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.

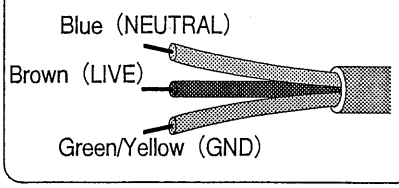
☐ AC power cable

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

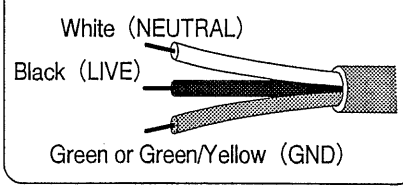
WARNING

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

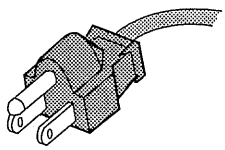
☐ Without a power plug



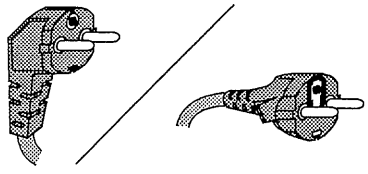
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

CONTENTS

CONTENTS

(Cont'd)

1. INTRODUCTION

1.1 Geceral Description

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

The ranges of the output signal ferquencies 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 0dBμ to 90dBμ (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 continouos points. The 100 points are grouped into 10 blocks, each consisting of 0 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 lador 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 ΔFREQ (frequency difference) display function and the ±/- function to see selectivity are provided.

(2) The range of output level is 0dBμ to 90dBμ (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 momorized 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 digiral mode.

(7) The input data can be corrected quickly by use of the BS (back space) key (⇦).

(8) All the memorized data can be copied to the memory of another KSG4481 by pressing the DUMP key once.

(9) All the operations on panel can be controlled in remote mode.

2. SPECIFICATIONS

○ Frequency (RF)

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

○ Output level

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

Residual modulation (S/N)

FM component	:	Demodulation frequency range = 50Hz to 15kHz 22.5kHz deviation ratio ≧46dB (≦111Hz)
AM component	:	Demodulation frequency range = 50Hz to 15kHz 30% depth ratio ≧46dB (≧0.15%)

○ Modulation

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

Internal modulation frequency	400Hz/1kHz/3kHz, ±3%
External modulation	
1) Input impedance	Approx. 10kΩ (unbalanced)
2) Input voltage requirement for external modulation	Approx. 3Vp-p *Note : For the above input voltage, an error of ±2% is allowed by HI-LO monitor.*

<Frequency Modulation>

Deviation	:	0 to 99.5kHz
Resolution	:	0.5kHz
Display	:	3-digit display
Accuracy	:	≦(Display value ±10) kHz
External modulation frequency characteristics	:	20Hz to 100kHz (1kHz reference) ±1dB

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

<Amplitude Modulation>

Depth : 0 to 50%

Resolution : 0.5%

Display : 3-digit display

Accuracy : ≦(Display value ±5)%

External modulation frequency characteristics : 50Hz to 10kHz (1kHz reference)
±1dB

Distortion : Demodulation range: 50Hz to 15kHz
Modulation frequency: 400Hz to 10kHz
Depth 30%
≦3% (at output level≦87dBμ)

○ Setting functions : 1) Numeric keys and rotary knob
(with cursor desgination)
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)

○ 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

○ 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 theselected 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.

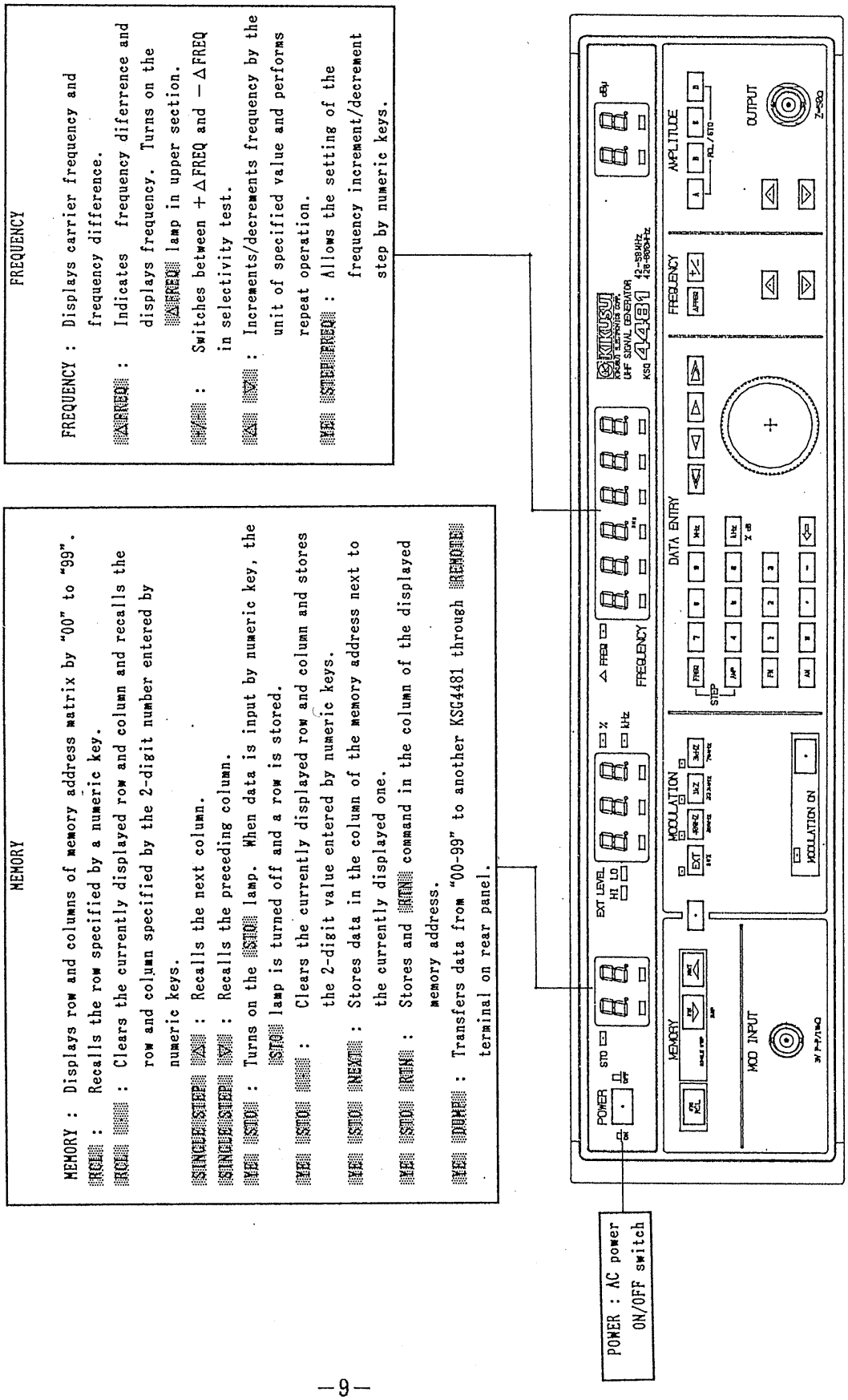
Setting Position	Center Voltage	Line Voltage Range	Fuse
A	100V	90 - 110V	1.0A
B	115V	104 - 126V	
C	215V	194 - 236V	0.5A
D	230V	207 - 253V	

