OPERATION MANUAL

MULTIPLEX SIGNAL GENERATOR

KSG3210

Second Edition

KIKUSUI ELECTRONICS CORPORATION

(KIKUSUI PART NO. Z1-477-820)

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.

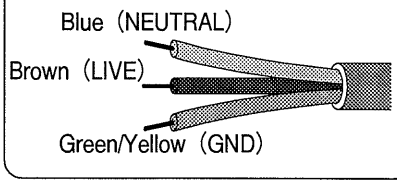
☐ AC power cable

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.

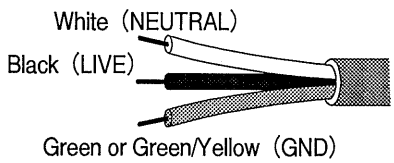
WARNING

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

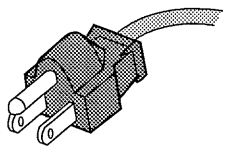
☐ Without a power plug



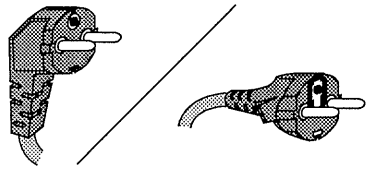
☐ Without a power plug



☐ 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

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1. INTRODUCTION

1.1 General Description

The KSG3210 is a multiplex signal generator that conforms to the United States FCC (Federal Communications Commission) FM stereo broadcast format. As it has excellent channel separation and modulation distortion characteristics and is equipped with remote functions, it is used not only as an FM broadcast equipment modulator, but also for measuring in testing research, stereo demodulation ICs and adaptors, and also in combination with the KSG4300 FM-AM preparatory signal generator for adjusting, testing and measuring the characteristics of high-quality FM stereo receivers and tuners.

The KSG3210 can also generate the transmission signals of the format stipulated by the EBU (Europe) for TRI (Traffic Radio Information), as wellas a similar format under consideration in the United States.

As these transmission signals can be output alone or mixed with FM stereo signals, it can be used in the research, development and production processes of FM stereo receivers with built-in TRI reception capabilities.

Panel controls are of the recall method (100-point memory), and uses a rotary knob for increased convenience of operation. The rotary knob maintains the familiar feeling of analog operation and is most helpful for setting memory recall, modulation level, pilot level, output level and TRI modulation level.

The most outstanding feature is that, because all control panel functions have been digitized, the KSG3210 modulation level, pilot level, various modes, TRI etc. can all be stored in the 100-point memory, and when connected to the KSG4100 - 4300, the KSG3210 memory operates synchronically, thus obviating the need to operate the KSG3210 when operating the KSG4100 - 4300 memory recall. This results in labor savings, especially on production lines.

As for remote control, key operation, rotary knob, etc. are modified and connected to the rear panel 14P connector along with the clock pulse input. This allows the expansion of functions.
Because GP-IB control is standard equipped, system upgrading to automatic measurement is possible.

Further, when connected to an SCA signal generator, an SCA signal can be added. TRI = Traffic Radio Information

1.2 Features

(1) The KSG3210 is extremely easy to operate because all operations are microprocessor controlled and set values are digitally displayed.

(2) All panel indications can be memorized, with 100 points able to be stored and recalled.

(3) By combining with the KSG4100 - 4300, control of the KSG3210 memory functions can be synchronized with the KSG4100 - 4300 memory operations.

(4) The stored data can be copied onto another unit of the same type by pressing the DUMP key.

(5) Memory recall, modulation level, pilot level, output level, TRI modulation level, etc. are continuously variable to the desired digit (designated by the cursor) by means of the rotary knob.

(6) Channel separation is excellent--72dB or better (actual measured value) at the middle frequencies.

(7) Phasing is extremely stable, with no need for calibration for very long periods.

(8) The internal modulation generator is provided with 7 waves for modulation, with superb low distortion--0.005% or less (actual measured value). These internal modulation generator signals can be output, enabling use as a low-distortion spot generator.

(9) A pilot signal output connector and phase adjustor are provided, so pilot signal phase adjustment is quite easy.

(10) Modulation preset keys are provided for monophonic 100%, stereo 100%, stereo 30% and TRI 100%, permitting one-touch operation. Also, ON/ OFF of the modulation level, pilot level and TRI modes are each independently controllable.

(11) The S/N ratio is excellent.

(12) An SCA channel signal input connector is provided on the rear panel.

(13) Each panel operation can be remote controlled.

(14) A GP-IB control is standard equipped.

2. SPECIFICATIONS

○ Separation	:	30Hz to 15kHz	≧66dB
○ Frequency Characteristics	:	30Hz to 15kHz	±0.3dB (1kHz reference)
○ Modulation Level			
Range			
Stereo	:	0 to 100%	pilot OFF
		0 to 115%	pilot ON at 15%
Monophonic	:	0 to 100%	
Resolution	:	0.5%	
Accuracy	:	≦(indicated value ±5)%	
Display	:	3-digit numeric	
○ Composite Output			
Range	:	1.5Vp-p to 9.99Vp-p	open-circuit voltage
Resolution	:	10mVp-p	
Accuracy	:	≦(indicated value ±0.5)Vp-p	
Display	:	3-digit numeric	
Impedance	:	Approx. 75Ω	unbalanced
Distortion Factor	:	At demodulation bandwidth 30Hz to 15kHz	
		200Hz to 10kHz	≦0.01%
		30Hz to 15kHz	≦0.05%
S/N Ratio	:	At demodulation bandwidth 30Hz to 15kHz	
		≧90dB	

○ Monophonic Output

Frequency Characteristics	:	30Hz to 80kHz	±0.5dB (1kHz reference)
Distortion Factor	:	At demodulation bandwidth 30Hz to 15kHz	
		200Hz to 10kHz	≦0.01%
		30Hz to 15kHz	≦0.05%
S/N Ratio	:	At demodulation bandwidth 30Hz to 15kHz ≧90dB	

○ Pilot Signal

Frequency/Accuracy	:	19kHz/±1Hz	
Modulation			
Range	:	0 to 15%	10% specified level
Resolution	:	1%	
Accuracy	:	≦(indicated value ±2)%	
Display	:	2-digit numeric	

○ Pilot Output

Output Voltage	:	Approx. 1Vrms	open-circuit
Impedance	:	Approx. 600Ω	unbalanced

○ Internal Modulation Generator

Frequency/Accuracy	:	30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10Hz, 15kHz/±5%

○ Internal Modulation Generator Output

Frequency	:	According to internal modulation generator frequency

Output Voltage	:	Approx. 1Vrms	open-circuit
Impedance	:	Approx. 600Ω	unbalanced
Distortion Factor	:	At demodulation bandwidth 30Hz to 15kHz ≦0.01%	

○ External Modulation Input

a) AF/L

Frequency Range

Stereo	:	30Hz to 15kHz	
Monophonic	:	30Hz to 80kHz	
Input Voltage	:	3Vp-p	±2%
Input Impedance	:	Approx. 10kΩ	unbalanced

b) R

Frequency Range

Stereo	:	30Hz to 15kHz	
Input Voltage	:	3Vp-p	±2%
Input Impedance	:	Approx. 10kΩ	unbalanced

○ SCA

Input Voltage	:	Approx. 1Vrms	at 10% modulation
Input Impedance	:	Approx. 10kΩ	unbalanced

○ Preemphasis : 25μs, 50μs, 75μs

TRI (Traffic Radio Information) Section

1) EBU System

○ SK (Transmitter Identification Signal)

Frequency/Accuracy : 57Hz/±3Hz

Modulation

Range : 0 to 10% 5% specified level

Resolution : 0.1%

Accuracy : ≦(indicated value ±2)%

Display : 2-digit numeric

○ DK (Announce Identification Signal)

Modulation : Amplitude modulation w/SK signal as carrier

Modulation Freq. : 125Hz (1/456 of 57kHz)

Modulation Level : 0 to 35% 30% specified level

Resolution : 1%

Accuracy : ≦(indicated value ±5)%

Display : 2-digit numeric

Distortion Factor : At demodulation bandwidth 15Hz to 15kHz
≦0.8%

o BK (Area Identification Signal)

Modulation	:	Amplitude modulation w/SK signal as carrier
Modulation Freq.	:	A 23.75Hz (1/2400 of 57kHz) B 28.27Hz (1/2016 of 57kHz) C 34.93Hz (1/1632 of 57kHz) D 39.58Hz (1/1440 of 57kHz) E 45.67Hz (1/1248 of 57kHz) F 53.98Hz (1/1056 of 57kHz)
Modulation Level	:	0 to 64% 60% specified level
Resolution	:	1%
Accuracy	:	≦(indicated value ±5)%
Display	:	2-digit numeric
Distortion Factor	:	At demodulation bandwidth 15Hz to 15kHz ≦1.5%
Area Selection	:	Step switching
Scan Function		
Scan Interval	:	0 to 9.9 sec
Resolution	:	0.1 sec
Skip Function	:	Each area possible (set to 0 sec)

o DK,BK Signal Output : Output when SK is OFF
DK approx. 0.3Vrms at 30% modulation
BK approx. 0.6Vrms at 60% modulation

2) USA System

○ 57kHz Pilot

Frequency/Accuracy : 57Hz/±3Hz

Modulation

Range : 0 to 10% 5% specified level

Resolution : 0.1%

Accuracy : ≦(indicated value ±2)%

Display : 2-digit numeric

○ ME1 (Message Signal 1)

Modulation : Amplitude modulation w/57kHz carrier

Modulation Freq. : 142.5Hz(1/400 of 57kHz)

Modulation Level : 0 to 64% 60% specified level

Resolution : 1%

Accuracy : ≦(indicated value ±5)%

Display : 2-digit numeric

Distortion Factor : At demodulation bandwidth 15Hz to 15kHz
≦0.8%

○ ME2 (Message Signal 2)

Modulation : Amplitude modulation w/57kHz carrier

Modulation Freq. : 154.9Hz (1/368 of 57kHz)

Modulation Level : 0 to 64% 60% specified level

Resolution : 1%

Accuracy : ≦(indicated value ±5)%

Display : 2-digit numeric

Distortion Factor : At demodulation bandwidth 15Hz to 15kHz
≦0.8%

o ZO (Zone Signal)

Modulation : Amplitude modulation w/57kHz carrier

Modulation Freq. :

1	23.75Hz (1/2400 of 57kHz)
2	28.27Hz (1/2016 of 57kHz)
3	34.93Hz (1/1632 of 57kHz)
4	39.58Hz (1/1440 of 57kHz)
5	45.67Hz (1/1248 of 57kHz)
6	53.98Hz (1/1056 of 57kHz)
7	63.62Hz (1/ 896 of 57kHz)
8	75.79Hz (1/ 752 of 57kHz)
9	98.95Hz (1/ 576 of 57kHz)
10	122.84Hz (1/ 464 of 57kHz)

Modulation Level : 0 to 70% 60% specified level (however, during simultaneous modulation with ME1 or ME2, the degree of modulation becomes approx. 1/2)

Resolution : 1%

Accuracy : ≦(indicated value ±5)%

Display : 2-digit numeric

Distortion Factor : At demodulation bandwidth 15Hz to 15kHz
≦1.5%

Area Selection : Step switching

Scan Function

Scan Interval : 0 to 9.9 sec

Resolution : 0.1 sec

Skip Function : Each zone possible (set to 0 sec)

o ME1/2/ZO Signal Output: Output when 57kHz is OFF
ME1 approx. 0.6Vrms at 60% modulation
ME2 approx. 0.6Vrms at 60% modulation
ZO approx. 0.6Vrms at 60% modulation

o Setting Modes

Functions : ON, MONO, MAIN, LEFT, RIGHT, SUB

Sources : 30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10kHz, 15kHz, EXT, EXT L/R

Pilot Signal : ON/OFF

TRI Signal : EBU, SK, DK, BK, USA, 57kHz, ME1, ME2, ZO, SCAN INTERVAL

o Setting Functions : 1) Memory setting of modulation level, pilot level, output level, TRI modulation level using the rotary knob

2) Preset keys
Monophonic 100% (Output level set)
Stereo 100%, 30%
TRI 100%

3) Memory set 10-keys
(operate only with memory function)

o Memory Function : 1) 100 points (modulation level, pilot level, TRI level, TRI modulation level, set mode, etc.)

