

OPERATION MANUAL

FM/AM SIGNAL GENERATOR

**KSG4481**

Second Edition

KIKUSUI ELECTRONICS CORPOTATION

(KIKUSUI PART NO. Z1-477-420)

M-90121

# Power Requirements of this Product

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

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

## Input voltage

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

## Input fuse

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

### WARNING

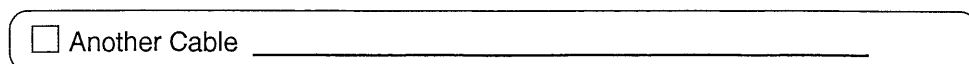
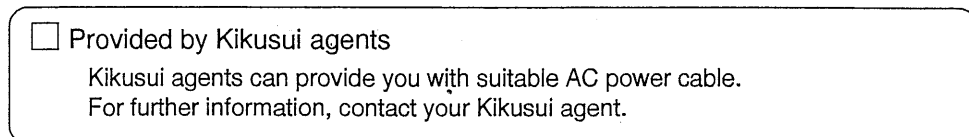
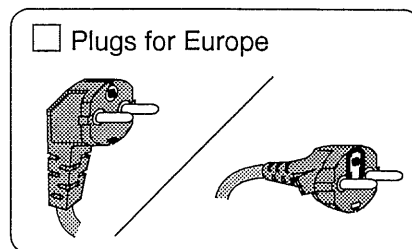
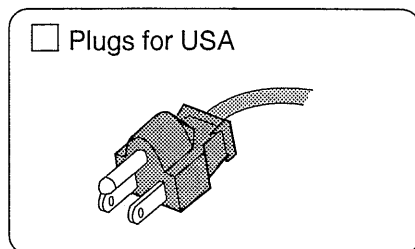
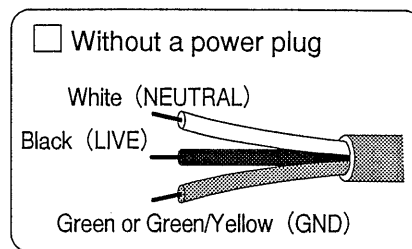
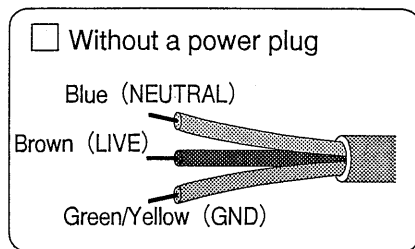
- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that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

## AC power cable

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

### WARNING

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



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# 1 . INTRODUCTION

## 1.1 General Description

The KSG4481 is a highly stable ( $5 \times 10^{-5}$ ) UHF TV and FM-AM standard signal generator adopting the PLL method for the phase lock with a standard crystal oscillator.


The ranges of the output signal frequencies are 420MHz to 800MHz (UHF TV broadcast band) and 42MHz to 58MHz (intermediate frequency band). The range of the output level for both frequency bands is 0dB $\mu$  to 90dB $\mu$  (at loaded).

The KSG4481 can be operated easily because all the operations are controlled by a built-in microprocessor.

The carrier frequencies, output levels, and modulation modes can be combined in desired ways, and the combinations can be associated to up to 100 continuous points. The 100 points are grouped into 10 blocks, each consisting of 10 points, and each point corresponds to a memory address. As to the output level, up to four different values can be stored and recalled independently. Also, the KSG4481 can reduce labor on production line because it has the function to control all the panel operations in remote mode.

The KSG4481 is to be used for the research and development of UHF-band TV signal receivers and for the adjustment and testing of products on production lines.

## 1.2 Features

- (1) The carrier frequency can be specified in six digits, and the values of any desired digit (specified by cursor) can be changed continuously by a rotary knob. Also, the  $\Delta$ FREQ (frequency difference) display function and the  function to see selectivity are provided.
- (2) The range of output level is 0dB $\mu$  to 90dB $\mu$  (at loaded), and its value can be specified in two digits by the step of 1dB. Also, an independent four-point memory function is provided for the output level.

- (3) The carrier frequency and output level can be incremented/decremented by specified values.
- (4) Preset keys are provided for modulation, and FM 3.5kHz, 22.5kHz, and 75kHz and AM 30% can be set by simply pressing the corresponding keys.
- (5) All the data on panel can be memorized by 100 continuous points grouped into 10 blocks, each consisting of 10 points, and four different values of output level can be stored and recalled separately.
- (6) The KSG4481 is easy to operate because all its operations are controlled by a microprocessor and specified values are displayed in digital mode.
- (7) The input data can be corrected quickly by use of the BS (back space) key (BS).
- (8) All the memorized data can be copied to the memory of another KSG4481 by pressing the DMP key once.
- (9) All the operations on panel can be controlled in remote mode.

## 2. SPECIFICATIONS

### o Frequency (RF)

Range	:	42MHz to 58MHz 420MHz to 800MHz
Resolution	:	1kHz                    42MHz to 58MHz 10kHz                   420MHz to 800MHz
Display	:	6-digit display, $\Delta$ FREQ display, and $\pm$ frequency inversion function
Accuracy	:	$\pm 5 \times 10^{-5} \pm 1$ -digit

### o Output level

Range	:	0dB $\mu$ to 90dB $\mu$ Into 50 $\Omega$ load    (0dB $\mu$ =1 $\mu$ V)
Resolution	:	1dB
Display	:	2-digit display
Memory	:	Four mutually independent point (A/B/C/D), with STORE/RECALL key
Reference level accuracy	:	$\pm 2.0$ dB                    At output level 90dB $\mu$
Attenuator accuracy	:	$\pm 2.5$ dB
Output impedance	:	50 $\Omega$ BNC type connector
VSWR	:	$\leq 1.5$ (At output level $\leq 70$ dB $\mu$ )
Spurious signals Harmonic	:	(Fundamental wave = 0dBc) $\leq -25$ dB

Residual modulation (S/N)

FM component : Demodulation frequency range = 50Hz to 15kHz  
22.5kHz deviation ratio  
 $\geq 46\text{dB}$  ( $\leq 111\text{Hz}$ )

AM component : Demodulation frequency range = 50Hz to 15kHz  
30% depth ratio  
 $\geq 46\text{dB}$  ( $\geq 0.15\%$ )

o Modulation

FM or AM with internal or external modulating signal  
(No compound FM/AM modulation)

Internal modulation frequency 400Hz/1kHz/3kHz,  $\pm 3\%$

External modulation

1) Input impedance Approx.  $10\text{k}\Omega$  (unbalanced)

2) Input voltage requirement for external modulation Approx. 3Vp-p  
*Note : For the above input voltage, an error of  $\pm 2\%$  is allowed by HI-LO monitor.*

<Frequency Modulation>

Deviation : 0 to 99.5kHz

Resolution : 0.5kHz

Display : 3-digit display

Accuracy :  $\leq (\text{Display value} \pm 10) \text{ kHz}$

External modulation frequency characteristics : 20Hz to 100kHz (1kHz reference)  
 $\pm 1\text{dB}$



Distortion : Demodulation range: 300Hz to 15kHz  
Modulation frequency: 400Hz to 10kHz  
22.5kHz deviation  
 $\leq 0.5\%$

<Amplitude Modulation>

Depth : 0 to 50%

Resolution : 0.5%

Display : 3-digit display

Accuracy :  $\leq (\text{Display value} \pm 5)\%$

External modulation : 50Hz to 10kHz (1kHz reference)  
frequency  $\pm 1\text{dB}$   
characteristics

Distortion : Demodulation range: 50Hz to 15kHz  
Modulation frequency: 400Hz to 10kHz  
Depth 30%  
 $\leq 3\%$  (at output level  $\leq 87\text{dB}\mu$ )

- o Setting functions :
  - 1) Numeric keys and rotary knob  
(with cursor designation)  
Frequency, output level, modulation and  
memory
  - 2) Step keys  
Frequency and output level
  - 3) Preset keys  
Frequency modulation: 3.5kHz/22.5kHz/75kHz  
Amplitude modulation: 30%

