded cable with RCA
                       type in plugs at both ends. Length = 0.8m)

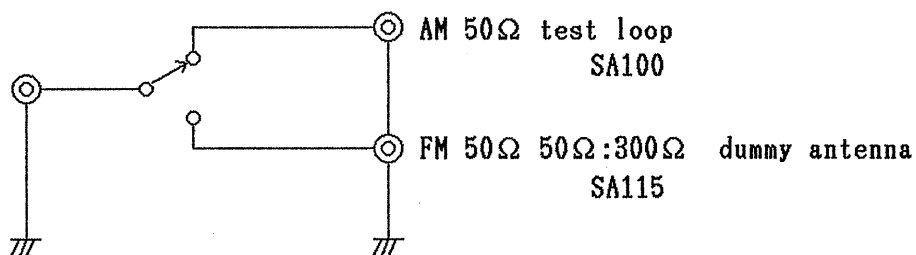2) Output switch and impedance switch circuit diagrams

SA153

AM 50Ω test loop
SA100

FM 50Ω 50Ω:300Ω dummy antenna
SA115

Figure 9-12

SA154

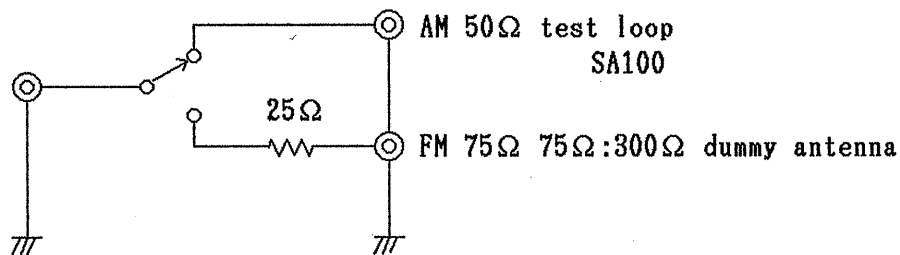AM 50Ω test loop
SA100

25Ω

FM 75Ω 75Ω:300Ω dummy antenna

Figure 9-13
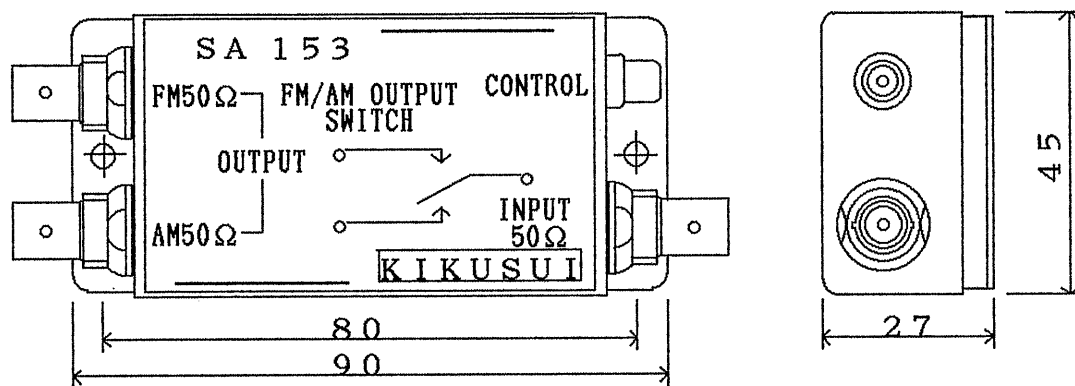
3) Outline drawing

Figure 9-14. Outline drawing

Note: *When using the SA150, SA153, or SA154, do not connect the 50Ω :*
75Ω dummy antenna for AM band and 50Ω : 300Ω balanced dummy
antenna for FM band to an AM/FM radio as shown in Figure 9-15
because the balance of the dummy antenna for FM band is lost at
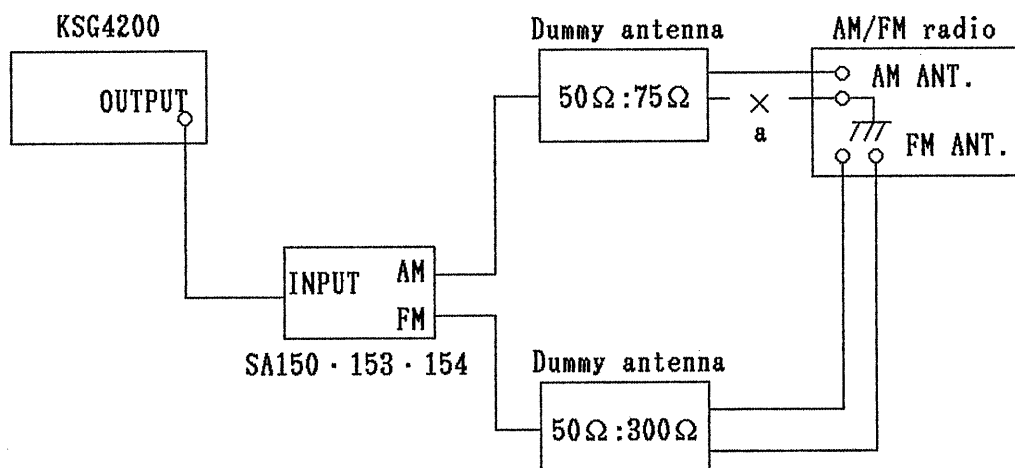*point "a".*

Figure 9-15