2) Use with 10 points x 10, or 100 continuous points possible

- DUMP Function : Using the DUMP key, it is possible to transfer the contents of the 100-point memory to another unit of the same model

- Remote Control : Same controls as the front panel

- GP-IB Interface : Interface function

Function	Code	Comments
Transmission Handshake	SH0	Has no functions
Reception Handshake	AH1	Has all functions
Talker	T0	Has no functions
Listener	L1	Basic listener func. only
Service Request	SR0	Has no functions
Remote/Local	RL1	Has all functions
Parallel Pole	PP0	Has no functions
Device Clear	DC1	Has all functions
Device Trigger	DT0	Has no functions
Controller	C0	Has no functions

- Backup Battery Provided

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

  Frequency : 50Hz/60Hz

  Power dissipation : Approx. 28VA

- Size and Weight

  Dimensions : 430(W) × 99(H) × 250(D) mm
  (16.93(W) × 3.90(H) × 9.84(D) in.)

  445(W) × 119(H) × 305(D) mm (Full envelope)
  (17.52(W) × 4.69(H) × 12.01(D) in.)

  Weight : Approx. 5.5kg (12 lbs)

○ Environmental Conditions (temperature and humidity)

Range to satisfy specifications	:	5 to 35°C (41 to 95°F); 85% or less
Allowable range for operation	:	0 to 40°C (32 to 104°F); 90% or less

○ Accessories	:	Ouptut cable (SA570)	1
		Power supply cord	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 KSG3210 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 KSG3210, 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 KSG3210 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

At the end of this operation manual are diagrams of the front and rear panels.
These diagrams are numbered from ① to ㉔, so hereinafter all explanations will refer to these numbers. Please read the explanations with the diagrams folded out so you can refer to them as needed. This section centers on how to operate for stereo modulation. Please refer to article 4.6 for how to operate for traffic radio information systems.

4.1 Explanation of the Front Panel

① POWER
The power supply switch. Turns on when pressed and off when pressed back. When the power is turned on, first all the front panel indicators illuminate momentarily, and then the mode immediately prior to turning off the power is indicated.
However, this excludes the ④ EXT LEVEL HI, LO indicators.

② MEMORY Indicator
Indicates the memory address rows and columns laid out in a matrix pattern. The left side indicates rows and the right side indicates columns.
Memory may be used as 100-point continuous or 10 blocks of 10 points each. Modulation level, pilot level, modulation mode, TRI format, TRI modulation level, area identifcation signal cursor location and other panel functions can be stored.

③ MEMORY Key
1) The SINGLE STEP △, ▽ keys are used for recall and 1-step advance/backup of columns.

2) The RCL and the 10-key are used for recall of rows.
0 ~ 9 from ⑫, ⑪ MODULATION to ⑨ MODIFY, and the ., +/- keys are only used for memory store and recall.

3) The RCL, ⑨ CLR (◁) keys are used to clear the row/column indicator, and 2-digit input with the 10-keys allows any row or column to be recalled.

4) The RCL, ⑨ (▷) keys are used to clear the column indicator, and 1-digit input with the 10-keys allows any column to be recalled.

5) With the ⑬ YE, STO (RCL) keys, the ② STO indicator (green) illuminates, and 1-digit input with the 10-keys causes the ② STO indicator to go out, and the setting level, mode, etc. are stored in the first row/column of each block.

6) With the ⑬ YE, STO (RCL), ⑨ (◁) keys, the row/column indicator is cleared, and 2-digit input with the 10-keys stores the setting level, mode, etc. in the rows/columns.

7) With the ⑬ YE, STO (RCL), ⑨ (▷) keys, the column indicator is cleared, and 1-digit input with the 10-keys stores the setting level, mode, etc. in the columns.

8) With the ⑬ YE, STO (RCL), RTN (▽) keys, the RTN command is stored in the indicated memory address column, and the inside of the memory block can be endlessly recalled.

9) With the ⑬ YE, STO (RCL), NEXT (△) keys, the setting level, mode, etc. are stored in the column of the memory address next to currently displayed one.

10) With the ⑬ YE, DUMP (▽) keys, the data contents stored in ② memory address "00 - 99" are transferred to another unit of the same model from the rear panel ⑰ REMOTE connector. Before the data is transferred the indicator goes out, incremented to ② memory address "00 - 99", and when transfer is complete the indicator returns to the mode set previously. However, the ㉘ TRI MOD AREA indicator becomes F and does not go out.

④ MODULATION Indicator

All level settings are conducted with the ⑨ rotary knob. Setting cannot be done by numeric entry.

The MODULATION indicator shows 4 types of level modes.

1) Modulation level setting, % indicator illuminates.

a) When the ⑩ PILOT key is ON (indicator lit), and when the modulation level, pilot level or ㉔ TRI mode are ON, the total accumulated TRI level is indicated. The modulation level range is 0 - 115%, and can be set in increments as small as 0.5%.
However, over 100% increments become 1%. Further more, modulation 115% is when the pilot level is set at 15%.

b) When the ⑩ PILOT key is OFF (indicator out), and when the modulationlevel and ㉔ TRI mode are ON, the total accumulated TRI level is indicated. The modulation level range is 0 - 105%, and can be set in increments as small as 0.5%.

2) Pilot level setting mode, PILOT and % indicators illuminate.
By means of the ⑬ YE, ⑩ % (PILOT) keys, it is possible to set the pilot level using the ⑨ rotary knob. At this time the PILOT indicator illuminates. The pilot level range is 0 - 15%, and can be set in increments as small as 1%.

3) TRI level (SK, 57kHz) setting mode, % indicator illuminates.
By pressing the ⑬ YE, ㉔ SK or 57kHz keys so that the SK, 57kHz indicators illuminate, it is possible to set the SK or 57kHz modulation level using the rotary knob.
The SK and 57kHz modulation level range is 0 - 10%, and can be set in increments as small as 0.1%.

4) Output level setting mode, OUTPUT Vp-p indicator illuminates.
By means of the ⑬ YE, ⑪ SET (MONO) keys, or the ⑬ YE, ⑨ Vp-p (▷>) keys, it is possible to set the output level using the rotary knob. At this time the OUTPUT Vp-p indicator illuminates, indicating in Vp-p the output voltage level when modulation level is 100%. Output level range is 1.5Vp-p - 9.99Vp-p, settable in increments as smallas 10mVp-p.
In addition, the external input level can be verified by means of this unit's external modulation signal source input level EXT LEVEL HI, LO indicator.

⑤ PILOT PHASE
Fine adjustment VR for 38kHz subcarrier and pilot signal phase matching.

⑥ SCOPE PHASE

Fine adjustment VR for phase correction of the oscilloscope used when calibrating the pilot phase.

⑦ LOCAL Key

1) LOCAL key

When in the GP-IB control mode, the REMOTE indicator (red) illuminates. At this time the panel LOCAL key can be used to return to the local mode. However, it does not operate when in the local lock-out mode.

2) REMOTE indicator

Illuminates when in the GP-IB control mode, and goes out when in the local mode.

3) ADDRESS key (⑬ YE, LOCAL)

When the YE key is pressed followed by the LOCAL key, the device address is shown on the ④ MODULATION indicator.
As long as the LOCAL key continues to be pressed, device address "09" is indicated.

⑧ COMPOSITE OUTPUT Z=75Ω

The composite signal BNC output connector. Because output impedance is approximate 75Ω both high and low input impedance FM standard signal generators and transmitters can be supplied.
Output level range is 1.5Vp-p - 9.99Vp-p.

⑨ MODIFY

1) ≪, ≫ keys, move cursor to ② , ④ indicator blocks.

2) <, > keys, move cursor within indicator block.

3) Rotary knob modify at a digit above the cursor position.

4) 10-keys ⑫ , ⑪ MODULATION and ⑨ MODIFY sections' (0 - 9, · , −) numeric value and signal input keys. Operate only in response to store and recall.

5) ⑬ [kHz], [%] by means of the (▷) key, ④ MODULATION indicator is switched to modulation level indicator.

6) ⑬ [kHz], [Vp-p] by means of the (▷▷) key, ④ MODULATION indicator is switched to output level indicator.

⑩ [PILOT] Key

1) The [PILOT] key alternately turns the pilot level on-off. When the indicator to the left of the key illuminates it is on, and when it goes out it is off. The 19kHz pilot level in ⑧ COMPOSITE OUTPUT is turned on-off.

2) By operating the ⑬ [kHz], [%] (PILOT) keys, the PILOT indicator of ④ MODULATION illumimates, and even if the [PILOT] key indicator is out, by setting the pilot level with ⑨ rotary knob, the [PILOT] key illuminates and can be set. In order to return from the pilot level setting mode to the total accumulated indication of the modulation level and the pilot level, press one of the ⑪, ⑫ MODULATION keys.

⑪ MODULATION FUNCTION

In the following manner this unit's composite signal is selected and ④ MODULATION indication, modulation level, etc. are also switched simultaneously.

1) The [ON] key turns the modulation level on-off. When the indicator illuminates it is on, and when it goes out it is off.

2) The [MONO] key turns off the ⑩ PILOT indicator and the pilot signal, and the signal becomes monophonic.

3) The [MAIN] key turns on the main channel signal, the [LEFT] key the left signal, the [RIGHT] key the right signal and the [SUB] key the sub channel signal; the ⑩ PILOT indicator illuminates and turns on (however, only when the [PILOT] key is on).

4) The ⑬ YE, SET (MONO) keys set the output level to 3.00Vp-p (monophonic modulation level 100%), and the output level may be set by means of the ⑨ rotary knob.

5) By means of the ⑬ YE, 100% (TRI) (MAIN) keys, the following are set : stereo modulation level 85%, pilot level 10%, SK or 57kHz modulation level 5%, DK modulation level 30%; or, ME1, ME2 modulation level 60%, BK or ZO modulation level 60%.

6) By means of the ⑬ YE, 100% (LEFT) keys, stereo modulation level 90%, pilot level 10% -- total 100% modulation level -- are set.

7) By means of the ⑬ YE, 30% (RIGHT) keys, stereo modulation level 30% is set. Accordingly, stereo modulation level 27%, pilot level 10% -- total 37% -- are set.

8) By means of the ⑬ YE, TONE ON (SUB) keys, the DK or ME1, ME2 tone signals, the BK or ZO tone signals are output from ⑧ COMPOSITE OUTPUT, as a single signal or as a composite signal of both tone signals.

9) By means of the ⑬ YE, TONE OFF (ON) keys, the above 8) tone signal output mode returns to the stereo modulation, TRI modulation level mode.

⑫ MODULATION SOURCE

Selects the modulation signal type.

1) The 30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10kHz, 15kHz keys select the internal modulation generator.

2) The EXT key operates the external signal source by means of one signal from the ⑮ AF/L input connector, with input level verifiable by approximate 3Vp-p ④ EXT LEVEL HI, LO indicator. When nothing is connected to the ⑮ AF/L input connector, ④ EXT LEVEL LO illuminates.

3) The EXT L/R key operates the external signal source by means of two signals from the ⑮ AF/L, ⑭ R input connectors, with input level verifiable by approximate 3Vp-p ④ EXT LEVEL HI, LO indicator. When nothing is connected to the ⑮ AF/L or ⑭ R input connectors, ④ EXT LEVEL LO illuminates.

4) The ⑬ YE, OFF (1kHz) keys turn preemphasis off. Refer to 4.5.7 for details of the following.

5) The ⑬ YE, 25μs (6.3kHz) keys effect 25μs preemphasis.

6) The ⑬ YE, 50μs (10kHz) keys effect 50μs preemphasis.

7) The ⑬ YE, 75μs (15kHz) keys effect 75μs preemphasis.
When using preemphasis, the ④ MODULATION indicator level drops 20dB. Accordingly, for monophonic modulation level 100% indication, 10% is indicated, and for stereo modulation, level 90%, 9% + pilot level 10% =19% is indicated. Further, when the TRI mode oprates, the indication becomes 19% + 5% = 24%. However, with the ⑪ MONO key, 14% is indicated, so please set and use it at 15%.

⑬ YE Key (Yellow Key)
When, after pressing the YE key with the shift function key, the various keys indicated by yellow on the panel are pressed, the functions indicated on the panel are executed.

⑭ R Input, PILOT OUTPUT
Utilizes BNC connctor; for two types of uses.
1) When the ⑫ MODULATION SOURCR EXT L/R key is pressed, it becomes the external signal source's R (right) side stereo modulation input connector.
2) When other than the EXT L/R key, the stereo phase calibration pilot signal is output.

⑮ AF/L Input, INT OSC OUTPUT
Utilizes BNC connector; for three types of uses.
1) When the ⑫ EXT L/R key is pressed, it becomes the L (left) side stereo modulation input connector for the external signal source comprised from two signals.