- Memory function : 1) 100 points for carrier frequency, output level, modulation level, modulation mode, etc.  
 2) 10 blocks×10, or 100 continuous points  
 3) Independent 4-point memory  
 Output level
- 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 frequency, output level, and modulation mode can be stored/recalled, the frequency and output level can be incremented/decremented by steps or continuously by rotary knob, modulation can be turned on/off, etc.
- Leakage : No detectable interference onto output
- Backup battery : Provided
- Power requirements
  - Line voltage : AC 100V, 115V, 215V, 230V; ±10% allowance (selectable by voltage selector plug)
  - Line frequency : 50Hz/60Hz
  - Power dissipation : Approx. 30VA
- Mechanical specifications
  - Dimensions of main frame : 430 W × 99 H × 250 D mm  
(16.93 W × 3.90 H × 9.84 D in.)
  - Maximum dimensions : 445 W × 119 H × 305 D mm  
(17.52 W × 4.69 H × 12.01 D in.)
  - Weight : Approx. 6kg (13.2 lb)

o Operation environment (temperature and humidity)

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

Maximum operating range : 0 to 40°C (32 to 104°F), 90% RH or less

o Accessories

Output cable (SA 550)	1
Power cable	1
Fuse 1.0A	1
Fuse 0.5A	1
Operation manual	1

### 3. PREPARATION FOR USE

#### 3.1 Unpacking and Inspection

Before being shipped from the factory, the KSG4481 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 KSG4481, 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	

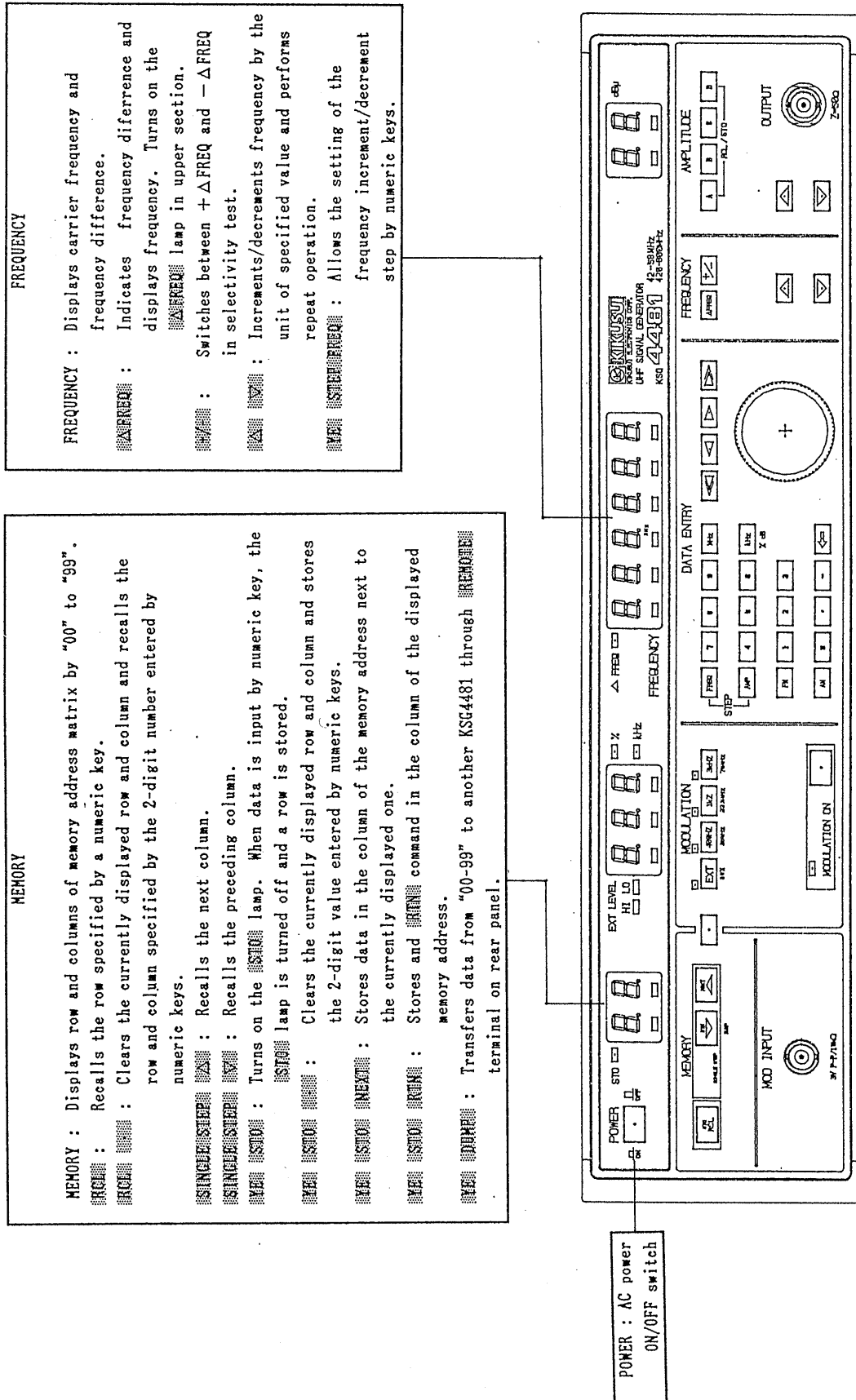
#### 3.3 Surrounding Temperature/Humidity, Warm-up Time, and Installation Place

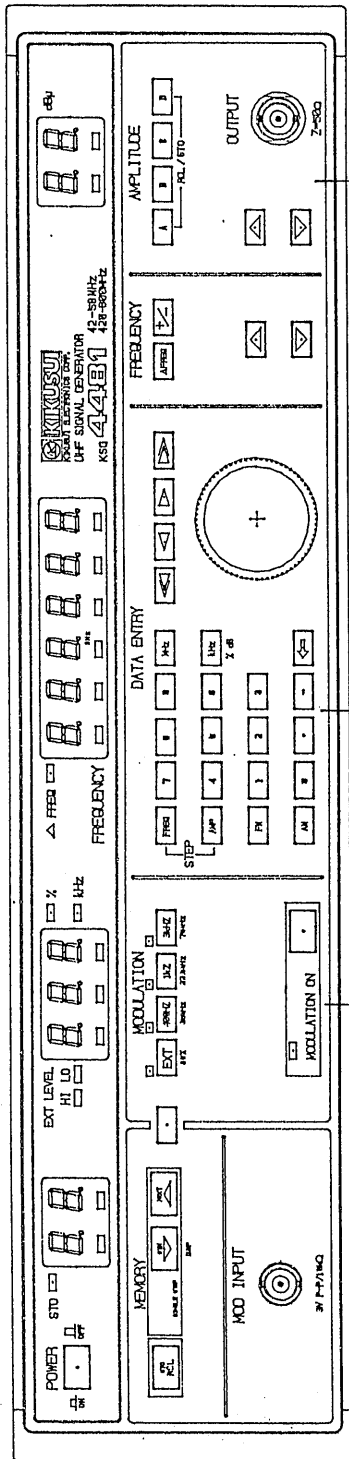
The KSG4481 operates correctly in temperatures from 0 to 40°C (32 to 104°F). If the instrument is used or placed under high temperature and humidity for a long time, failures will occur and the life of the instrument will be shortened.