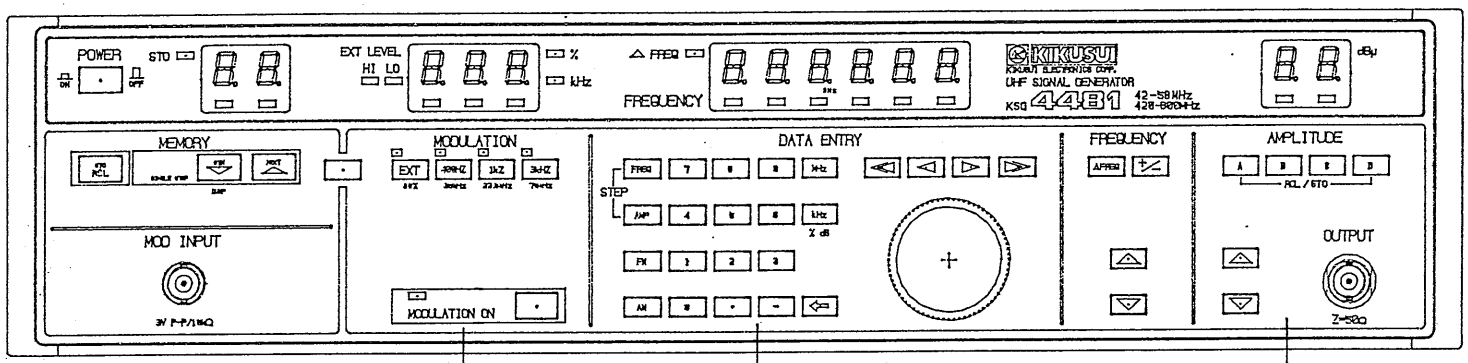
3.3 Surrounding Temperature/Humidity, Warm-up Time, and Installation Place

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

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

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

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

% : Indicates AM depth by the unit of 0.5%.

kHz : Indicates FM frequency deviation by the unit of 0.5kHz.

EXT 400Hz 1kHz 3kHz : Switches between external and internal modulation for FM and AM.

MODULATION ON : Turns modulation ON/OFF.

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

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 % dB : Entr units.

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

◁◁ ▷▷ : Move cursor into block.

◁ ▷ : Move cursor within block.

Rotary knob : Modifies the value at cursor position.

AMPLITUDE

AMPLITUDE : Displays RF output level by two digits.

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

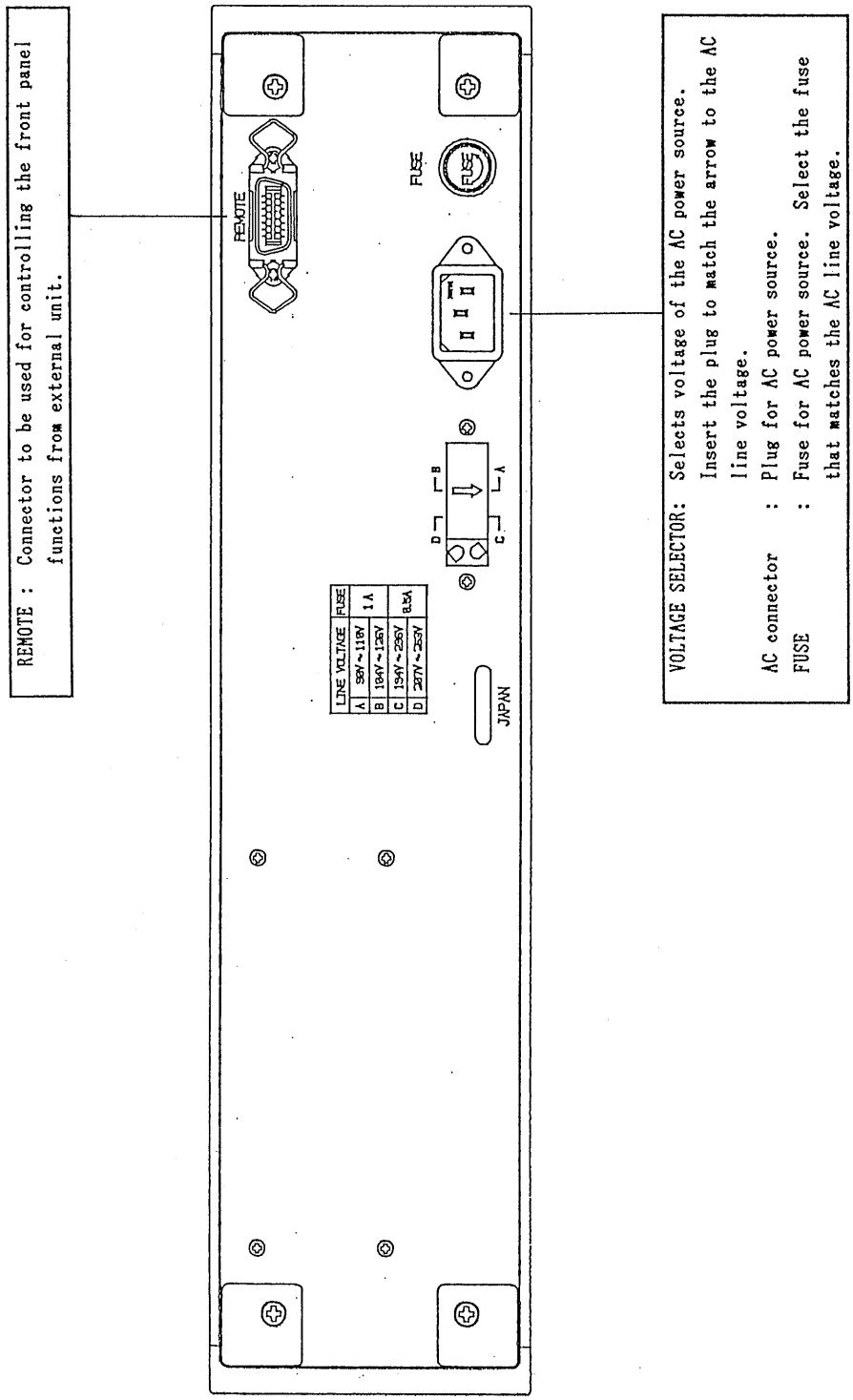
△ ▽ : Increments/decrements amplitude by the unit of specified value and performs repeat operation.