2) When the ⑫ EXT key is pressed, it becomes the AF input connector for the external signal source comprised from one signal.

3) When the ⑫ MODULATION SOURCE 30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10kHz, 15kHz keys are pressed, it becomes the internal modulation generator output, and can be used as a low-distortion spot generator or synchronous signal.

㉓ TRI MOD Indicator

The TRI MOD indicator shows two modes: the TRI modulation level and the area identification number. Switching of the indicator is conducted by means of the ⑬ %, ㉔ %/AREA (ME2) keyes.

Both the EBU and USA systems are operated in the same manner.

1) TRI level setting, % indicator illuminates.

a) When either the ㉔ DK or ME1, ME2 keys are pressed, the SK-DK or 57kHz-ME1-ME2 indicators show on, the DK announce identification signal (ME1, ME2 message signals) modulation level can be indicated, and set by the ⑨ rotary knob. The modulation level range is EBU system 0 - 35%, USA system 0 - 64%, settable in increments as small as 1%.

b) If ㉔ SK, 57kHz, BK or only the ZO key is pressed, when on is indicated, the BK area identification signal (ZO zone signal) modulation level can be indicated, and set by the ⑨ rotary knob.
The modulation level range is EBU system 0 - 64%, USA system 0 - 70%, settable in increment as sall as 1%.

c) When EBU system ㉔ SK-DK-BK, USA system ㉔ 57kHz-ME1-ME2-ZO or the ME2-ZO keys are pressed and on indicated, the combined DK announce identification signal (ME1, ME2 message signals) modulation level and BK area indentification signal (ZO zone signal) modulation level aggregate modulation level can be indicated, and set by the ⑨ rotary knob.
However, at this time the DK announce identification signal (ME1, ME2 message signal) modulation level can be set.
The modulation level range is 0 - 99%, settable in increments as small as 1%.

2) Area indicator, AREA indicator illuminates. EBU system is indicated as A - F, and USA system is indicated as 1 - 10.
Each pressing of the ㉔ △ key allows area selection.
When returning to the modulation level indicator from the area indicator, press the ⑬ YE, ㉔ %/AREA (ME2) key.

㉔ TRI = Traffic Radio Information
Conducts switching between the EBU and USA systems as well as indicator switching and setting of the modulation level, etc.

1) EBU system

a) When the SK key is pressed to illuminate the indicator, the aggregateof the TRI modulation level setting value and the atereo modulation level is shown on the ④ MODULATION indicator.

b) When ㉓ TRI MOD % is indicated, if the DK key is pressed to illuminate the indicator, the announce identification signal (DK) modulation level setting value is indicated. However, the SK key is also turned on. Also, when ㉓ AREA is indicated, nothing changes.

c) When ㉓ TRI MOD % is indicated, if the BK key is pressed to illuminate the indicator, the aggregate modulation level of the announce identification signal (DK) modulation level and area identification signal (BK) modulation level is indicated.
When the BK key is off, the announce identification signal (DK) modulation level alone is indicated.

d) When the △ key is pressed, the indicator is switched to ㉓ AREA, and the area identification signal may be selected from A - F.

2) USA system

a) If the 57kHz key is pressed to illuminate the indicator, the aggregate of the TRI modulation level setting value and the stereo modulation level is shown on the ④ MODULATION indicator.

b) When ㉓ TRI MOD % is indicated, if the ME1 key is pressed to illuminate the indicator, the messang signal (ME1, ME2) modulation level setting value is indicated. However, the 57kHz key is also turned on.Also, when ㉓ AREA is indicated, nothing changes.

c) Operetion of the ME2 key is also according to article b) above.

d) When ㉓ TRI MOD % is indicated, if the ZO key is pressed to illuminate the indicator, the aggregate modulation level of the message signal (ME1, ME2) modulation level and zone signal (ZO) modulation level is indicated. When the ZO key is off, the message signal (ME1,ME2) modulation level alone is indicated. However, when the ME1, ME2 and ZO keys on simultaneously, the modulation level becomes approximately half that of the modulation level of ZO alone.

e) When the △ key is pressed, the indicator is switched to ㉓ AREA, and the zone signal may be selected from 1 - 10.

3) ⑬ YE key operetion

a) The ⑬ YE, % (SK, 57kHz) keys permit setting of the modulation level on the ④ MODULATION indicator.

b) The ⑬ YE, EBU/USA (DK, ME1) keys switch back and forth between the EBU and USA systems.

c) The ⑬ YE, % /AREA (ME2) keys switch back and forth between AREA indication and modulation level indication.

d) When the ⑬ YE, SCAN INTERVAL (BK, ZO) keys are pressed, the area/zone scan interval can be set by means of the ⑨ rotary knob.

e) When the ⑬ YE, START (△) keys are pressed, area/zone scanning begins and the ㉓ AREA indicator flashes.

4) Stopping scan operation

a) If, during scanning opretion, the ㉔ STOP (△) key is pressed, scanning stops.

4.2 Explanation of the Rear Panel

⑯ SCA INPUT

Utilizes a BNC connector as an input terminal for the SCA signal. Input impedance is approximate 10kΩ and the input level needed for 10% is approximate 1Vrms. When not to be used, please do not connect anything to it.

⑰ REMOTE has three types of uses.

1) As a connector for controlling panel functions externally.

2) Connect when synchronizing with a standard signal generator's memory.

3) As output for memory dumping to another unit of the same model.

⑱ GP-IB

A connector for control utilizing GP-IB

⑲ VOLTAGE SELECTOR

This selects the voltage of the AC power supply. Reinsert the plug so that the arrow corresponds to the AC line voltage.
Refer to article 3.2.

⑳ AC CONNECTOR

The AC power supply plug.

㉑ FUSE

The AC power supply fuse. Use a appropriate for the AC line voltage; the appropriate fuse is indicated on the rear panel.

㉒ INPUT/OUTPUT

The AF/L, R, COMPOSITE OUTPUT indicators mark holes prepared for the attachment of connectors to output the front panel input/output signals from the rear panel. The rear panel attachment connectors are factory-installed options.

4.3 Turning on the Power Supply

Connect the power cord to a power supply of the specified voltage and press the ① POWER switch. First all the front panel indicators illuminatemomentarily, and then the mode immediately prior to turning off the power is indicated.
However, this excludes the ④ EXT LEVEL HI, LO indicators.

4.4 Basic Method of Operation

4.4.1 One-Touch Operation

1) By means of the ⑬ [illegible], ⑪ [illegible] (MONO) keys, internal modulation generator 1kHz, output level 3.00Vp-p (monophonic modulation 100%) may beset, and the FM standard signal general (hereinafter referred to as SG) external modulation generator input level may be set.
By means of the ⑨ rotary knob, adjust the SG external modulation signal generator input level HI, LO to the appropriate levels, and 100% = 75kHz deviation.
Refer to article 4.5 for details of each level setting.

2) By means of the ⑬ [illegible], ⑪ [illegible] (MAIN) keys, in the case of the EBU system, stereo modulation level 85%, pilot level 10% and SK modulation level 5% -- a total of 100% -- are indicated on the ④ MODULATION indicator. On the ㉓ TRI MOD indicator, DK modulation level 30% and BK modulation level 60% -- a total of 90% -- are indicated. Also, in the case of the USA system, stereo modulation level 85%, pilot level 10% and 57kHz modulation level 5% -- a total of 100% -- are indicated on the ④ MODULATION indicator. On the ㉓ TRI MOD indicator, ME1, ME2 modulation level 60% and ZO modulation level 30% -- a total of 90% -- are indicated.
The one-touch level setting is extremely easy and convenient.
However, when ME1, ME2 and ZO are illuminated simultaneously, the ME1, ME2 modulation level is 60% and the ZO modulation level is 30%, but when ME1, ME2 are out and only ZO is illuminated, the modulation level is 60%.

a) With opration of the ⑪ MODULATION FUNCTION MAIN, LEFT, RIGHT, SUB keys, composite output becomes 100%.
With each switching of the ⑪ MAIN, LEFT, RIGHT, SUB keys, the SG HI, LO indicator may switch back and forth, but the error is not large so there are no problems in actual use.

b) With the ⑪ MONO key, the ⑩ PILOT indicator goes out, and monophonic modulation level 85%, TRI modulation level 5% -- a total of 90% -- are indicated. 90% is indicated because with monophonic modulation and a pilot level of 0%, it is not possible to judge whether or not the TRI signal is being operated. Please turn the TRI modulation level off andset with the MONO key at 100%.

3) By means of the ⑬ YE, ⑪ 100% (LEFT) keys, stereo modolation level 90% and pilot level 10% are set. The ④ MODULATION indicator becomes the 100% aggregate of the modulation level and pilot level, and the TRI mode turns off.

a) With operation of the ⑪ MODULATION FUNCTION MAIN, LEFT, RIGHT, SUB keys, composite output becomes 100% and one-touch operation is possible.
With each switching of the ⑪ MAIN, LEFT, RIGHT, SUB keys, the SG HI, LO indicator may switch back and forth, but the error is not large so there are no problems in actual use.

b) With the ⑪ MONO key, the ⑩ PILOT indicator goes out, and monophonic modulation level becomes 100%.

c) If the ⑪ ON key is pressed to turn off the indicator, during monophonic modulation the modulation level turns off and 0.0% is indicated. During stereo modulation the pilot level indicator shows remaining 10%. This indicator is the pilot level mode, so pilot level cannot be set. Accordingly, if the ⑨ rotary knob is rotated to set the pilot level, the setting will be of the aggregate modulation level and pilot level.

4) By means of the ⑬ YE, ⑪ 30% (RIGHT) keys, stereo modulation level becomes 30%. Accordingly, the indicator 90% × 0.3 = 27% and pilot level 10% are added for an indicator of 37%.

In this case, when used in combination with an SG, the SG LO indicator illuminates.

a) By oprating the ⑪ MAIN, LEFT, RIGHT, SUB keys, stereo outout becomes 37%.

b) The ⑪ MONO key turns off the ⑩ PILOT indicator and indicates monophonic modulation 30%.

c) If the ⑪ ON key is pressed to turn off the indicator, during monophonic modulation the modulation level turns off and 0.0% is indicated. During stereo modulation the pilot level indicator shows remaining 10%. If the ⑪ ON key is pressed once more to turn on the indicator, it returns to monophonic 30%, stereo modulation 37% indication.

5) By means of the ⑬ YE, ⑪ TONE ON (SUB) keys, in the case of the EBU system, the DK, BK key indicators illuminate and the composite DK, BK signal is output from the ⑧ COMPOSTITE OUTPUT. If the BK is pressed to turn it off, the DK signal alone is output. If only the BK key is illuminated, the BK signal alone is output.
The output level from ⑧ COMPOSITE OUTPUT is in proportion to the modulation level of each key. In other words, it becomes 0.3Vrms for DK signal 30% modulation, and 0.6Vrms for 60% modulation.
The above also applies for the USA system. Refer to 4.6.3 for details.

6) By means of the ⑬ YE, ⑪ TONE OFF (ON) key, the stereo modulation mode is returned to from 5) operation.

4.4.2 Memory Operation

1) Operation in combination with SG
This unit's memory operates synchonously if the modulation level, pilot level, modulation source, TRI modulation level, TRI mode, etc. are stored, the rear panel ⑰ REMOTE and SG REMOTE connected by a synchronization cable and then merely operating the SG MEMORY △, ▽ keys.
Refer to article 4.7 for details on how to store and recall.

[NOTE] The synchonization cable uses an anphenol type 14-pin connector. Among the 14 pins, number 8 is unconnected, but all others are connected.
Optional synchronization cable SA520.

2) Operation of the stereo signal generator alone.

a) Modulation level, pilot level, modulation source, TRI modulation level, TRI mode, etc. are stored, and used by operating the ⑧ MEMORY △, ▽ keys.

b) The ⑧ RCL, ⑨ ◁ keys clear the row/column indicator, and 10-key 2-digit input allows the desired row/column to be recalled.

c) The ⑧ RCL, ⑨ ▷ keys clear the column indicator, and 10-key 1-digit input allows the desired column to be recalled.

4.5 The Various Level Settings

The ④ MODULATION indicator shows the following modes.

1) During stereo modulation when the ⑩ PILOT is on, the aggregate indicator of modulation level, pilot level and TRI modulation level. 0 - 115%.

2) During stereo modulation when the ⑩ PILOT is off, it indicates the aggregate of modulation level and TRI modulation level. 0 - 105%.

3) During monophonic modulation, it indicates the aggregate of modulation level and TRI modulation level. 0 - 105%.