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

**EXT 20%** : External modulation input terminal for FM or AM single signal.

**EXT 30%** : Indicates external modulation input level range. The range is normal when **EXT 50%** is off.

**EXT 50%** : Indicates AM depth by the unit of 0.5%.

**EXT 50%** : Indicates FM frequency deviation by the unit of 0.5kHz.

**EXT 50%** : Switches between external and internal modulation for FM and AM.

**MODULATION ON** : Turns modulation ON/OFF.

**EXT 20%** : Presets AM depth at 30%, FM deviation 3.5kHz, 22.5kHz, or 75kHz.

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

**0-9** : Allows the setting of frequency by numeric keys.

**←** : Allows the setting of output level by numeric keys.

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

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

**0-9, ., -** : Enter numeric values.

**←** : Entr units.

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

**←** : Move cursor into block.

**←** : Move cursor within block.

**Rotary knob** : Modifies the value at cursor position.

**AMPLITUDE** : Displays RF output level by two digits.

**←** : Recall keys for the independent 4-point memory.

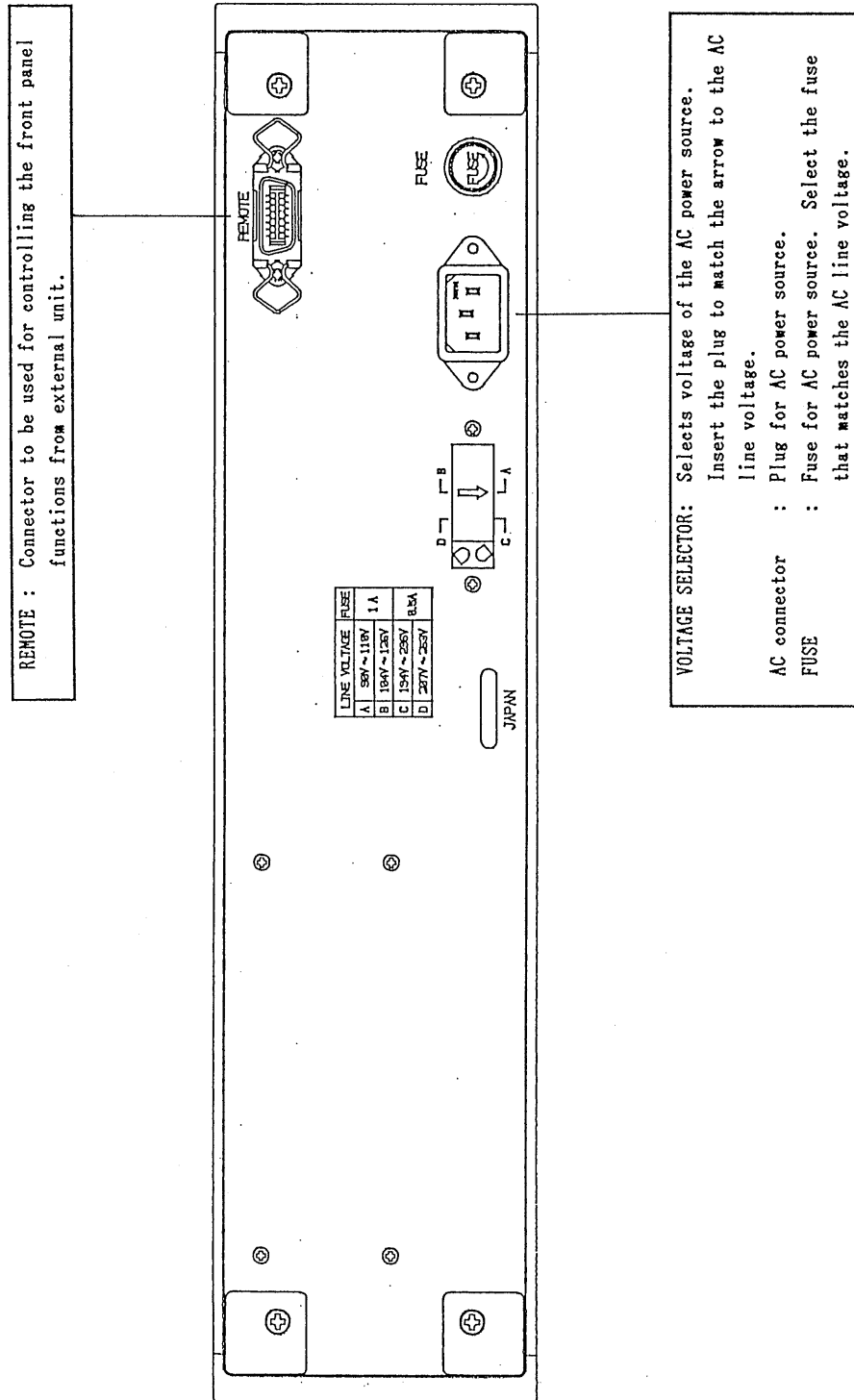
**+** : Increments/decrements amplitude by the unit of specified value and performs repeat operation.

**+** : BNC terminal for RF output. 0dBμ to 99dBμ into 50Ω load. The signal source impedance is 50Ω.

**+** : The store keys for the independent 4-point memory.

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

## 4.2 Rear Panel Features

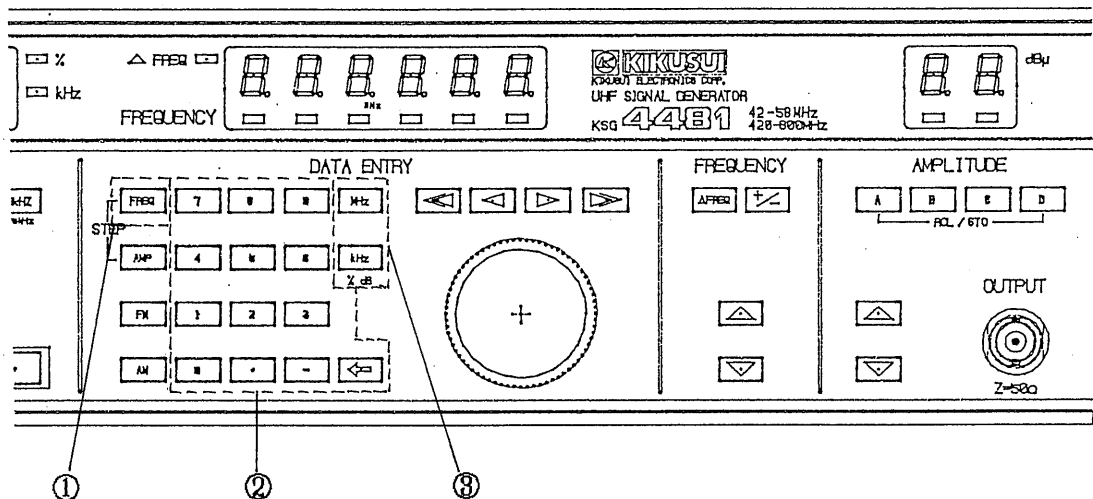


### 4.3 Turning on the Power Supply

Connect the power 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 5; a value of more than five digits is not accepted.

Since the resolution for the frequency range of 420MHz to 800MHz is 10kHz, the digit of 1kHz (the lowest digit of [FREQUENCY] section) is right blank for this range.

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: 697.75MHz is input

× ..... Undefined  
 ⌋ ..... Turned off

Key operation	FREQUENCY display
① <b>FREQ</b>	×××.××× Previous value
② <b>6</b>	6⌋⌋⌋⌋
③ <b>9</b>	69⌋⌋⌋
④ <b>7</b>	697⌋⌋⌋
⑤ <b>.</b>	697.⌋⌋⌋
⑥ <b>7</b>	697.7⌋⌋
⑦ <b>5</b>	697.75⌋
⑧ <b>MHz</b>	697.75⌋

Press keys in the order of ① to ⑧ in the above chart, the display is shown in the column on the right.

(b) Example: 53.8MHz is input.

Key operation	FREQUENCY display
	697.75⌋
<b>FREQ</b>	697.75⌋
<b>5</b>	5⌋⌋⌋⌋
<b>3</b>	53⌋⌋⌋⌋
<b>.</b>	53.⌋⌋⌋⌋
<b>8</b>	53.8⌋⌋⌋
<b>MHz</b>	⌋53.800

When a wrong character is input by a numeric key, that character can be deleted by pressing the **⌋** (back space) key. If the back space key is pressed continuously, all the currently displayed characters are deleted and the previous value is displayed.

- (c) Example: 547.75 MHz was to be input, but an error was made during the input.

Key operation	FREQUENCY display
[[FREQ]]	└53.800
[[5]]	5└└└└└
[[4]]	54└└└└
[[8]] "8" was pressed for "7" by mistake	548└└└
[[6]] Press once	54└└└└
[[6]] Press twice	└53.800

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





[[5]]	5└└└└└
[[4]]	54└└└└
[[7]]	547└└└
[[.]]	547.└└└
[[7]]	547.7└└
[[5]]	547.75└
[[MHz]]	547.75└

- (d) Example: 53.8MHz was input for 53.7MHz by mistake.