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

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

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

4.2 Rear Pamel Features

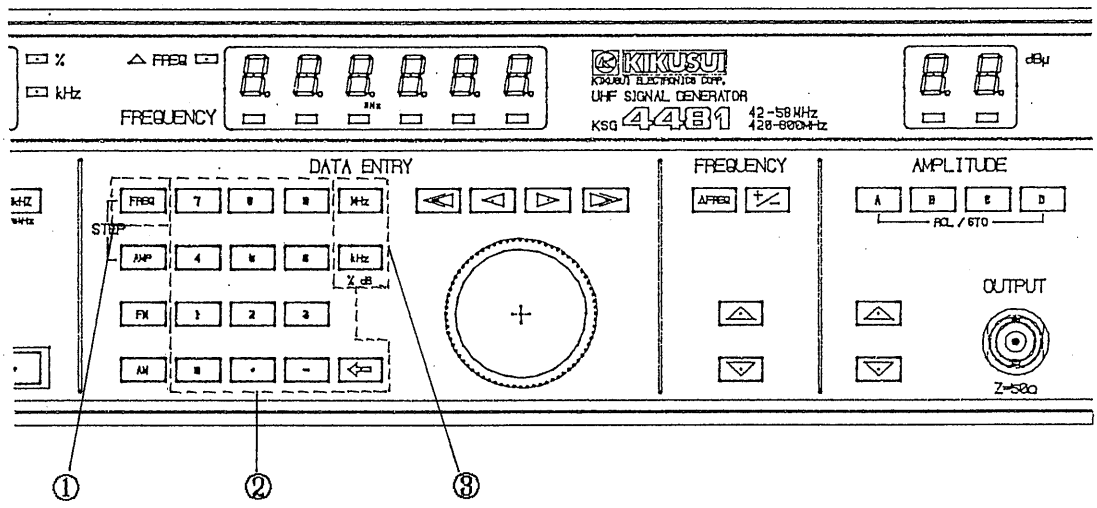


4.3 Turning on the Power Supply

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 FREQ	×××.×××	Previous value
② 6	6␣␣ ␣␣␣	
③ 9	69␣ ␣␣␣	
④ 7	697 ␣␣␣	
⑤ .	697.␣␣␣	
⑥ 7	697.7␣␣	
⑦ 5	697.75␣	
⑧ MHz	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␣
FREQ	697.75␣
5	5␣␣ ␣␣␣
3	53␣ ␣␣␣
.	53.␣␣␣␣
8	53.8␣␣␣
MHz	␣53.800

When a wrong character is input by a numeric key, that cahracter 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 ␣␣␣
←	Press onec	54␣ ␣␣␣
←	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 nuit 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
	600.00␣
◁ Press once	600.00␣
 Turn the rotary knob clockwise by two steps	600.20␣

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

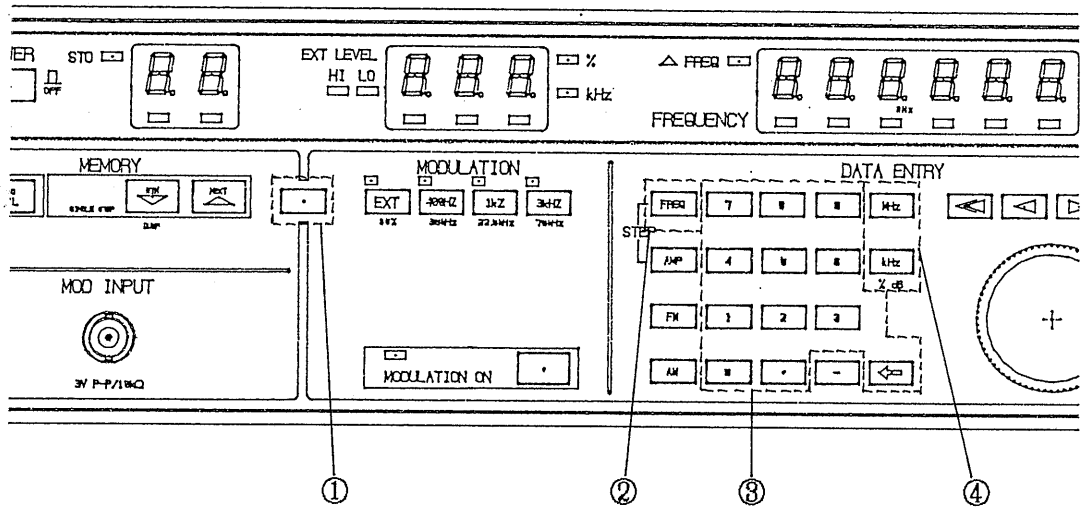
Key operation	FREQUENCY display
	600.20␣
◁ Press twice	600.20␣
 Turn the rotary knob counterclockwise by two steps	580.20␣

After changing frequency by the rotary knob, the unit key (MHz or kHz) need not be pressed.

4.4.3 Setting frequency step for △ and ▽ keys

Set a desired step value 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 1MHz for △ and ▽ keys when carrier frequency is 580.2MHz.