4) When in modulation level indication mode, the pilot indication with the ⑩ PILOT key on becomes a decimal point number like 10.0% (when ⑪ ON, ⑭ SK or 57kHz are off), and the pilot level cannot be set.

5) The indicator when setting the pilot level, illuminates ④ MODULATION's PILOT indicator and become fixed like 10%.
The pilot level can be set. 0 - 15%.

6) When in the output level indication mode, the output level setting can be done with the ⑨ rotary knob. 1.5Vp-p - 9.99Vp-p.

7) The external modulation signal ⑮ AF/L, ⑭ R input level is verified by the ④ MODULATION's EXT LEVEL HI, LO indicator. However, ⑭ R input is switched to ⑮ AF/L input and verified.

4.5.1 Modulation Level Setting

1) Setting with the rotary knob
When the cursor is not within the ④ MODULATION indicator, the ⑨ MODIDY ≪, ≫ keys are used, and when within the ④ MODULATION indicator, the ◁, ▷ keys can be used to increase/decrease the modulation level at or above the cursor position digit.

2) ⑩ PILOT key indicator, when out and off

a) Indicates the modulation level when the ⑪ ON key is illuminated, and 0.0% when it is turned off. Modulation level turns off.

b) When the ⑪ MONO key is pressed the ⑪ ON key also illuminates and the previous setting level is indicated. The modulation level is incresed/decrease by means of the ⑨ rotary knob, and set to the necessary value. When set to 99.5%, if the modulation is lowered from 100% by means of the ⑨ rotary knob, as the cursor is in the 1% digit, the cursor will also move to 99.0% rather than 99.5%.
At this time, when it becomes 99.0%, if the ⑨ ▷ key is used to move the cursor one digit to the 0.5% digit and then raised one increment, it can be set to 99.5%.

c) Just like the MONO key, when the ⑪ MAIN - SUB keys are pressed, the previous setting level is indicated. Both the monophonic modulation level and the stereo modulation level may be set from 0 - 100%, but because the stereo modulation level 90% corresponds to the monophonic modulation level 100%, when set to 90% (⑩ PILOT key off) with the MAIN key, with the MONO key it indicates 100%.

Monophonic modulation level and stereo modulation level indication correspond as shown below. However, stereo modulation level settings from 90% - 100%, when with the monophonic modulation level should actually be indicated from 100% - 111%, but because the level never goes over 100%, it is indicated as 100%.

Monophonic Indicator	Stereo Indicator
100%	100% = 90% × 1.11 = 111%
100%	95% = 90% × 1.06 = 106%
100%	90% = 90% × 1.0
80%	72% = 90% × 0.8
60%	54% = 90% × 0.6
40%	36% = 90% × 0.4
20%	18% = 90% × 0.2
0%	0%

3) When the ⑩ PILOT key indicator is illuminated and on, however, with the ⑪ MONO key, the PILOT key cannot be turned on.

a) When the ⑪ MONO key is pressed the ⑩ PILOT key indicator goes out and turns off, by operating the ⑪ ON key, when on the previously set modulation level is indicated, when off 0.0% is indicated.

b) When the ⑪ MAIN - SUB keys are pressed, the ⑪ ON key and ⑩ PILOT key indicators also illuminate simultaneously, and the previous setting level is indicated. The setting level represents the aggregate of the modulation level, pilot level and TRI modulation level.
For example, when the pilot level is 10%, if monophonic is set to 80%, with the stereo modulation level it is 72% (as per above), and 72% + 10% = 82.0% is indicated.
In the above manner, take care to note that when the ⑩ PILOT key indicator is illuminated and on, the indicator level is the aggregate of the modulation level, pilot level and TRI modulation level.
Rotate the ⑨ rotary knob and set to the necessary modulation level.

c) As for pilot level verification, when turned off with the ⑪ ON key and the indicator is out, the pilot level is indicated by a decimal number like 10.0%. However, when TRI mode is off. In this manner the decimal indicator is the verification mode indicator. Accordingly, even if the ⑨ rotary knob is rotated, the pilot level cannot be set, and rotating the rotary knob results in the total modulation level being set.

4.5.2 Pilot Level Setting

1) Press the ⑬ YE, ⑩ % (PILOT) keys. The ④ MODULATION's PILOT indicator illuminates. Even when the ⑩ PILOT key is off, by rotating the ⑨ rotary knob the ⑩ PILOT key illuminates, and the pilot level can be set. However, the ⑪ MONO key is excluded.

2) To return to the modulation level set mode from the pilot level set mode, press the desired key of ⑪, ⑫ MODULATION.

4.5.3 Output Level Setting

1) One-touch setting is possible with the ⑬ YE, ⑪ SET (MONO) keys, indicated as 3.00Vp-p (internal modulation generator 1kHz, monophonic modulation level 100%). Connect ⑧ COMPOSITE OUTPUT and the SG's external modulation input terminal, and set the SG's EXT LEVEL HI, LO appropriate level using the ⑨ rotary knob.
The KSG4100 - KSG4300 series SG modulation input level is approximate 3Vp-p, but there are differences from model to model, so adjust to the appropriate level.

2) To switch from the modulation level indicator mode to the output level indicator, if the ⑬ YE, ⑨ Vp-p (▷>) keys are pressed, the set output level and ④ MODULATION's OUTPUT Vp-p illuminate, so adjust the SG modulation input level to the appropriate level.
However, except for total modulation level 100%, the SG modulation input level cannot be set precisely, so please be careful.

3) To switch from the output level indicator to the modulation level indicator, use the desired keys of ⑪, ⑫ MODULATION, or the ⑬ [kHz], ⑨ [%] (▷) keys.

4.5.4 Modulation Source Setting

When the modulation source selector key is pressed, the various corresponding indicators are illuminated.

1) By means of the ⑫ [30Hz] - [15kHz] key internal modulation generator signal, the composite signal switched by the ⑪ MODULATION FUNCTION is output from the ⑧ COMPOSITE OUTPUT.

2) Even of the ⑫ [EXT] key is pressed, the previously set modulation level and EXT LEVEL LO are indicated on the ④ MODULATION indicator, but are not output. If the appropriate level is input to the ⑮ AF/L input connector, at the point when both the ④ MODULATION's EXT LEVEL HI, LO indicators go out, when the external signal source input level is set, the set modulation level is switched by the ⑪ MODULATION FUNCTION and output from the ⑧ COMPOSITE OUTPUT as a composite signal.

3) The ⑫ [EXT L/R] key is for modulating the ⑮ L and ⑭ R inputs with two signals, and only the ⑪ MODULATION FUNCTION's [ON], ⑩ [PILOT] keys illuminate. All other keys go out. As with 2), the previously set modulation level is indicated but not output, so please input the external signal source.
Further, there is no ⑭ R input level verification indicator, so connect and switch to the ⑮ AF/L input, and set to the ④ MODULATION EXT LEVEL HI, LO appropriate level.

4.5.5 Using the YE key

1) ⑬ YE, ⑧ STO (RCL) keys; keys for storing the setting mode in the memory. From 1) - 4) refer to article 4.6.

2) ⑬ YE, ⑧ STO (RCL), RTN (▽) keys; function for repeat operation part way through the memory.

3) ⑬ YE, ⑧ DUMP (▽) keys; function for transferring the memory contents to another unit of the same model.

4) ⑧ YE, ⑧ STO (RCL), NEXT (△) keys; function for continuous connection of memory blocks.

5) ⑬ YE, ㉔ % (SK, 57kHz) keys; allow setting of the SK, 57kHz modulation level.

6) ⑬ YE, ㉔ EBU/USA (DK, ME1) keys; switch the TRI system.

7) ⑬ YE, ㉔ % /AREA (ME2) keys; switch the ㉓ TRI MOD indicator to modulation level indication or AREA indication.

8) ⑬ YE, ㉔ SCAN INTERVAL (BK, ZO) keys; when pressed the area/zone scan interval can be set by the ⑨ rotary knob.

9) ⑬ YE, ㉔ START (△) keys; when pressed area/zone scanning begins.

10) PREEMPHASIS
⑬ YE, ⑫ OFF (1kHz) keys; turn off preemphasis.
⑬ YE, ⑫ 25μs (6.3kHz) keys; operate 25μs preemphasis.
⑬ YE, ⑫ 50μs (10kHz) keys; operate 50μs preemphasis.
⑬ YE, ⑫ 75μs (15kHz) keys; operate 75μs preemphasis.
Indication is cut 20dB. Accordingly, 100% indication becomes 10% indication. Refer to article 4.5.7.

11) ⑬ YE, ⑪ SET (MONO) keys; with the monophonic modulation level 100% signal, indication becomes 3.00Vp-p. The keys for setting the SG external modulation input level. Refer to article 4.4.1 1).

12) ⑬ YE, ⑪ 100% (TRI) (MAIN) keys; the keys for setting stereo modulation level 85%, pilot level 10% and SK or 57kHz level 5%. Refer to article 4.4.1 2).

13) ⑬ YE, ⑪ 100% (LEET) keys; the keys for setting stereo modulation level 90% and pilot level 10%. Refer to article 4.4.1 2).

14) ⑬ YE, ⑪ 30% (RIGHT) keys; the keys for setting stereo modulation level 30%, 90% × 0.3 = 27%, and pilot level 10%. Refer to article 4.4.1 3).

15) ⑬ YE, ⑪ TONE ON (SUB) keys; for tone signal output.

16) ⑬ YE, ⑪ TONE OFF (ON) keys; return to stereo modulation operation.

17) ⑬ YE, ⑩ % (PILOT) keys; for the pilot level setting mode.

18) ⑬ YE, ⑨ % (▷) keys; for switching the ④ MODULATION indicator mode to modulation level % indication.

19) ⑬ YE, ⑨ Vp-p (▷▷) keys; for switching the ④ MODULATION indicator mode to output level indication (Vp-p).

20) ⑬ YE, ⑦ ADDRESS (LOCAL) keys; when the ⑦ LOCAL key is pressed following the ⑬ YE key, the device address is indicated on the ④ MODULATION indicator. As long as the ⑦ LOCAL key is pressed, the device address "09" is indicated. Refer to article 6.3.

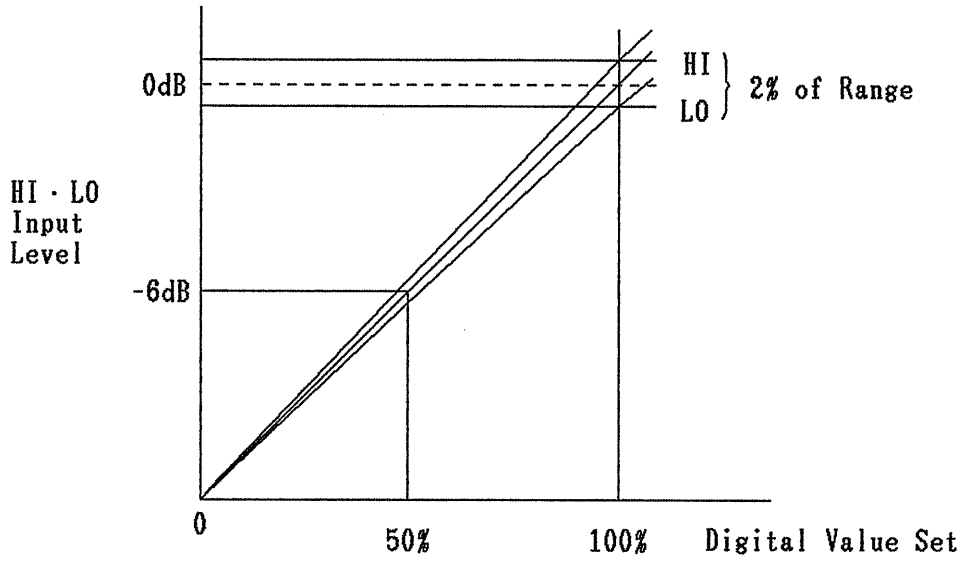
4.5.6 Connecting and Setting the External Modulation Signal Source

(1) Connecting and setting

The external modulation signal is connected to the panel ⑮ AF/L input connector. Input impedance is approximate 10kΩ and the appropriate input level is approximate 3Vp-p. The external modulation signal source level is adjusted withthe range in which both the ④ MODULATION EXT LEVEL HI, LO indicators go out. In this mode, merely by changing the panel setting level, the necessary modulation level is set.

As a result, there is no need to readjust the external modulation signal source level each time the modulation level, modulation mode, etc. are changed.
When the external modulation signal source level is low, LO illuminates, and when too high, HI illuminates.