Key operation	FREQUENCY display
[[FREQ]]	547.75└
[[5]]	5└└└└└
[[3]]	53└└└└
[[.]]	53.└└└└
[[8]]	53.8└└└
[[MHz]]	└53.800
[[5]]	5└└└└└
[[3]]	53└└└└
[[.]]	53.└└└└
[[7]]	53.7└└└
[[MHz]]	└53.700






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




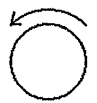

The rotary knob increases or decreases the value of the digits at and above the cursor position in the [FREQUENCY] display section. If the cursor is not found in the [FREQUENCY] display section, bring it into the section by the  or  key; to move the cursor within the section, use the  or  key.

(a) Example: To change frequency from 600MHz to 600.20MHz



The mark " \_ " denotes the cursor position

Key operation	FREQUENCY display
	6 0 0 . 0 0 
 Press once	6 0 0 . 0 0 
 Turn the rotary knob clockwise by two steps	6 0 0 . 2 0 

(b) Example: To change frequency from 600.20MHz to 580.20MHz

Key operation	FREQUENCY display
	6 0 0 . 2 0 
 Press twice	6 0 0 . 2 0 
 Turn the rotary knob counterclockwise by two steps	5 8 0 . 2 0 

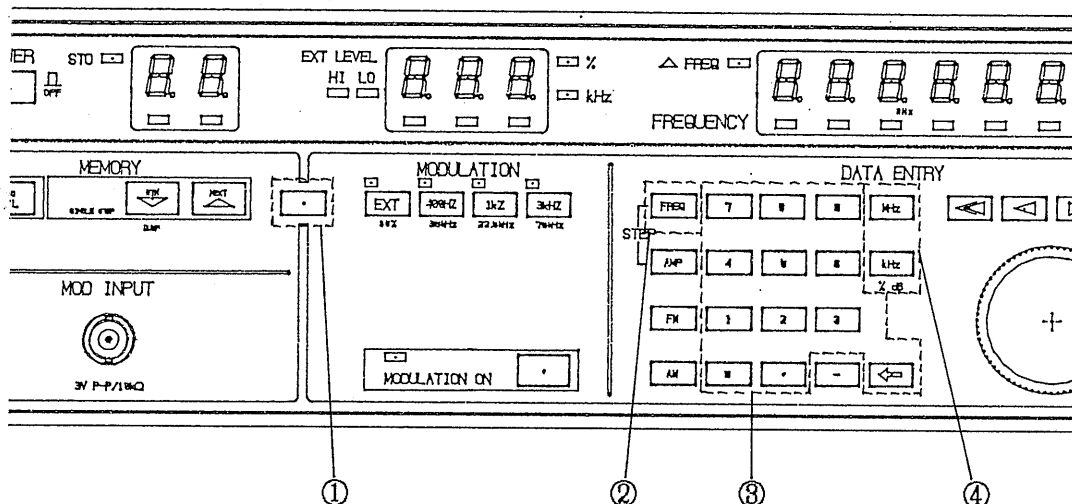
After changing frequency by the rotary knob, the unit key

( or ) need not be pressed.

#### 4.4.3 Setting frequency step for $\Delta$ and $\nabla$ keys

Set a desired step value for the [FREQUENCY]  $\Delta$  and  $\nabla$  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  $\Delta$  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  $\Delta$  key is different from that of the same key pressed without  $\Delta$  key.

(a) Example: To set 1MHz for  $\Delta$  and  $\nabla$  keys when carrier frequency is 580.2MHz.

Key operation	FREQUENCY display
$\Delta$ STEP FREQ	580.20 Previous value
$\Delta$	1
$\Delta$ MHz	580.20
$\Delta$ Press once	581.20

Keep pressing the  $\Delta$  or  $\nabla$  key in the [FREQUENCY] section, and the repeat function is applied to keep increasing or decreasing the frequency by the unit of 1MHz.

#### 4.4.4 Frequency difference $\Delta$ FREQ and $\nabla$ keys

The  $\Delta$ FREQ function, to check the value of change in frequency, is useful for measuring the band width of a receiver.

When the  $\Delta$ FREQ key is pressed, the  $\Delta$ FREQ indicator in the [FREQUENCY] display section is turned on and the frequency difference ( $\Delta$ FREQ) is displayed.


(a) Example: 580 MHz is set currently.

Key operation	FREQUENCY display	
$\Delta$ FREQ	××× ×××	
STEP FREQ	××× ×××	
$\Delta$	1 _ _ _	
0	1 0 _ _ _	
0	1 0 0 _ _ _	
MHz	××× ×××	
FREQ	××× ×××	
5	5 _ _ _	
8	5 8 _ _ _	
0	5 8 0 _ _ _	
MHz	5 8 0 . 0 0 _	
$\Delta$ FREQ	_ _ 0 . 0 0 _	$\Delta$ FREQ indicator comes on
[FREQUENCY] $\nabla$	- _ 0 . 1 0 _	Carrier frequency 579.90MHz
$\Delta$	_ _ 0 . 0 0 _	

If the operator keeps pressing the  $\Delta$  or  $\nabla$  key in the [FREQUENCY] section, the repeat function is applied and the frequency keeps increasing or decreasing by the unit of 100kHz.

If the  $\Delta$  key is pressed in the above example, the carrier frequency returns to the initial value (center value).

(b) Example: 580MHz is set currently.

Key operation	FREQUENCY display	
	580.00	
<b>ΔFREQ</b>	0.00	ΔFREQ indicator comes on
<b>4</b> Press twice	0.00	
 Turn the rotary knob counterclockwise by five steps	5.00	Carrier frequency 575MHz
<b>ΔFREQ</b>	575.00	

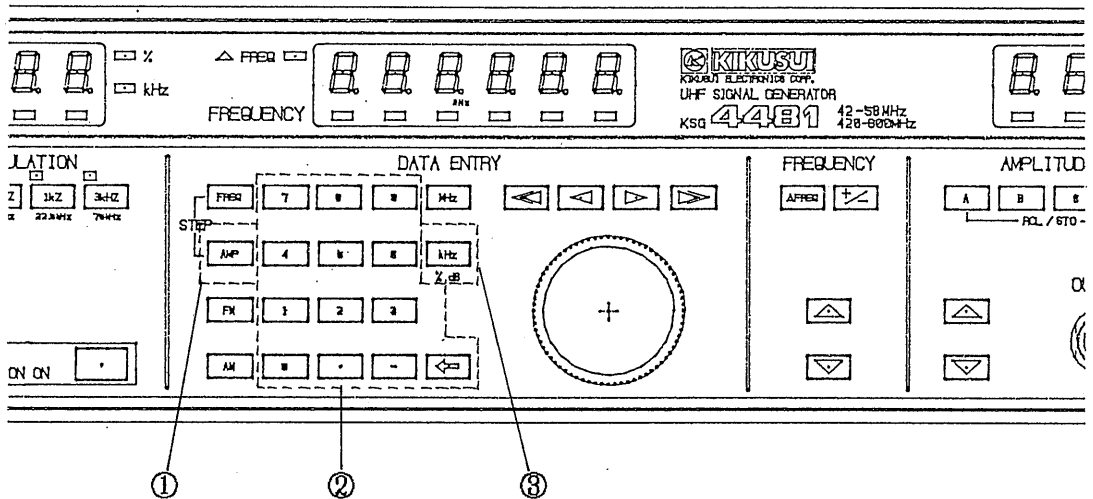
To release the ΔFREQ function, press the **ΔFREQ** key again. In the above example, the carrier frequency effective after therelease is 575MHz.