Key operation	FREQUENCY display	
YE STEP FREQ	580.20␣	Previous value
1	1␣␣ ␣␣␣	
MHz	580.20␣	
△ Press once	581.20␣	

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 1MHz.

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 ΔFREQ indicator in the [FREQUENCY] display section is turned on and the frequency difference(ΔFREQ) is displayed.

(a) Example: 580 MHz is set currently.

Key operation	FREQUENCY display	
[YE]	××× ×××	
[STEP FREQ]	××× ×××	
[1]	1␣␣ ␣␣␣	
[0]	10␣ ␣␣␣	
[0]	100 ␣␣␣	
[kHz]	××× ×××	
[FREQ]	××× ×××	
[5]	5␣␣ ␣␣␣	
[8]	58␣ ␣␣␣	
[0]	580 ␣␣␣	
[MHz]	580.00␣	
[ΔFREQ]	␣␣0.00␣	ΔFREQ indicator comes on
[FREQUENCY] [▽]	−␣0.10␣	Carrier frequency 579.90MHz
[C←]	␣␣0.00␣	

If the operator keeps pressing the [△] or [▽] key in the [FREQUENCY] section, the repeat function is applied and the frequency keeps increasing or decreasing by the unit of 100kHz.
If the [C←] 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␣	
ΔFREQ		␣␣0.00␣	ΔFREQ indicator comes on
×1	Press twice	␣␣0.00␣	
	Turn the rotary knob counterclockwise by five steps	−␣5.00␣	Carrier frequecy 575MHz
ΔFREQ		575.00␣	

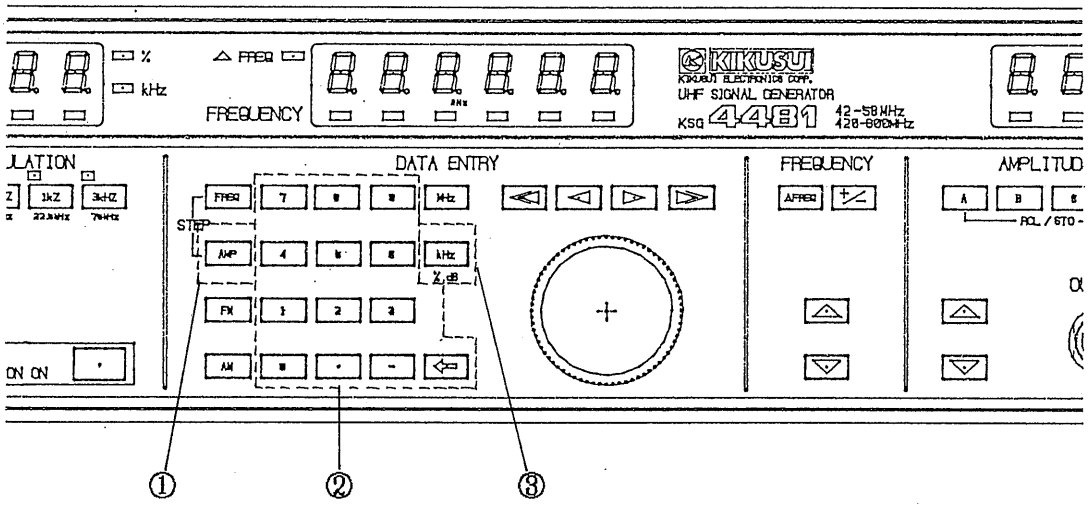
To release the ΔFREQ function, press the ΔFREQ key again. In the above example, the carrier frequency effective after therelease is 575MHz.

(c) Example: Using +/− key after modification of 580MHz by ΔFREQ

Key operation	FREQUENCY display	
	580.00␣	
FREQ	580.00␣	
ΔFREQ	␣␣0.00␣	ΔFREQ indicator comes on
2	2␣␣ ␣␣␣	
0	20␣ ␣␣␣	
0	200 ␣␣␣	
kHz	␣␣0.20␣	Carrier frequency 580.2MHz
+/−	−␣0.20␣	Carrier frequency 579.8MHz
ΔFREQ or FREQ	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	
AMP	××	..... Previous value
6	6␣	
0	60	
dB	60	

(b) Example: To set 5dB

Key operation	AMPLITUDE display
AMP	60
5	5␣
dB	␣5

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

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

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

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

4.5.2 Rotary knob

The rotary knob increases or decreases the value of the digits at and above the cursor position in the [AMPLITUDE] section.
Use the ◁ 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 dB (kHz) unit key need not be pressed.

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

The mark "_" denotes the cursor position

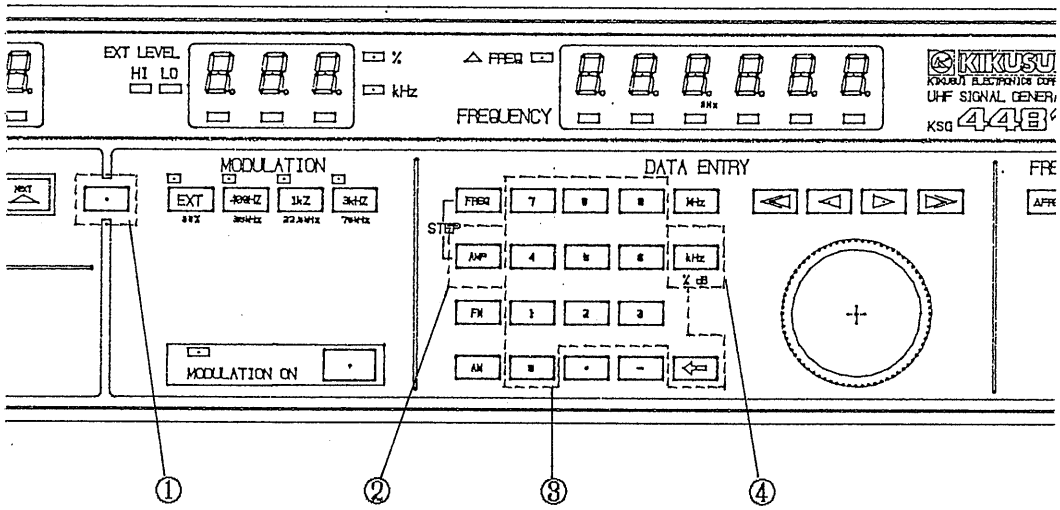
Key operation		AMPLITUDE display
		4 6
◁	Press once	4 6
	Turn the rotary knob clockwise by two steps	6 6

(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.