(2) Explanation of the setting range



The relation of set input levels is shown in above diagram.
When the external modulation signal is adjusted and put into the HI, LO range, both the indicators go out and the set value deviation goes into the ±2% range. With this HI, LO level as standard, the modulation level is internally set to the digital setting value. In other words, the external modulation signal source input level does not need to be moved once set. This unit's digital setting is used to set the necessary value. Also, as shown in the diagram, the input level range operates linearly with respect to the input level.
For example, after setting the input level in the HI, LO range and setting the indicator to 100%, if the input level is cut − 6dB, the indicator is the 100% mode and the modulation level becomes 50%. At this time, the LO indicator illuminates, but the normal 50% modulaton level is obtained. Further, regarding the SG external modulation input level aswell, there is the above relationship and the HI, LO range when setting the output level operates at peak for the composite signal wave as well as the single signal wave.

When set in the HI, LO appropriate range, the HI, LO indicators are out, but each time the stereo signal generator ⑪ MONO, MAIN, LEFT, RIGHT, SUB keys are switched, the HI, LO indicators some times illuminate alternately.
As the HI, LO range is extremely narrow, even when the HI, LO indicators illuminate alternately, the error is not large, so there is no problem inactual use.

[NOTE] Because the peak level of the composite signal output consisting of the MAIN signal + SUB signal + pilot signal includes the addition of the 38kHz two cycles and 19kHz one cycle, as opposed to the MAIN signal + pilot signal peak level, the LEFT, RIGHT, SUB signals + pilot signal's peak level becomes a peak level of 97%. Accordingly, compared to the amplification ratio it is lower by 0.26dB.
As a result, the LO indicator tends to illuminate more readily with operation of the LEFT, RIGHT, SUB keys.

4.5.7 Preemphasis

Preemphas is characteristics can be added by means of the ⑬ YES, ⑫ 25μs, 50μs, 75μs keys.
Standard preemphasis characteristics are shown in Figure 4-1.
The 20dB line in Figure 4-1 shows the mode when preemphasis is off.
As preemphasis is added, the flat lower region under 400Hz is 20dB lower. Preemphasis operates with stereo, monophonic, internal modulation and external modulation.
Regarding modulation level indication, for monophonic modulation level 100%, 10% is indicated. For stereo modulation level 90%, the indicator becomes 9% indication + pilot level 10% = 19%.
For TRI mode operation, the indicator becomes 19% + 5% = 24%. However, with the MONO key, 14% is indicated, so please use with it set to 15%.

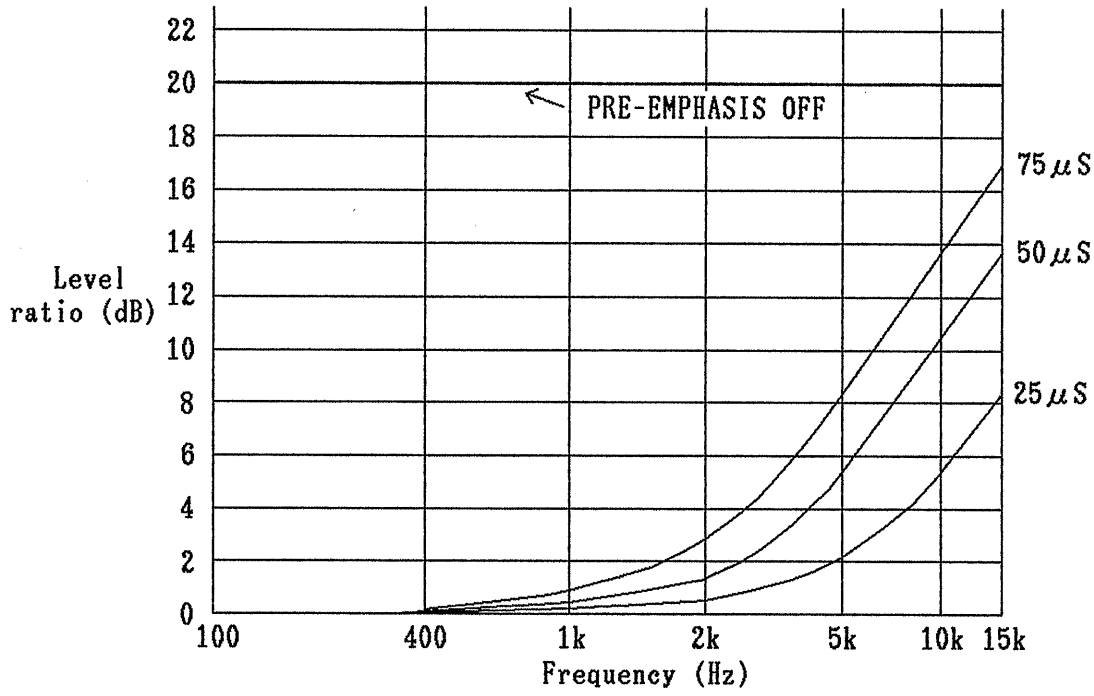


Figure 4-1. Standard Preemphasis Characteristics

4.5.8 SCA* Level Setting

The SCA modulation level is determined, at 10%.
The ⑯ SCA INPUT input connector is provided on the rear panel.
The signal applied here is output to the ⑧ COMPOSITE OUTPUT connector regardless of this unit's operating mode (internal generator, external signal source input). Accordingly, please do not connect any signal except the SCA signal to the rear panel ⑯ SCA INPUT connector.
The SCA signal level setting is done with the modulation level off and the pilot level off. If the ⑯ SCA INPUT input level is set to approximate 1Vrms, modulation becomes 10%. As this is not applied to the ④ MODULATION modulation level indicator, when the 10% SCA signal is added, the main, sub channel modulation level is limited to 80%, and also when the SG is modulated, FM deviation is kept within 75kHz. When using traffic radio information signals, do not connect anything to SCA input ⑯ SCA INPUT.

* SCA = Subsidiary Communication Authorization

4.5.9 Pilot Phase Calibration

1) Prepare an X-Y oscilloscope and connect with this unit as shown below.

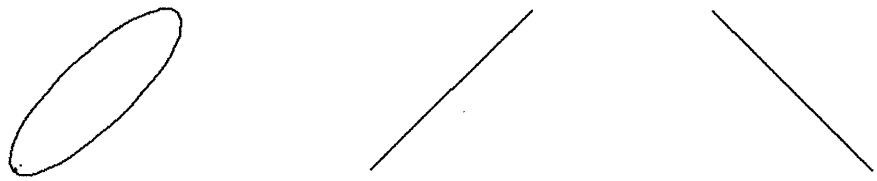
KSG3210		X-Y oscilloscope
⑭ PILOT OUTPUT connector	.....	X INPUT connector 200mV/DIV (Horizontal)
⑧ COMPOSITE OUTPUT connector	.....	Y INPUT connector 50mV/DIV (Vertical)

2) Press the ⑬ YES, ⑪ SET (MONO) keys to set output level 3.00Vp-p (internal modulation generator 1kHz, monophonic modulation level 100%).

3) Press the ⑬ YES, ⑪ 100% (LEFT) keys to set stereo modulation level 90% ⑩ pilot level 10%.

4) If the internal modulation generator is not at 1kHz, press the ⑫ 1kHz key.

5) Press the ⑪ MODULATION FUNCTION ON key to turn it off and set modulation level 0%, pilot level 10%. If oscilloscope input sensitivity is setto X INPUT 200mV/DIV, Y INPUT 50mV/DIV, waveforms similar to the ones shown in Figure 4-2 appear on the oscilloscope, so rotate the ⑥ SCOPE PHASE semifixed adjuster, adjusting so a waveform like Figure 4-2 (b) is formed.



(a) Out of phase. (b) In phase. (c) 180° out of phase.

Figure 4-2

6) Leaving the oscilloscope input sensitivity adjustment knob as it is, set this unit's keys as shown below.

⑩ Turn the PILOT key off.
⑪ Press the MODULATION FUNCTION SUB key to turn it ON.

Waveforms like the ones shown in Figure 4-3 appear on the oscilloscope, so rotate the ⑤ PILOT PHASE semi-fixed adjustor, adjusting so a waveform like Figure 4-3 (b) is formed.
If the above operations are performed, the pilot signal and 38kHz subcarrier signal phases will be matched.

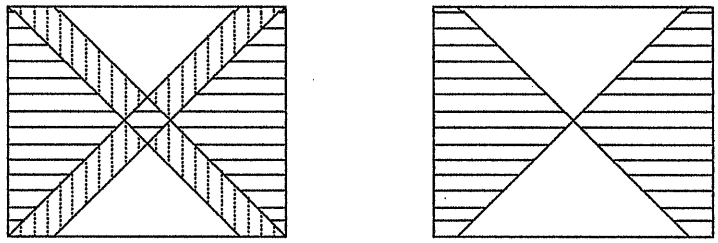


Figure 4-3

4.6 Outline of the Traffic Radio Informaton Systems

There are two types of traffic radio information (TRI) systems: the EBU system, which is presently being implemented in Europe, and the USA system, which is under consideration in the United States.
The compositions of these signals are very similar, consisting of 1) transmitter identification signals, 2) announce identification signals and 3) area identification signals.
The transmitter identification signals identify the stations broadcasting traffic information. Stations transmit using 57kHz FM modulation as the main carrier frequency.
These are referred to as "SK" in the EBU system and as "57kHz (pilot)" in the USA system.
The announce identification signals are only transmitted while traffic information is being broadcast, and are amplitude modulated into the transmitter identification signal (SK/57kHz). The receiver can only receive traffic information while this signal is being detected.
These are referred to as "DK" in the EBU system and as "ME1, ME2 (message signal 1, 2)" in the USA system.
The area identification signals identify the areas needing traffic information, and are amplitude modulated into the transmitter identification signal (SK/57kHz). They allow the receiver to listen to only the traffic information for the desired area(s). These are referred to as "BK" in the EBU system and as "ZO (zone signal)" in the USA system.
This unit generates traffic radio information signals for both the EBU and USA systems.
Further, the various identification signal modulation levels can be independently digitally set, and output as independent signals is also possible.

4.6.1 Operation of the EBU System Signal Generator Section

1) Preparations
   Do not connect anything to the rear panel ⑯ SCA INPUT connector.

2) Basic operation

a) The EBU and USA systems are selected interchangably by means of the ⑬ YE, ㉔ EBU/USA (DK, ME1) keys. The EBU indicator illuminates.

b) One-touch setting possible by setting the ⑬ YE, ⑪ 100% (TRI) (MAIN) keys. Set stereo modulation level 85%, pilot level 10% transmitter SK modulation level 5%, announce DK modulation level 30%, area BK modulation level 60%, and BK's area is set to A.

c) The ㉔ SK key is pressed to turn it ON. Each time it is pressed, it alternately illuminates and goes out. When the indicator is illuminated,it is ON. At this time, the ④ MODULATION indicator shows the aggregate of the set modulation levels.

d) The ㉔ DK and BK keys are pressed to turn them ON. Each time they are pressed, they alternately illuminate and go out.
When the indicators are illuminated, are ON. The ㉓ TRI MOD DK, BK modulation level indicates the aggregate of the DK, BK modulation levels.

3) Setting the transmitter SK modulation level

a) Press the ⑬ YE, ㉔ % (SK, 57kHz) keys.

b) The ④ MODULATION indicator's SK/57kHz indicator illuminates, entering the SK indication mode and the set mode. The ④ MODULATION indicator shows the modulation level corresponding to the main carrier frequency.
Normally, the deviance of the frequency corresponding to the main carrier frequency is ±3.75kHz, so 5.0% is indicated.

c) Move the cursor to within the ④ MODULATION indicator (refer to article4.5.1 1) for how to move the cursor), and set the SK modulation level to the necessary level using the ⑨ rotarry knob. The setting range is 0.0 - 10.0%, settable in increments as small as 0.1%.

d) In order to clear the ④ MODULATION indicator SK indication mode, pressthe desired key among the ⑩, ⑪, ⑫ MODULATION keys -- the indication becomes the total modulation level.

4) Setting the announce DK modulation level

a) Press the ㉔ SK, DK keys together to illuminate the SK, DK indicators and turn them ON.

b) Press the ⑱ YL, ㉔ %/AREA (ME2) keys to illuminate the ㉓ TRI MOD % indicators.

c) Move the cursor to within the ㉓ TRI MOD indicator (refer to article 4.5.1 1) for how to move the cursor), and set the DK modulation level to the necessary level using the ⑨ rotary knob. The setting range is 0 - 35%, settable in increments as small as 1%.