(c) Example: Using **kHz** key after modification of 580MHz by ΔFREQ

Key operation	FREQUENCY display	
	580.00	
<b>FREQ</b>	580.00	
<b>ΔFREQ</b>	0.00	ΔFREQ indicator comes on
<b>2</b>	2	
<b>0</b>	20	
<b>0</b>	200	
<b>kHz</b>	0.20	Carrier frequency 580.2MHz
<b>7</b>	0.20	Carrier frequency 579.8MHz
<b>ΔFREQ</b> or <b>FREQ</b>	579.80	

## 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 60dB







Key operation	AMPLITUDE display
<b>AMP</b>	×× ..... Previous value
<b>6</b>	6
<b>0</b>	60
<b>dB</b>	60



(b) Example: To set 5dB

Key operation	AMPLITUDE display
<b>AMP</b>	60
<b>5</b>	5
<b>dB</b>	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 dB )





Key operation	AMPLITUDE display
	┌ 5
	4 ┌
 "9" was pressed for "6" by mistake	4 9
	4 ┌
	4 6
	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  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  and  keys for moving the cursor. When there is no cursor in the [AMPLITUDE], use the  and  keys.

Turn the rotary knob clockwise, and the output level will increase; turn it counterclockwise, and the output level will decrease.

After changing the output level by rotary knob, the  () unit key need not be pressed.



(a) Example: To change output level from 46dB to 66dB

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

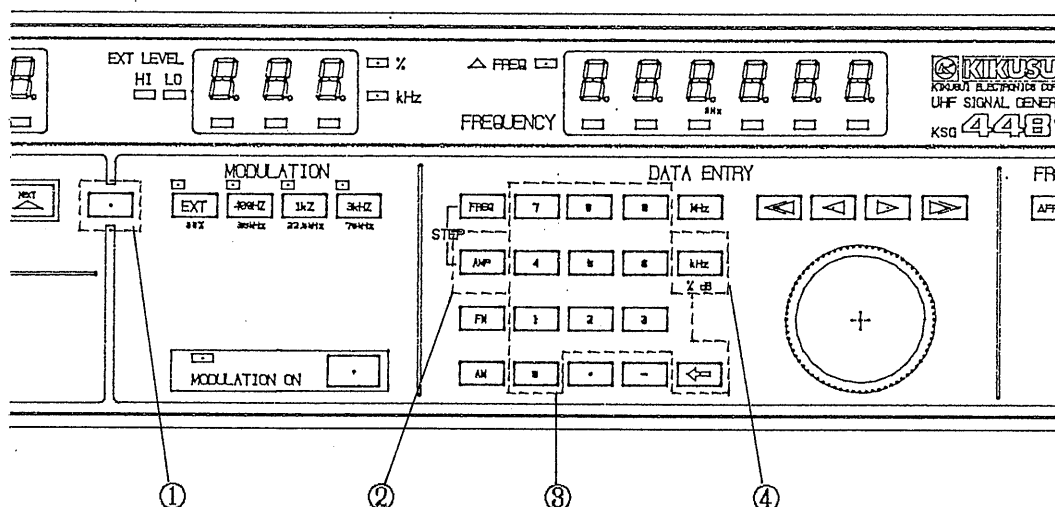


(b) Example: To change output level from 66dB to 60dB

Key operation	AMPLITUDE display
	6 6
 Press once	6 6
 Turn the rotary knob counterclockwise by six steps	6 0






#### 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.



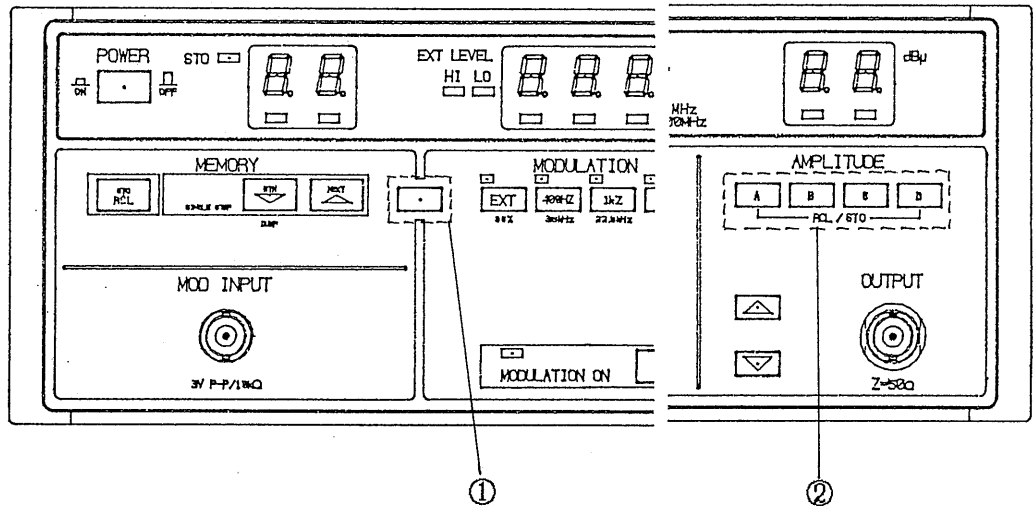
Press keys in the order of ①, ②, ③, and ④ in the above chart.

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

Key operation	AMPLITUDE display
  STEP AMP	6 0
	2 0
	6 0
 Press once	6 2

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 **STN** 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 keys **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 area containing the value.

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

## 4.6 Setting the Modulation

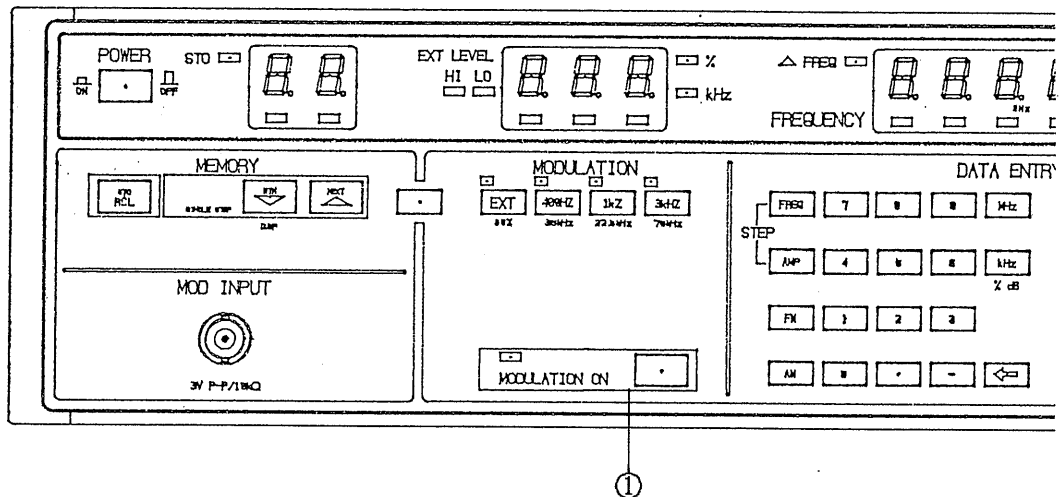
### 4.6.1 $\text{FM}$ key

- Press  $\text{FM}$   $30\%$ , and the AM depth is set to 30%.
- Press  $\text{FM}$   $3.5\text{kHz}$ , and the FM peak frequency deviation is set to 3.5kHz.
- Press  $\text{FM}$   $22.5\text{kHz}$ , and the FM peak frequency deviation is set to 22.5kHz.
- Press  $\text{FM}$   $75\text{kHz}$ , 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.