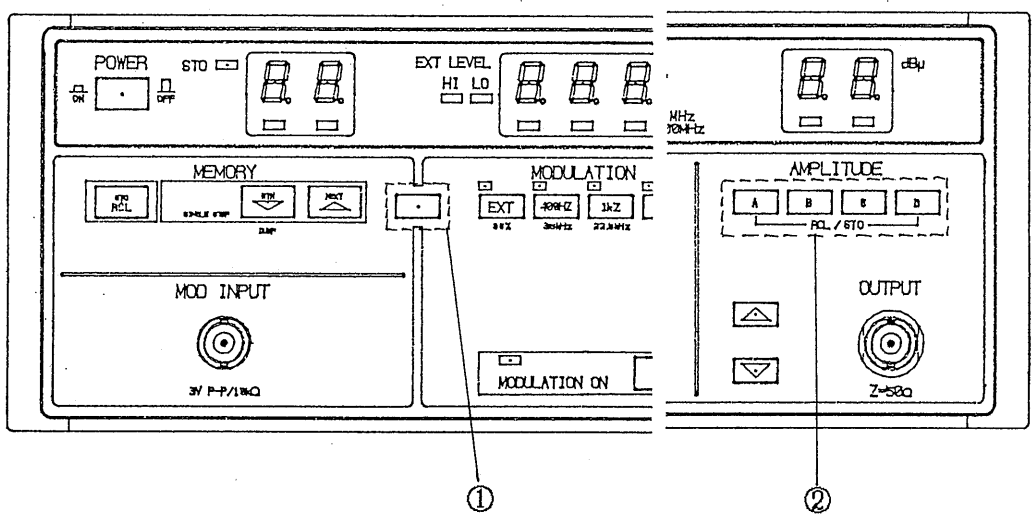
Press keys in the order of ①, ②, ③, and ④ in the above chart.

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

Key operation	AMPLITUDE display
YE STEP AMP	6 0
2	2 ␣
dB	6 0
△ Press once	6 2

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 Use of independent 4-point memory



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

To store the currently displayed value of output level, press the YE key in section ① and one of the keys A to D in section ② in this order. The value is stored into the memory area corresponding to the kye 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 [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.

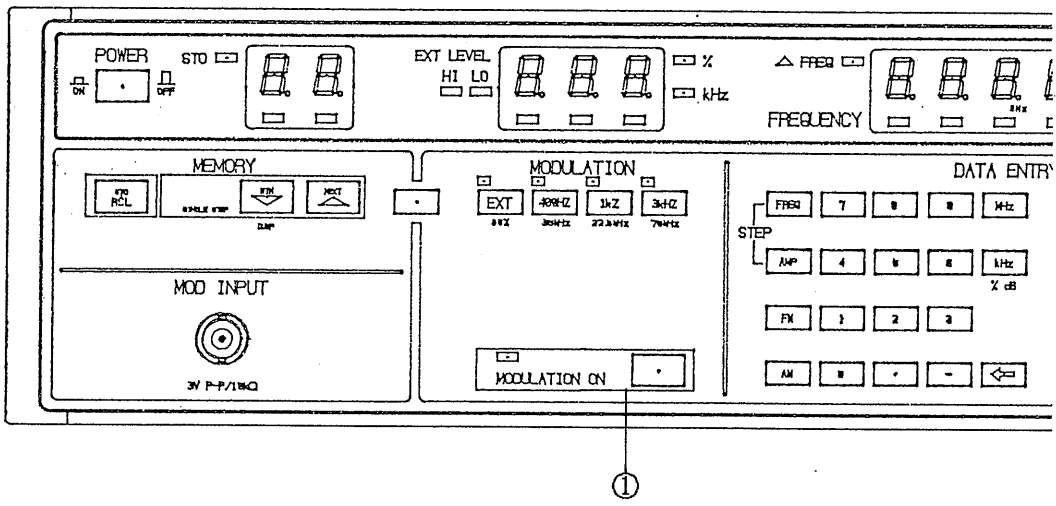
c) Press [YE] [22.5kHz], and the FM peak frequency deviation is set to 22.5kHz.

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.

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



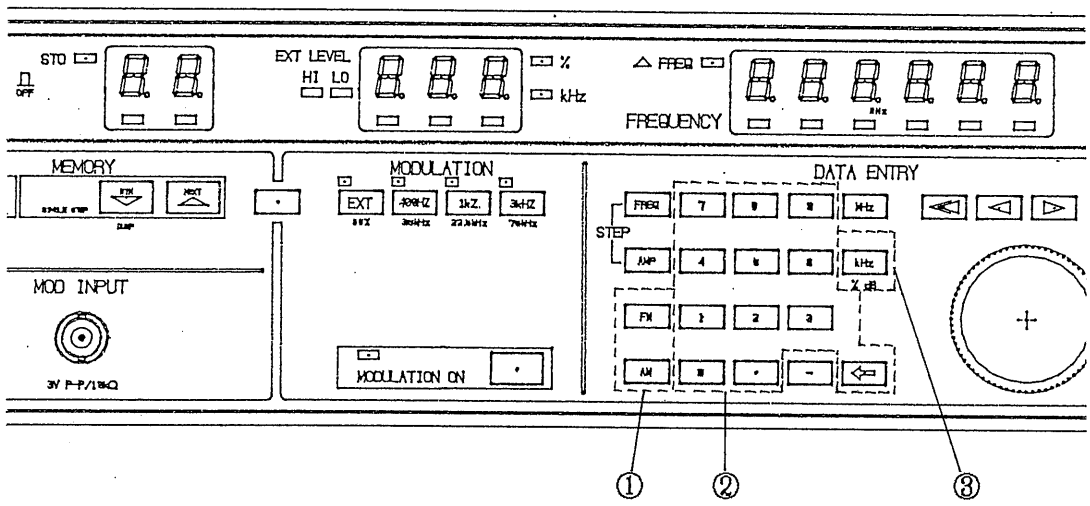
(a) Example: 75kHz deviation is to be set for 400Hz internal FM source

Key operation	MODULATION display
[FM 400Hz]	[400Hz] indicator is on
[FM]	××.× ... Previously set value
	[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 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
FM	××.× .... Previously set value kHz is displayed as unit
2	2␣␣
5	25␣
kHz	25.0

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

Key operation	MODULATION display
AM	××.× .... Previously set value % is displayed as unit
3	3␣␣
0	30␣
%	30.0

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
FM		25.0
◁	Press once	25.0
	Turn the rotary knob clockwise by one step	35.0

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

Key operation		MODULATION display
AM		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(kHz or %) need not be pressed.