[NOTE] If BK is ON, the aggregated modulation level of the DK and BK modulation levels is indicated in the ㉒ TRI MOD indicator.
At this time, if the ⑨ rotary knob is changed, only the DK modulation level changes.

5) Setting the area BK modulation level

a) Press the ㉔ SK, BK keys together to illuminate the SK, BK indicators and turn them ON. At this time, if the ㉔ DK indicator is illuminated, turn it OFF.

b) Move the cursor to within the ㉔ TRI MOD indicator (refer to article 4.5.1 1) for how to move the cursor), and set the BK modulation level to the necessary level using the ⑨ rotary knob. The setting range is 0 - 64%, settable in increments as small as 1%.

[NOTE] If DK is ON, the aggregated modulation level of the DK and BK modulation levels is indicated in the ㉒ TRI MOD indicator.
At this time, if the ⑨ rotary knob is changed, only the DK modulation level changes, and BK will remain unchanged.

6) Setting the scan interval, and how to start and stop scanning

6.1) Area selection

a) When the ⑬ YE, ㉔ %/AREA (ME2) keys are pressed to illuminate the ㉓ TRI MOD indicator's AREA indicator, A - F area indication are shown.

b) The A - F area identification signals (frequencies) can be changed each time the ㉔ A key is pressed or by moving the cursor and using the ⑨ rotary knob.

6.2) Setting the scan interval

a) Illuminate the ㉓ TRI MOD indicator's AREA indicator, showing the A - F area indicators.

b) When the ⑬ YE, ㉔ SCAN INTERVAL (BK, ZO) keys are pressed, the ㉓ TRI MOD indicator's %, AREA indicators both go off and it becomes the scan interval indicator. This shows, in seconds, the scan interval between the AREA number indicated immediately previously and the AREA number to be indicated next.

c) The cursor is automatically set to the second's position, so set the necessary interval using the ⑨ rotary knob.
The setting range is 0.0 - 9.9 seconds, settable in 0.1 second increments.

d) When it is desirable to skip a certain area, set to 0 seconds.
To clear the skip area, use the ⑨ rotary knob to select the area and set the interval to other than 0.0 seconds.

e) To clear the scan interval set mode, return to the AREA indicator by pressing the desired TRI MOD key.

6.3) To start scanning

a) Illuminate the ㉓ TRI MOD indicator's AREA indicator, showing the A - F area indicators.

b) Press the ⑬ YES, ㉔ START (△) keys to begin scanning and the ㉓ AREA indicator flashes.

c) The relationship between the area indicator and scan mode is as shown in the following article.

Indicator	Area	Frequency
→	A	23.75Hz
	B	28.27Hz
	C	34.93Hz
	D	39.58Hz
	E	45.67Hz
	F	53.98Hz

Scan mode

[NOTE 1] When the ㉒ TRI MOD indicator shows %, or when all scan intervals A - F are set at 0 seconds, the scan function does not operate.

[NOTE 2] The scan mode cannot be memorized.

6.4) To stop scanning
While scanning, press the ㉔ STOP (△) key to stop scanning.

4.6.2 Operation of the USA System Signal Generating Section

1) Preparations
Do not connect anything the rear panel ⑯ SCA INPUT connector.

2) Basic operation

a) Use the ⑬ YES, ㉔ EBU/USA (DK, ME1) keys to select the USA system and illuminate the USA indicator.

b) One-touch setting is possible by setting the ⑬ YES , ⑪ 100% (TRI) (MAIN) keys. Set stereo modulation level 85%, pilot level 10%, transmitter 57kHz modulation level 5%, message signal 1, 2, ME1, ME2 modulation level 60%, zone signal ZO modulation level 60%, and ZO's area is set to 1. However, when the ME1, ME2 and ZO keys are turned on, ZO modulation level 30% -- a total of 90% -- are indicated.

c) The ㉔ 57kHz key is pressed to turn it ON. Each time it is pressed, it alternately illuminates and goes out. When the indicator is illuminated, it is ON. At this time, the ④ MODULATION indicator shows the aggregate of the set modulation levels.

d) The ㉔ ME1 or ME2, and ZO keys are pressed to turn them ON. Each time the ME1 and ME2 keys are pressed, they alternately illuminate and go out. When the indicators are illuminated, they are ON.
The ㉔ ZO key also alternately illuminates and goes out each time it is pressed, and when the indicator is illuminated it is ON.

3) Setting the pilot 57kHz modulation level
Operaters just like SK of the EBU system. Refer to 4.6.1 article 3) and subsitute 57kHz for the in "Setting the SK modulation level"

4) Setting the message signal 1, 2, ME1 ME2 modulation level

a) Press the ㉔ 57kHz, ME1 keys together to illuminate the SK, DK indicators and turn them ON.

b) Press the ⑬ YES, ㉔ %/AREA (ME2) keys to illuminate the ㉓ TRI MOD % indicators.

c) Move the cursor to within the ㉓ TRI MOD indicator and set the modulation level to the necessary level using the ⑨ rotary knob. The settingrange is 0 - 64%, settable in increments as small as 1%.

d) Turn ㉔ ME2 ON and set the modulation level in the same manner as ME1.

[NOTE] If ZO is ON, the total of 1/2 the ZO modulation level plus the ME1 or ME2 modulation level is indicated in the ㉘ TRI MOD indicator. At this time, if the ⑨ rotary knob is changed, only level the ME1 or ME2 (whichever is ON) modulation level changes.

5) Setting the zone signal ZO modulation level
Operation is similar to that for BK of the EBU system. Herein are explained those points which are different.

a) Modulation level range is 0 - 70%, settable in incremets as small as 1%.

b) If ME1 or ME2 is ON, the total of 1/2 the ZO modulation level plus ME1 or ME2 modulation level is indicated in the ㉘ TRI MOD indicator.

6) Setting the scan interval, and how to start and stop scanning
Operates just like BK of the EBU system. However, the USA system area numbers are 10 points, 1 - 10. Refer to 4.6.1 6).

4.6.3 Output of the DK (ME1, ME2) or BK (ZO) Signal Only (Tone Output)

1) Output of the DK or BK signal only (tone signal)

a) When the ⑬ YE, ⑪ TONE ON (SUB) keys are pressed, the entire ④ MODULATION indicator goes out, and the tone output mode is entered. Also, SK does not operate -- only the DK and BK signals are output.

b) Select either of the ㉔ DK, BK keys, or both.

c) When the ⑬ YE, ⑪ TONE OFF (ON) keys are pressed, it is cleared and the stereo modulation mode is entered.

2) Output of the ME1, ME2 or ZO signal only (tone output)
Operates just the EBU system tone output.

To use, substitute ME1 or ME2 for DK in article 1) above.
At this time, if DK only is selected, an independent signal is output, and if both keys are selected, a composite signal is output from ⑧ COMPOSITE OUTPUT. The output level is proportional to the set modulation level. In other words, for a 30% modulation level, it is approximate 0.3Vrms.

4.6.4 How to Use the YE Key

1) The ⑬ YE, ㉔ % (SK, 57kHz) keys indicate and select the set mode for the modulation level corresponding to the main carrier frequency.

2) The ⑬ YE, ㉔ EBU/USA (DK, ME1) keys switch traffic radio information systems.

3) The ⑬ YE, ㉔ %/AREA (ME2) keys switch the ㉓ TRI MOD indicator to modulation level indication or area indication.

4) The ⑬ YE, ㉔ SCAN INTERVAL (BK, ZO) keys conduct the scan interval setting.

5) The ⑬ YE, ㉔ START (△) keys begin area or zone scanning.

6) The ⑬ YE, ⑪ 100% (TRI) (MAIN) keys set the following.

a) When in the EBU system
Stereo modulation level 85%, pilot level 10%, SK modulation level 5%, DK modulation level 30%, BK modulation level 60% and area A are set.

b) When in the USA system
Stereo modulation level 85%, pilot level 10%, 57kHz modulation level 5%, both ME1, ME2 modulation level 60%, ZO modulation level 60% and area 1 are set.

7) The ⑬ YE, ⑪ TONE ON (SUB) keys operate DK, BK, ME1, ME2, ZO as independent signals or as composite output signals.

8) The ⑬ YE, ⑪ TONE OFF (ON) keys are for returning to stereo modulation, traffic radio information signal output operation.

4.7 Memory Operation

4.7.1 Memory Recall

The memory is laid out in a matrix format. In other words, it is laid outin 10 horizontal rows and 10 vertical columns, for a total of 100 points. The memory layout diagram is shown below.

	MEMORY Address			2-Digit Numeric Display					
00	01	02	03	04	05	06	07	08	09
10									.
20									.
30									.
40									.
50									.
60									.
70									.
80									.
90	. . . . .								99

[Basic recall operations]

1) Move the cursor with ⑨ MODIFY, and recall the row/column with the rotary knob.

2) The recall order is, row recall with the ③ RCL key, ⑫, ⑪, ⑨ 10-key 0 - 9 keys; and column recall with the ③ MEMORY △ key.

3) The memory can also be recalled directly by using the ③ RCL key and the ⑨ ◁ ▷ (◁) keys to turn off the ② MEMORY indicator, and then recalling rows and columns with 2-digit input using the 10-key 0 - 9 keys.

4) The memory can also be recalled directly by using the ③ RCL key and the ⑨ ◁ ▷ (▷) keys to turn off the ② MEMORY indicator, and then recalling columns with 1-digit input using the 10-key 0 - 9 keys. For the following examples, modulation level, pilot level, TRI signal level, area, etc. are set according to articles 4.4 - 4.6, and stored in the memory according to the article 4.7.2 store operations.

a) Example: Move the cursor to ② MEMORY using the ⑨ MODIFY ◁◁ key, and recall directly using the ⑨ rotary knob.

b) Example: When recalling ② memory address "10"
② memory indicator
③ RCL key, ⑫ numeral 1 (30Hz) key 10"

c) Example: When recalling ② memory address "43"
③ RCL key, ⑪ numeral 4 (MONO) key
Press the ③ MEMORY △ key three times. "43"

d) Example: When recalling ② memory address "85"
③ RCL key, ⑪ numeral 8 (SUB) key
Press the ③ MEMORY △ key five times. "85"

e) Example: When directly recalling ② memory address "56"
With the ③ RCL key, ⑨ ◁ (◁)keys, the ② MEMORY indicator goes out. The ⑪ 5 (MAIN), ⑪ 6 (LEFT) are input by means the 10-keys. "56"

f) Example: When directly recalling ② memory address "58"
With the ③ RCL key, ⑨ ▷ (▷) keys, the ② MEMORY indicator goes out. The ⑪ 8 (SUB) is input by means of the 10-keys. "58"

4.7.2 Storing in the Memory

As mentioned in article 4.7.1 on recalling, the memory address is laid out in a matrix format, and is capable of storing practically all the functions on the panel.
However, the output level is an independent function and hence cannot be stored. Regarding basic store operations, the modulation level, pilot level, traffic information signal level, area, etc. are set, and opereted in the order ⑬ YE key, ③ STO (RCL) key, ⑫, ⑪ 10-keys, or ③ MEMORY △ key.
Or, using the ⑬ YE key, ③ STO (RCL) key, ⑨ ◁ (◁) key to turn off the ② MEMORY indicator, and then inputting a 2-digit number with the ⑫, ⑪ 0 ~ 9 keys, it is possible to store row and column numbers directly.

a) Exampe: When storing modulation level 85%, pilot level 10%, SK modulation level 5%, DK modulation level 30%, BK modulation level 60%, area A in memory address "10"

1) Modulation level setting
With the ⑪ MAIN key on, ⑩ PILOT key off, ㉔ SK, 57kHz key off,use the rotary knob to set the modulation level to 85%.

2) Pilot level setting
Press the ⑬ YE, ⑩ % (PILOT) keys, and use the rotary knob to set the pilot level to 10%.

3) Use the ⑬ YE, ㉔ EBU/USA (DK, ME1) keys to select the EBU system,press the ⑬ YE, ㉔ % (SK, 57kHz) keys to illuminate the ④ MODULATION SK/57kHz indicators and set the SK modulation level to 5.0%.

4) Illuminate the ㉔ DK, BK keys and set the ㉓ TRI MOD modulation level to 90%.

5) Press the ⑪ MAIN key again.

6) Press the ⑬ YE, ㉔ %/AREA (ME2) keys to set area A.
With the above settings, use the ⑬ YE, ③ STO (RCL), ⑫ numeral 1 (30Hz) keys to store in memory address "10".

b) Example: When storing different items in memory address "13"

1) Press ⑬ RCL, ⑫ 1 (30Hz), ③ △ two times to set to "12".