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



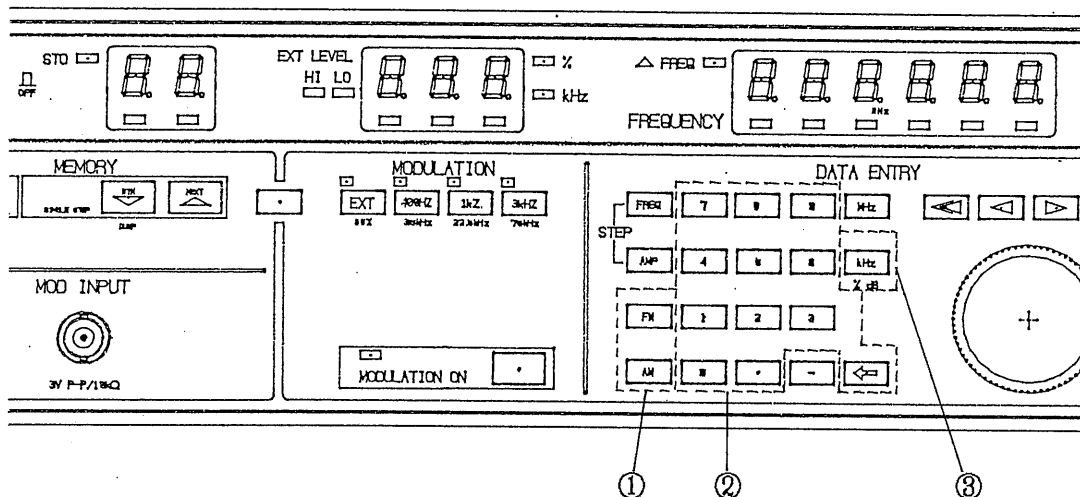
- (a) Example: 75kHz deviation is to be set for 400Hz internal FM source

Key operation	MODULATION display
$\text{FM}$ $400\text{Hz}$	$400\text{Hz}$ indicator is on
$\text{FM}$	$\times \times . \times$ ... Previously set value
	$\text{kHz}$ indicator is on
$7$	7 $\_ \_$
$5$	75 $\_$
$\text{kHz}$	75.0

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

The modulation is terminated when key ① is pressed and the ON indicator is turned off. At this time, 0.0 kHz 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 desired values may be specified by numeric keys (0~9), but the maximum FM deviation and AM depth are 99.5 kHz and 50% respectively and the resolution is 0.5.

Therefore, when the **kHz** or **%** key is pressed to input the specified value, the value between XX.0 and XX.4 is changed to XX.0 and that between XX.5 and XX.9 is changed to XX.5 automatically.





(a) Example: To set FM 25kHz

Key operation	MODULATION display
	××.× .... Previously set value  is displayed as unit
	2 _ _
	2 5 _
	2 5 . 0

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




Key operation	MODULATION display
	××.× .... Previously set value  is displayed as unit
	3 _ _
	3 0 _
	3 0 . 0

#### 4.6.4 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.



(a) Example: To change FM deviation from 25kHz to 35kHz

The mark "\_" denotes cursor position

Key operation	MODULATION display
	2 5 . 0
 Press once	2 5 . 0
 Turn the rotary knob clockwise by one step	3 5 . 0

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







Key operation	MODULATION display
	30.0
 Press once	30.0
Turn the rotary knob counter-clockwise by five step	25.0

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

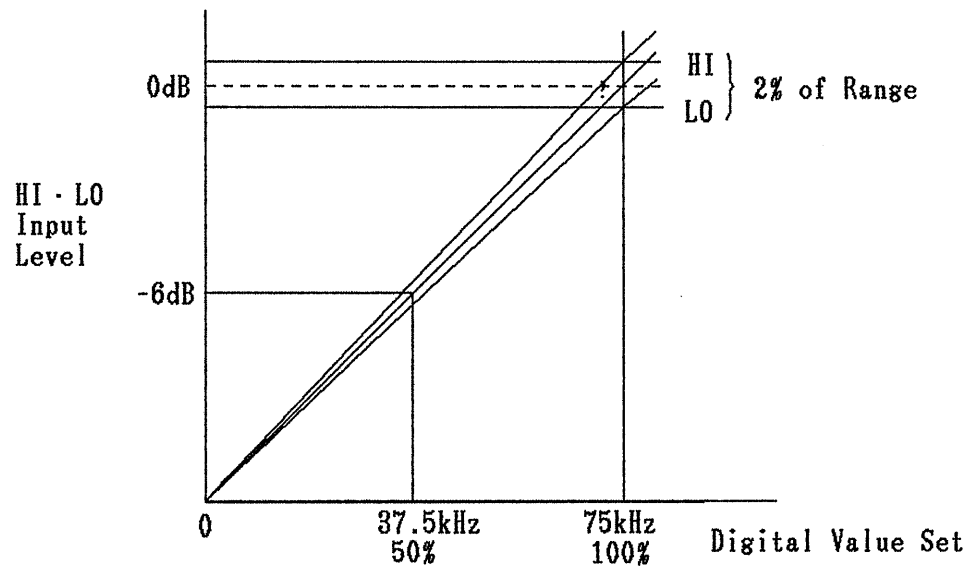
#### 4.6.5 External modulation signal connection and setting

##### (1) Connection and setting method

Connect the external modulation signal input terminal to [MOD INPUT] on the front panel. The input impedance is approximately 10k $\Omega$ , and appropriate input level is about 3Vp-p.

The appropriate input level range is obtained when both  and  of EXT LEVEL are turned off. Adjust the level of external modulation signal source to the range that turns off both  and . When the level of external modulation signal source is too low,  is turned on; when it is too high,  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  $\pm 2\%$ . The modulation 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  $-6\text{dB}$ .

Then, 75kHz remains displayed but the actual peak frequency deviation is reduced to 37.5kHz. At this time, the LO lamp is turned on, but modulation is done correctly at the peak frequency deviation of 37.5kHz.

## 4.7 Memory

### 4.7.1 Memory recall method

Memory addresses are allocated in a matrix of 10 rows 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] **Δ** key.

Also, a memory row and column can be called directly by the entry of a 2-digit number by numeric keys (0-9) after clearing the [MEMORY] display by the **RCL** and **Δ** 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 explained in Section 4.7.2:

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

<b>RCL</b> key, <b>1</b> key	MEMORY display
	"10"

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

<b>RCL</b> key, <b>4</b> key	
Press [MEMORY] <b>Δ</b> key three times	"43"



(c) Example: To recall memory address "85"

**RCL** key, **8** key

Press [MEMORY] **Δ** key five times "85"

When two or more addresses are to be recalled 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 **MEM** 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 **MEM** key. When the [MEMORY] display is cleared by the **MEM** 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 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] **Δ** 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 **MEM**.

(a) Example: To store 600MHz carrier frequency, 60dBu output level, 1kHz internal modulation source, and 75kHz FM into memory address "10"

①	<b>FREQ</b>	× × × . × × ×
	<b>6</b>	6 _ _ _
	<b>0</b>	6 0 _ _
	<b>0</b>	6 0 0 _ _
	<b>MHz</b>	6 0 0 . 0 0 _

Besides the above method, the carrier frequency may be set by the rotary knob or [FREQUENCY] **Δ** or **∇** key.

②	AMP	× ×
	6	6 ∟
	0	6 0
	dB	6 0

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

③	kHz	× × . ×
	YE 3kHz(75kHz)	7 5 . 0 kHz

Besides the above method, the modulation level and mode may be set by numeric keys (**0-9**) and modulation mode key.

After setting the above data, press **YE**, **STO**, and **MEM**. Then, the data is stored into memory address "10".

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

MEMORY display

- ① **RCI** **MEM** **A** (Press **A** twice) "12" is displayed
- ② Set carrier frequency, output level, modulation mode, etc.
- ③ Press **YE** **STO** **A** "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 **MEM**.
- 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 **MEM** 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

<b>RCL</b> <b>000</b> <b>Δ</b> Press	"13"
three times	
<b>YE</b> <b>STO</b> <b>RTN</b>	"13" RTN command is stored

[How to use the function]

<b>RCL</b> <b>000</b>	"10" (First memory address)
<b>Δ</b>	"11" (Second memory address)
<b>Δ</b>	"12" (Third memory address)
<b>Δ</b>	"13" (Fourth memory address)
<b>Δ</b>	"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** **000** **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** **000**, and **Δ** keys (Press three times)  
 Press **YE** **STO** **Δ** "14" RTN command is stored at  
 "14"  
 ..  
 ..  
**YE** **STO** **Δ** (Press "19"  
 five times)

Each time the **Δ** 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.