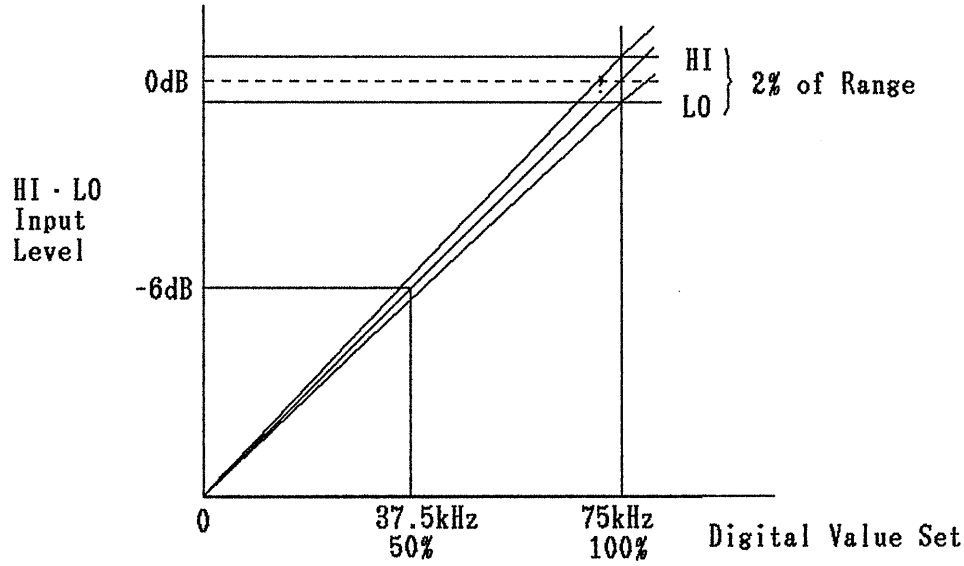
4.6.5 External modulation signal connection and setting

(1) Connection and setting method

Connect the external modulation signal input terminal to [MOD INPUT] on the front panel. The input impedance is approximately 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 timethe 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 isset within the error range of ±2%. The modulaion is converted into adigital 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.

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 [illegible] kyes.
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, 1 key	"10"

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

RCL key, 4 key	
Press 「MEMORY」 △ key three times	"43"

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

RCL key, 8 key

Press [MEMORY] △ key five 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 · 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 the step values of carrier frequency, output level, and ΔFREQ function cannot be stored.

The basic store operation is to set data such as carrier frequency, output level, and modulation mode and press YE, STO, numeric key, and [MEMORY] △ in this order. Also, the data can be stored directly into a row and column by entering a 2-digit number by numeric keys after clearing the [MEMORY] display by YE and ·.

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

①	FREQ	×××.×××
	6	6␣␣ ␣␣␣
	0	60␣ ␣␣␣
	0	600 ␣␣␣
	MHz	600.00␣

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

② AMP ××
6 6␣
0 60
dB 60

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

③ kHz ××.×
YE 3kHz(75kHz) 75.0 kHz

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 three times	"13"	
YE STO RTN	"13"	RTN command is stored

[How to use the function]

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

4.7.4 How to release RTN key

The following two methods are available:

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

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

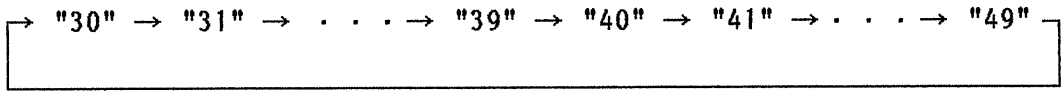
4.7.5 Recalling more than ten columns continuously (Setting NEXT key)

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:



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 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
RIN (▽)	"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 [YES], [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 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.

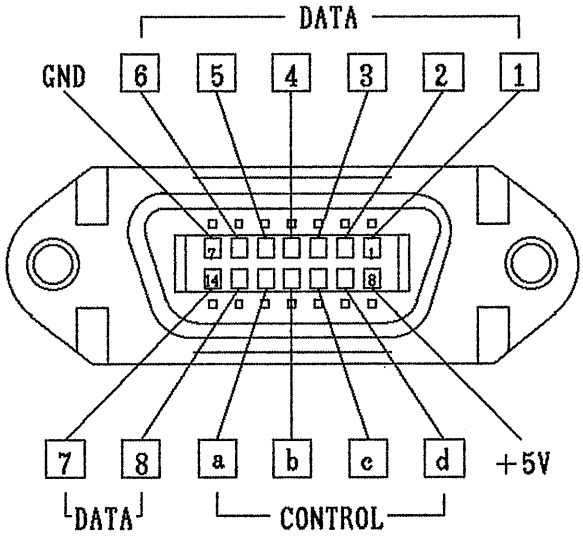


Figure 5-1

[Explanation of terminals]

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

1) DATA terminals [illegible] - [illegible] (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 [illegible] - [illegible] directly.