2) Set the modulation level, pilot level, etc.

3) Press the ⑬ YE, ③ STO (RCL), △ keys to set "13".
The mode of 2) above is stored in memory address "13".

c) Example: When storing in memory address "45"

1) Set the modulation level, pilot level, etc.

2) Turn off the ② MEMORY indicator with ⑬ YE, ③ STO (RCL), ⑨ ◁ (◁) keys

3) Use the 10-keys to input ⑪ 4 (MONO), ⑪ 5 (MAIN), and the mode of 1) above is stored.

[NOTE 1] When storing continuously, the ⑬ YE, ③ STO (RCL), ⑨ ◁ (◁) keys cannot be abbreviated (i.e. short-cut).

[NOTE 2] The article 4.7.3 ③ RTN (▽) key cannot be stored by this direct storage method.

[NOTE 3] The traffic radio information signal scan mode, scan interval cannot be stored.

4.7.3 When Not Storing in Any Memory Address

(Setting RTN key)

a) Example: When it is desired to change "10"→"11"→"12"→"13"→"10"→"11".

Key Operation	② MEMORY Indicator	
Press the ③ RCL, ⑫ 1(30Hz) and △ keys three times	"13"	
⑬ YE, ③ STO (RCL), RTN (▽)	"13"	The return command is input.

[How to Use]

③ RCL, ⑫ 1 (30Hz)	"10"	first memory
③ △	"11"	second memory
③ △	"12"	third memory
③ △	"13"	fourth memory
③ △	"10"	back to first memory

4.7.4 Cancelling the RTN (▽) Key

There are two methods.

1) Use the ③ RCL, ⑨ · (◁), ⑫ 1 (30Hz), ⑪ 9 (<◁) keys for "19"
   Press the ⑬ YE, ③ STO (RCL), ▽ keys "19"
   Memory address returns to the previous mode's ten steps.

2) Use the ③ RCL, ⑫ 1 (30Hz), ③ △ keys for "13"
   Press the ⑬ YE, ③ STO (RCL), △ keys "14" (RTN is stored here)
   The ⑬ YE, ③ STO (RCL), △ keys ..
   Repeat the above operations four times. ..
   ..
   ..
   "19"

   RTN is sent from one to the next, and the memory address returns the previous mode's Ten steps.

4.7.5 When Using the Recall Memory for Over Ten Continuous Steps

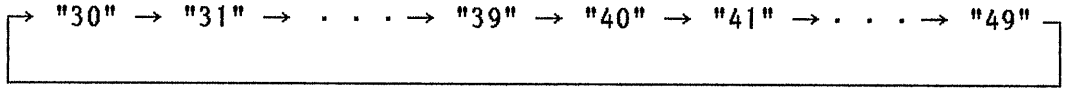
(Setting NEXT key)

Normally, the recall memory is in ten steps (00-09, 10-19, · · · · , 90-99), but the following operations allow the number of steps to be increased in units of 10.
With the ② MEMORY indicator column number as 9, continuing to operate the ⑬ YE, ③ STO (RCL), NEXT (△) keys, the next tens steps may also be recalled.

a) Example: When making it possible for memory "30"-"49" to be continuously recalled.

Key Operation	② MEMORY Indicator	
×	"39"	previous indicator mode
⑬ YE	"39"	
③ STO (RCL)	"39"	STO indicator illuminates
③ NEXT (△)	"40"	STO indicator goes out

Recall operation is as follows



[NOTE] Endless memory address operation is not possible with the ⑨ rotary knob.

4.7.6 Clearing the NEXT (△) key

Set whichever of the memories (09, 19, · · ·, 89) are to be cleared, and operate the ⑬ YE, ⑧ STO (RCL), RTN (▽) keys, in order.

a) Example: When returning memory "30" - "49", which had been made continuously recallable, to "30" - "39", "40" - "49" block function.

Key Operation	② MEMORY Indicator	
×	"39"	Previous indicator mode
⑬ YE	"39"	
⑧ STO (RCL)	"39"	STO indicator illuminates
⑧ RTN (▽)	"39"	STO indicator goes out

4.7.7 Memory Copying to Another Unit of the Same Model

1) The master 100-piont memory can be copied onto another unit of the same model.

2) Memory copying is done as follows.

a) Turn each device's power switch ON.

b) Connect each device's ⑰ REMOTE connector using the DUMP cable.

c) Copying begins with the operation of the master's ⑬ YE, ⑧ DUMP (▽) keys.

[NOTE] The DUMP cable uses an anphenol type 14-pin connector. Among the 14 pins, numbers 8 - 10 are unconnected, but all others areconnected.
Optional DUMP cable SA510

5. REMOTE CONTROL

5.1 General Discription

5.1.1 Outline

The KSG3210 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.

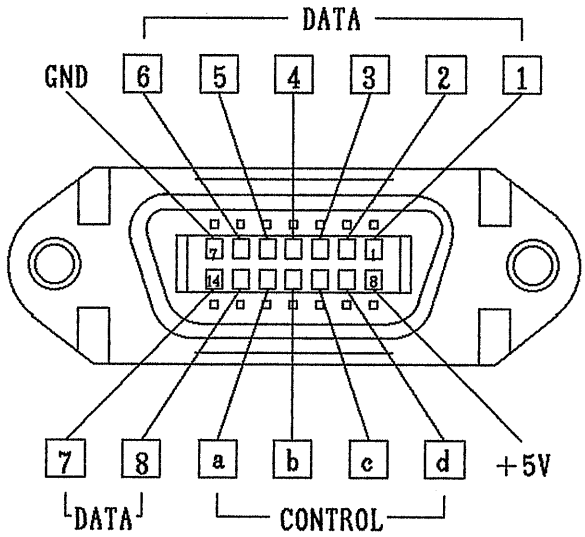


Figure 5-1

[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 ofthe KSG3210. 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

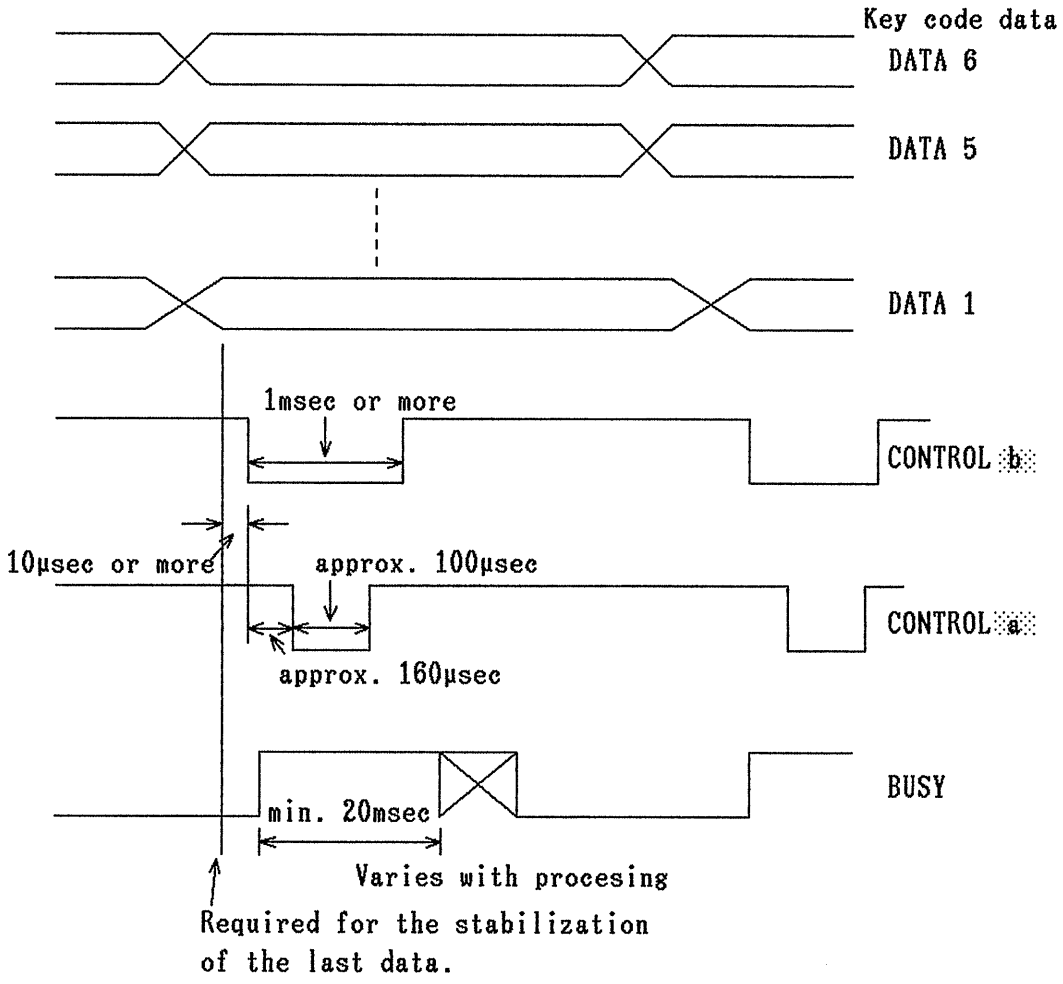


Figure 5-2

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

	DATA input pin number					
	6	5	4	3	2	1
Key name	MSB	← Key Code →				LSB
MEMORY RCL / STO	0	0	0	1	0	0
MEMORY ▽ / RTN (DUMP)	0	0	0	1	1	1
MEMORY △ / NEXT	0	0	0	1	1	0
YE (Yellow Key)	0	1	1	0	1	1
SK , 57kHz (%)	1	0	0	0	0	1
DK , ME1 /(EBU/USA)	1	0	0	0	1	0
ME2 /(%/AREA)	1	0	0	0	1	1
BK , ZO /(SCAN INTERVAL)	1	0	0	1	0	0
△ (START/STOP)	1	0	0	1	1	0
EXT	0	0	1	0	0	1
30Hz	0	1	0	0	0	0
100Hz	0	1	0	0	0	1
400Hz	0	0	1	0	1	1
1kHz (PRE-EM OFF)	0	0	1	1	0	0
6.3kHz (25μs)	1	0	1	0	0	0
10kHz (50μs)	1	0	1	0	1	1
15kHz (75μs)	1	0	1	1	0	0
EXT L/R	1	0	0	1	1	1
ON (TONE OFF)	0	0	1	1	1	1
MONO (SET)	1	0	1	0	1	0
MAIN (100% TRI)	0	1	1	1	0	0
LEFT (100%)	0	1	1	1	0	1
RIGHT (30%)	0	1	1	1	1	0
SUB (TONE ON)	0	1	1	1	1	1
PILOT (%)	0	0	1	1	1	0

(Cont'd)

Table 5-1

Key name	MSB	← Key Code →				LSB
MODIFY ≪◁	0	1	0	1	1	1
MODIFY ◁	1	1	1	1	0	0
MODIFY ▷ (%)	1	1	1	1	1	0
MODIFY ▷▷ (Vp-p)	0	1	1	0	0	0
MODIFY Rorary knob UP	0	0	0	0	0	0
MODIFY Rorary knob DOWN	0	0	0	0	0	1
MODULATION 0 (EXT)	1	1	0	0	0	0
MODULATION 1 (30Hz)	1	1	0	0	0	1
MODULATION 2 (100Hz)	1	1	0	0	1	0
MODULATION 3 (400Hz)	1	1	0	0	1	1
MODULATION 4 (MONO)	1	1	0	1	0	0
MODULATION 5 (MAIN)	1	1	0	1	0	1
MODULATION 6 (LEFT)	1	1	0	1	1	0
MODULATION 7 (RIGHT)	1	1	0	1	1	1
MODULATION 8 (SUB)	1	1	1	0	0	0
MODIFY 9 (≪◁)	1	1	1	0	0	1
MODIFY - (◁)	1	0	1	1	1	0
MODIFY ⊢ (▷)	1	0	1	1	0	1
LOCAL (REMOTE)	1	0	1	1	1	1

5.2.4 Setting recall by remote control (example)

The recall of "57" is to be set.

1) Set the RCL code "000100" according to the panel key code table (Table 5-1).
2) Send CONTROL [redacted] which is set to "0" for 1msec or longer as shown in Figure 5-2 (input data timing).
3) Set the data "101110" according to the code table and send CONTROL [redacted] signal as shown in Figure 5-3.