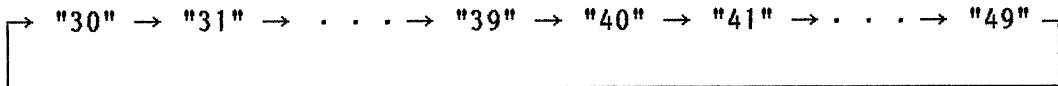
4.7.5 Recalling more than ten columns continuously  
(Setting **NEXT** key)

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
<b>YE</b>	"39"
<b>STO</b>	"39" STO LED comes on
<b>NEXT</b>	"40" STO LED comes off

The memory addresses are recalled as follows:



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 **RIN** 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
<b>YE</b>	"39"
<b>STO</b>	"39" STO LED comes on
<b>RIN</b> ( ∇ )	"39" STO LED comes off

#### 4.7.7 Copying memory data to another KSG4481

- 1) The 100-point and the output level 4-point memory data can be copied to another unit of KSG4481.
- 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 **MEM**, **DUMP** ( $\nabla$ ), 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 KSG4481 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.

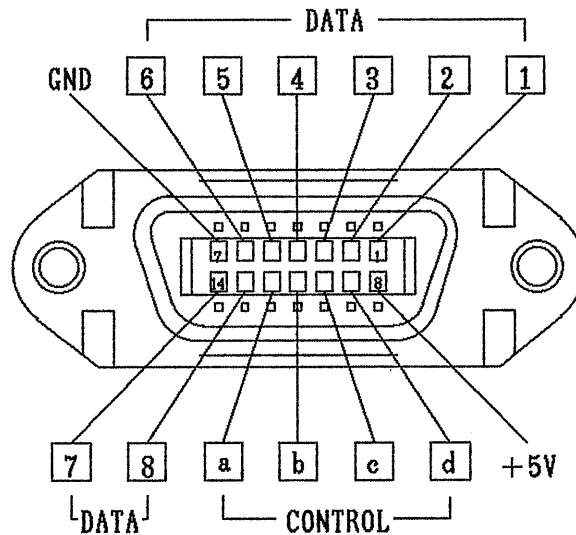


Figure 5-1

[Explanation of terminals]

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

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

The DATA terminals are used for connecting a bus to the rear panel of the KSG4481. 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 - 6 directly.*

2) CONTROL terminals **11** and **12** (Pins 11 and 12)

**12** DATA STROBE output terminals (Pin 12)

Normally, "1" is output from this terminal. When data is read, "0" is output from it.

**11** 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 **9** and **10** (Pins 9 and 10)

**9** and **10** Display control output terminals

When "1" is output from either of these terminals (**9** or **10**), data is being processed.

That is, the logical sum of the signals output from **9** and **10** 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

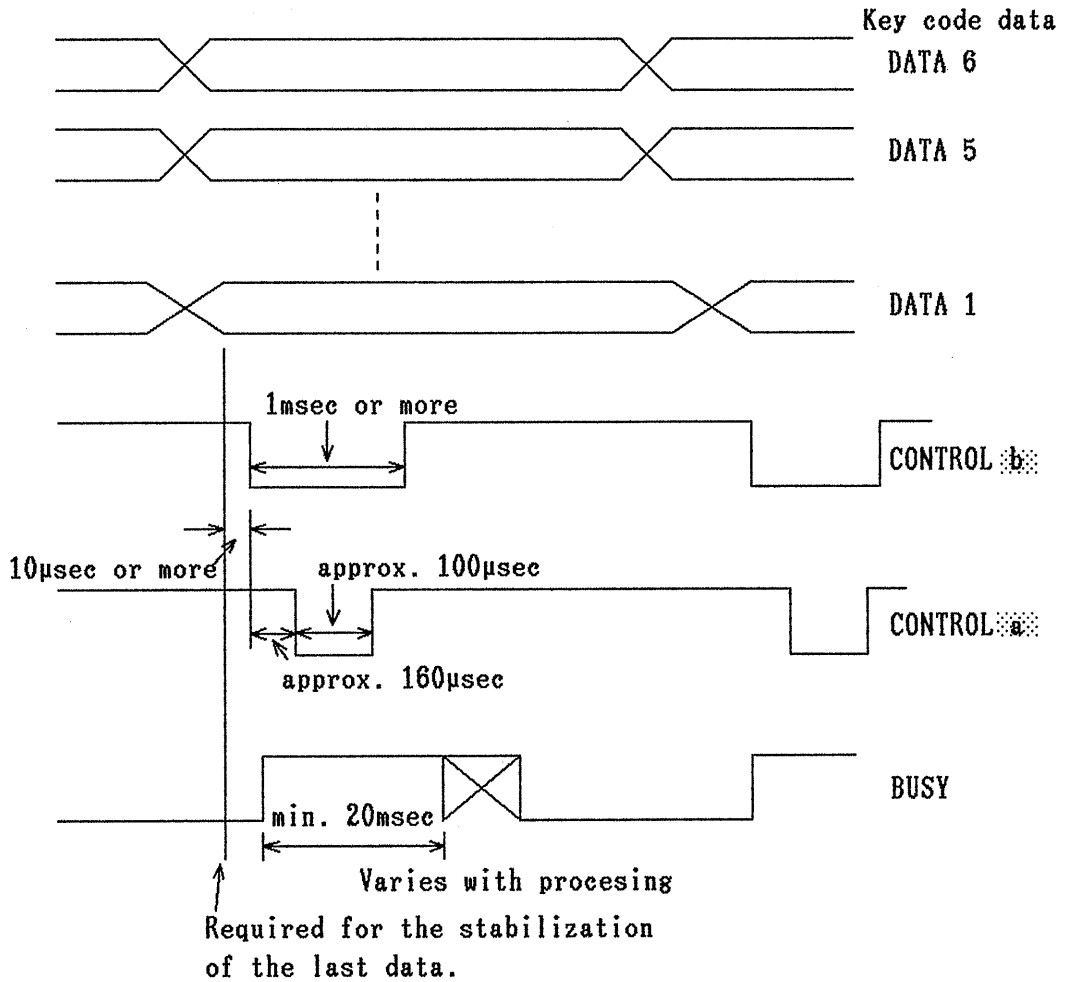


Figure 5-2

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 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	
MEMORY RCL / STO	0	0	0	1	0	0
” V / RIN	0	0	0	1	1	1
” Δ / NEXT	0	0	0	1	1	0
YE (Yellow Key)	0	1	1	0	1	1
MODULATION EXT	0	0	1	0	0	1
” 400Hz	0	0	1	0	1	1
” 1kHz	0	0	1	1	0	0
” 3kHz	1	0	1	0	1	0
MODULATION 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	0	1	0	1	0	0
DATA 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
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



(cont'd)

Table 5-1

Key name	← Key Code →					
	MSB					LSB
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 ΔTREQ	1	1	1	1	0	1
FUNCTION +/-	1	0	1	0	0	1
FUNCTION Δ	0	1	1	0	0	1
FUNCTION ∇	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 Δ	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 600MHz 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 1 msec or longer as shown in Figure 5-2 (input data timing).
- 3) Set the data "600" according to the code table and send CONTROL  signal as shown in Figure 5-3.

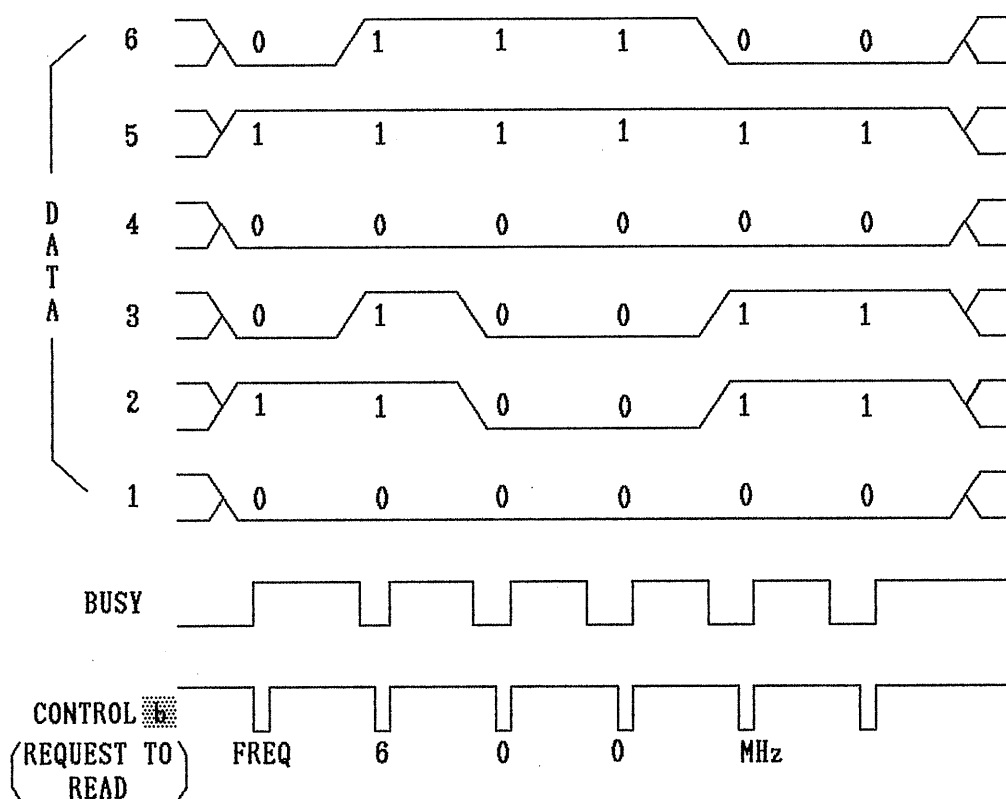




Figure 5-3

- 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.