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

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

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

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

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

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

4) +5V (Pin 8)

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

5) GND (Pin 7)

5.2.2 Input data timing

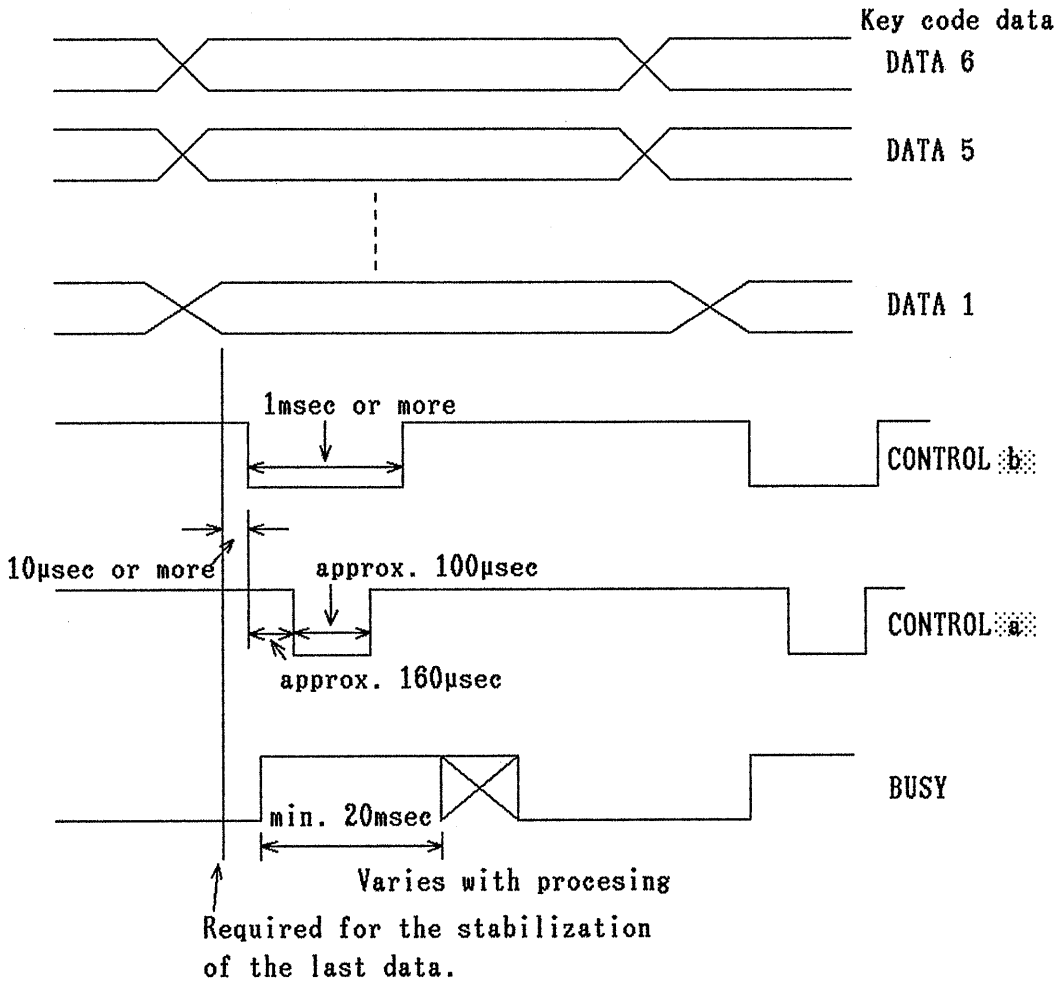


Figure 5-2

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

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

5.2.3 Panel key code table

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

Table 5-1

Key name	Key code input pin number					
	6	5	4	3	2	1
	MSB	← Key Code →				LSB
MEMORY RCL / STO	0	0	0	1	0	0
〃 ▽ / RIN	0	0	0	1	1	1
〃 △ / 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	MSB	← Key Code →				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
FREQUNCY △FREQ	1	1	1	1	0	1
FUNCTION +/−	1	0	1	0	0	1
FUNCTION △	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 △	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 [b] 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 [b] signal as shown in Figure 5-3.

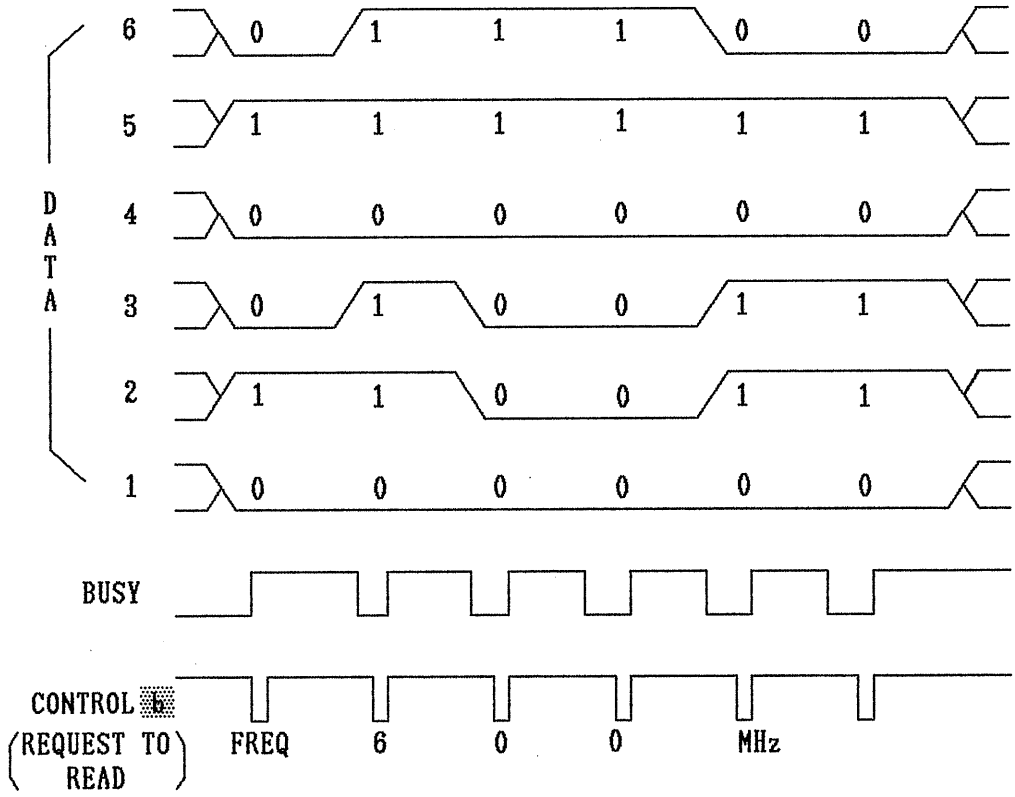


Figure 5-3

4) Finally, send "010110" for "MHz" with CONTROL [b] signal, and the data transmission is completed.
5) When the signal generator receives the last data, namely, "010110" for "MHz" and CONTROL [b], it starts processing the specified frequency.

5.2.5 Remote Control circuit diagram example and operation.

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

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

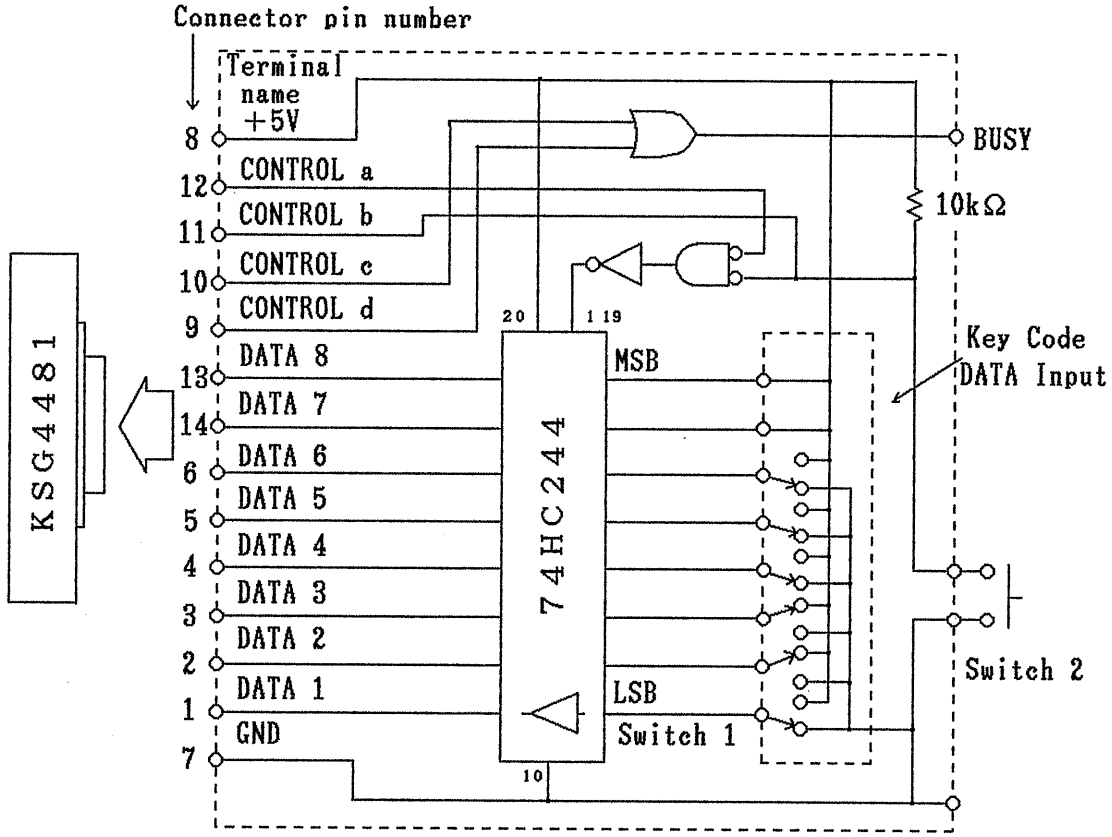


Figure 5-4

Set the data of MEMORY RCL △ on Key Code Data Input Switch 1 according to the key code table (Table 5-1) and set CONTROL [illegible] to "0" (Press Switch 2). Then, approximately 160μsec later, CONTROL [illegible] 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 100μsec when CONTROL [illegible] 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 [redacted] 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.

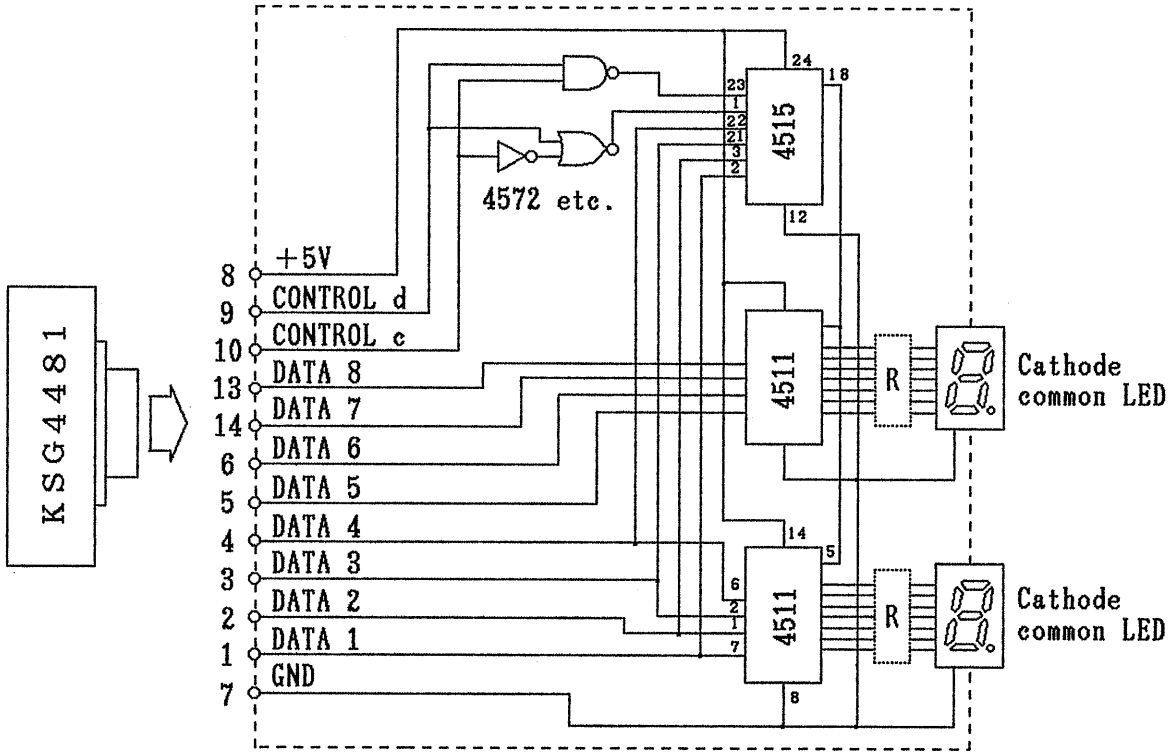


Figure 5-5

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 approximatly 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 curcuit 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.