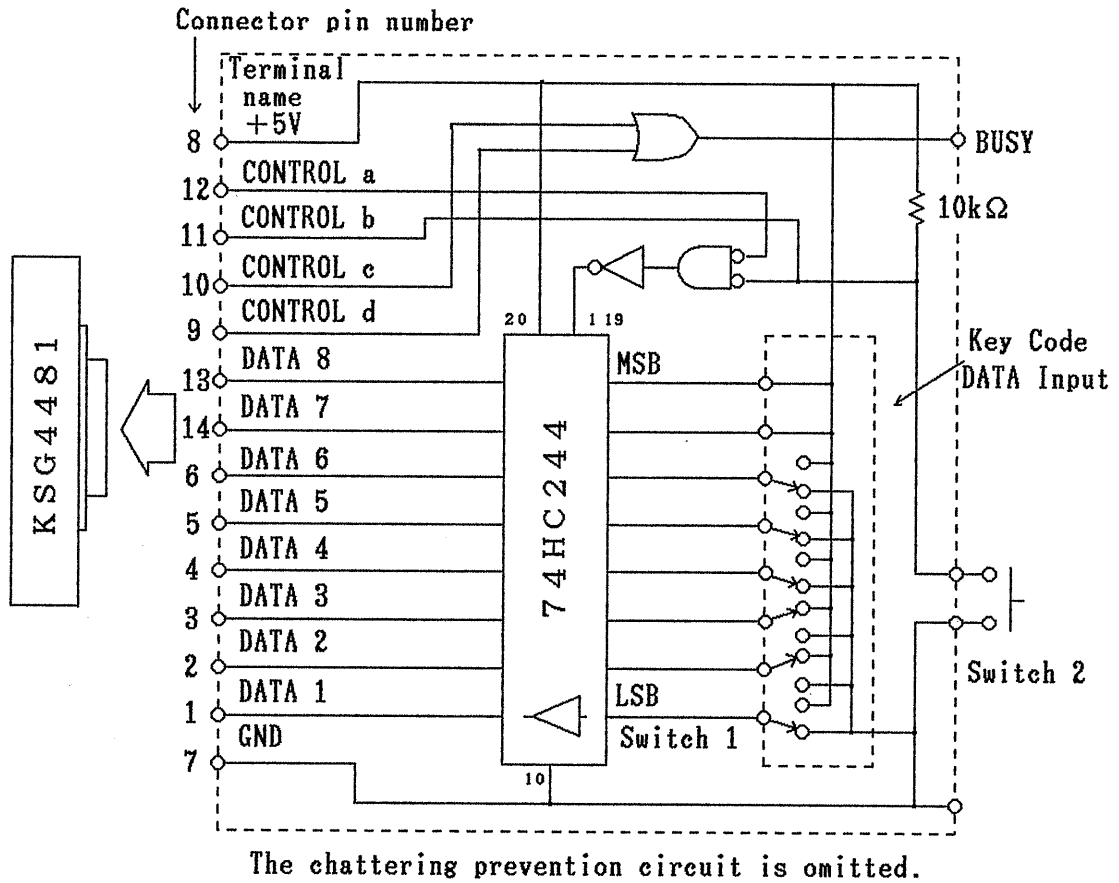



Figure 5-4

Set the data of MEMORY RCL  $\Delta$  on Key Code Data Input Switch 1 according to the key code table (Table 5-1) and set CONTROL  $\square$  to "0" (Press Switch 2). Then, approximately 160 $\mu$ sec later, CONTROL  $\square$  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 KSG4481 during the period of approximately 100 $\mu$ sec when CONTROL  $\square$  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  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.

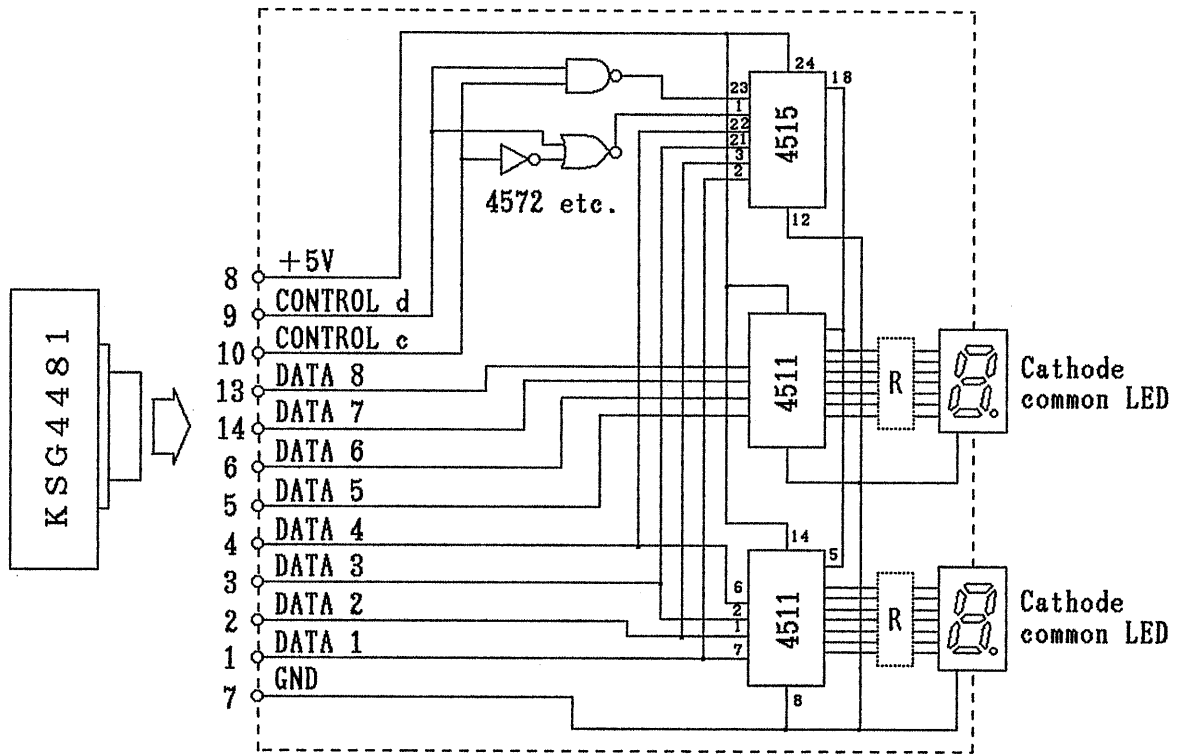


Figure 5-5

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. BACKUP BATTERY AND INITIALIZING CPU

The KSG4481 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 CADINC BACKUP N-SB3 of Sanyo Electric Co., Ltd.

[Battery position and replacement method]

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

Remove the single screw on the right side holding case and the four screws on 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 four screws on the left side and single screw on the right. Then, turn on the power switch and initialize the CPU by pressing the initial set button once by inserting a screwdriver through the hole in the side of the aluminum sash case.