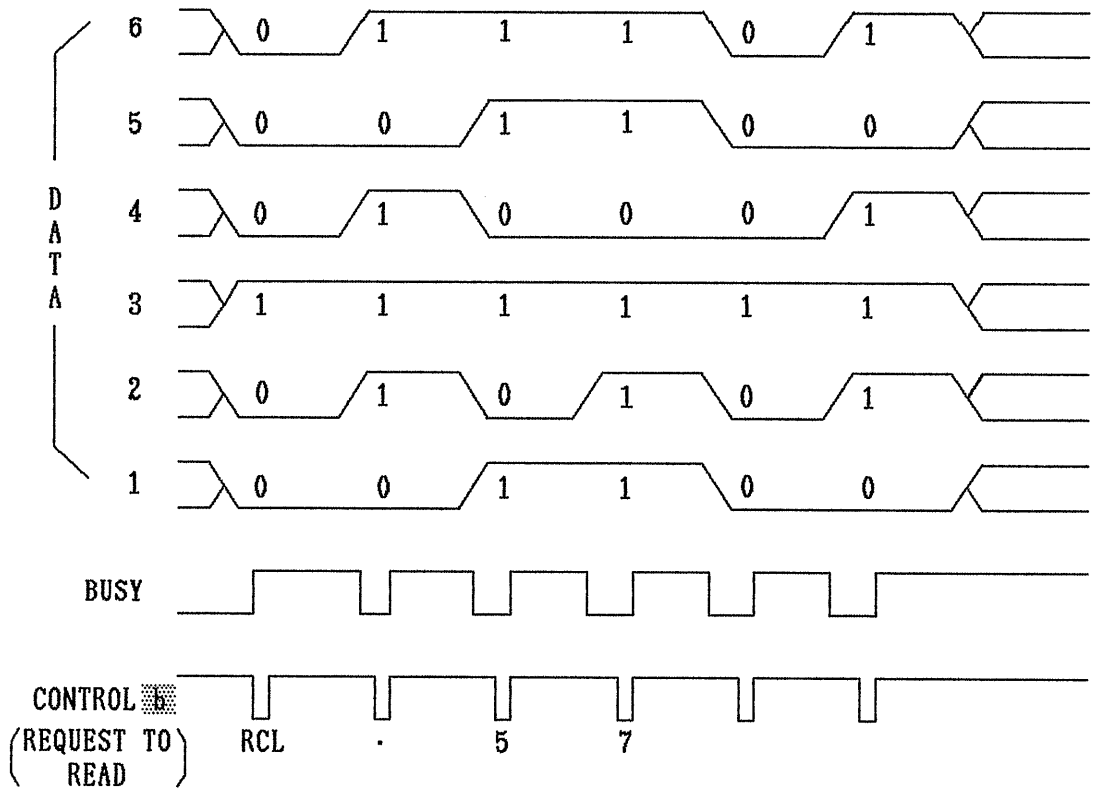


Figure 5-3

4) Finally, send "110101" and "110111" with CONTROL [redacted] signal, and the data transmission is completed.
When the signal generator receives the last data, it starts processing the recall.

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 Multiplex 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.

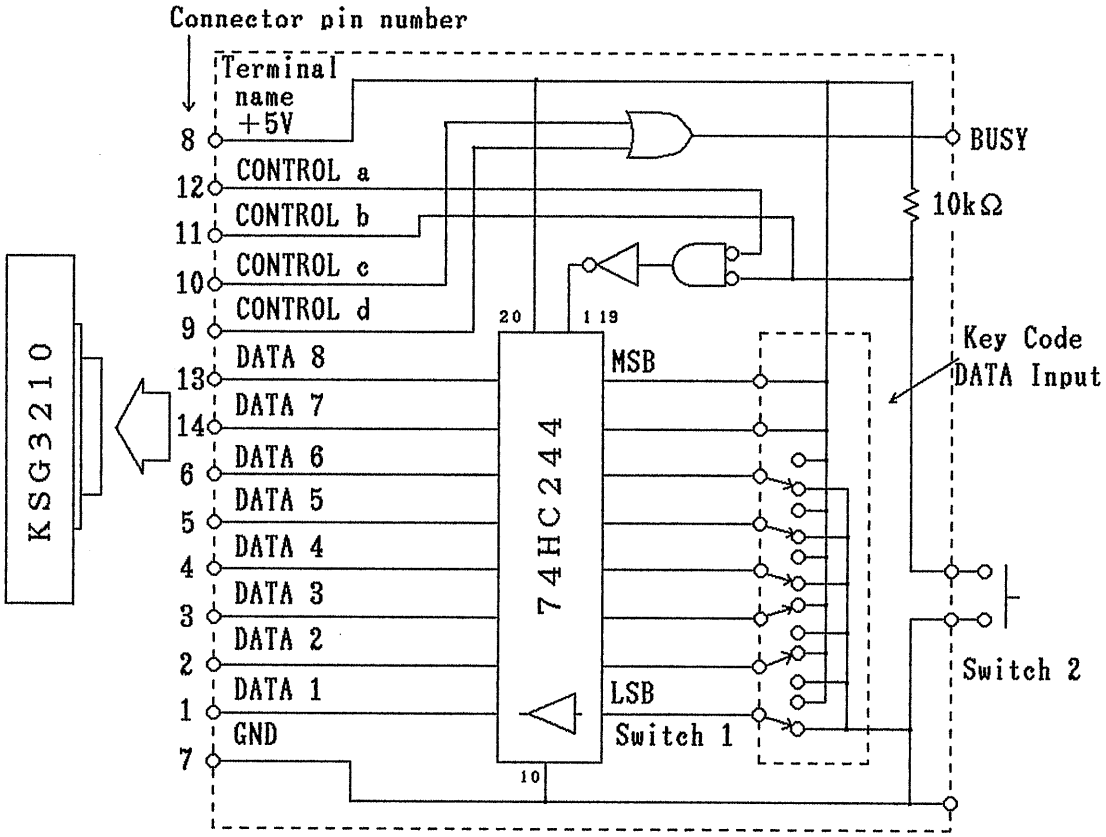


Figure 5-4

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 [redacted] to "0" (Press Switch 2). Then, approximately 160μsec later, CONTROL [redacted] 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 KSG3210 during the period of approximately 100μsec when CONTROL [redacted] 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 [illegible] 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.

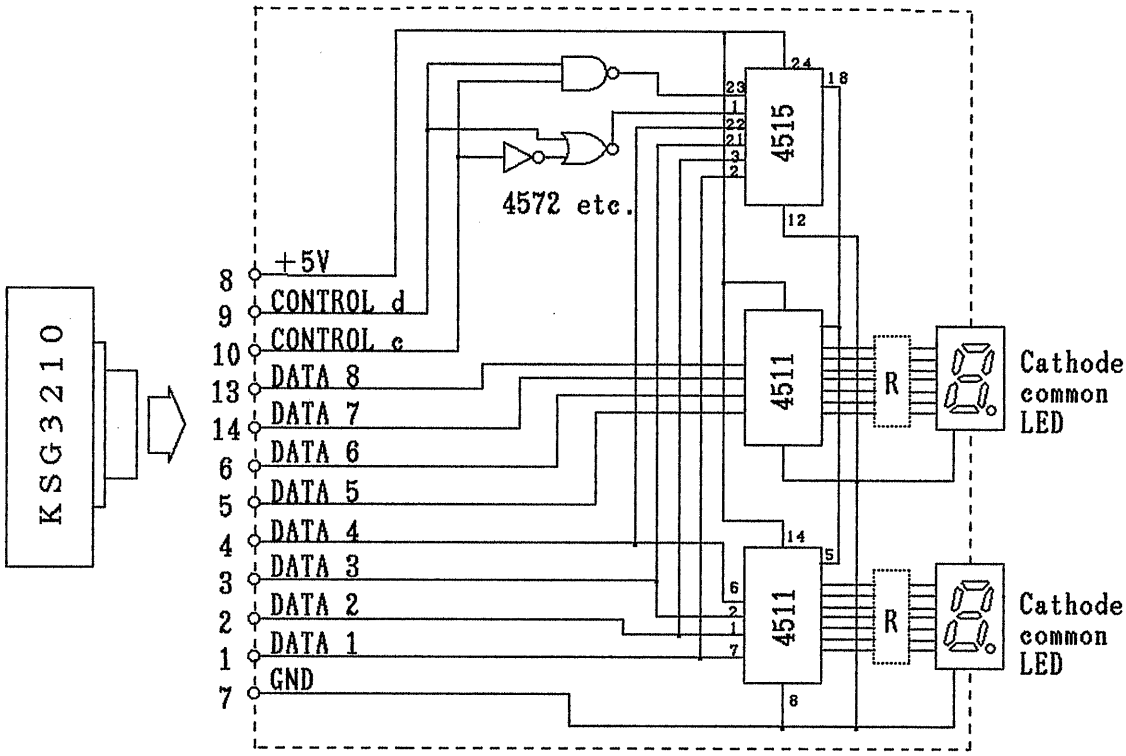


Figure 5-5

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. GP-IB

(General Purpose Interface Bus)

6.1 Introduction

6.1.1 General Description

The KSG3210 has a GP-IB interface, and it can be controlled by the IEEE 488 standard interface bus.

6.1.2 Features

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

2) The remote mode can be verified by the ⑦ REMOTE indicator.

3) The multiplex signal generator can be set in local mode at any time by the pressingof ⑦ 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 multiplex signal generator can be displayed in the [MODULATION] section.

6.2 Performance

6.2.1 Electrical Specifications Related to Interface System

Compiles to IEEE Std 488-1975.

6.3 Operation Procedure

6.3.1 Preparation for Use

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

1) Press the ⑦ LOCAL key after the ⑱ YES key, and device address "09" is displayed in the ④ MODULATION 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 6.3.2.

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

6.3.2 Address Setting Method

The address of the KSG3210 is set at "09" when the instrument is delivered from the factory.
The address switch is mounted on the CPU board in the multiplex 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-90103 found in the rear aluminum sash case viewed from the front panel. The address "09" can be changed to a desired address.
Remove the single screw on the right side the aluminume sash case.
The aluminum sash case can be taken out. Lift the case and remove the four screws, and pull out the case.
After setting the address, put the board back to its original position.

① Table 6-1 lists the values of S2 and corresponding addresses.

② When a switch of S2 is set to ON, the corresponding bit is set to the level of "0".

③ Figure 6-1 shows how S2 is set for address "09".

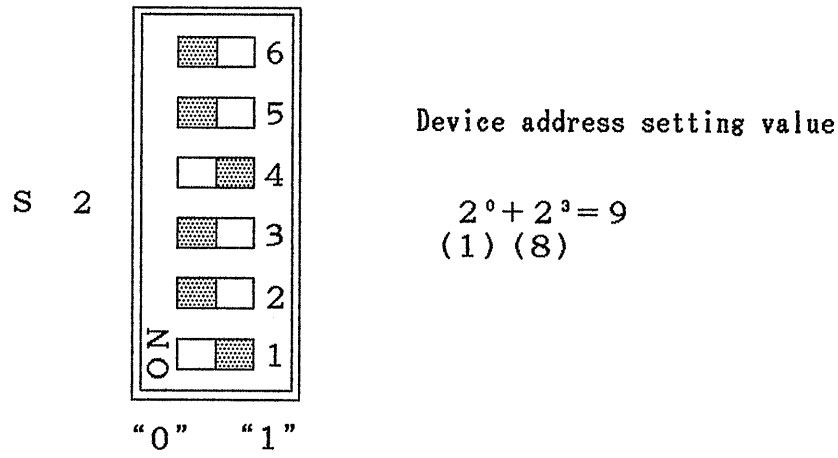


Figure 6-1

Table 6-1

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 "09" at the factory

DIP SW

1 = OFF 0 = ON

6.3.3 Available Control Command and Bus Line Commands

Table 6-2

Control command and bus line command (for hp BASIC)	Explanation
OUTPUT	Specifies 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 multiplex 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 multiplex signal generator in local mode to allow manual operation on the front panel.
CLEAR	Sets the multiplex signal generator in the same state as the initial power-on state.

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

6.3.4 Program Code Table

Use the codes in Table 6-3 for the stereo modulation by KSG3210 and those in Table 6-4 for setting traffic radio information.

Tables 6-5 and 6-6 list the codes in alphabetical order, and Table 6-7 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 6-3 GP-IB Program Codes for Stereo Modulation

Classified by function

Function	Program code
Modulation level	AF
Modulation function	
MAIN	M1
LEFT	M2
RIGHT	M3
SUB	M4
EXT L/R	M5
MONO	M6
ON	M7 (MO)
Modulation source	
EXT	S1
30Hz	S2
100Hz	S3
400Hz	S4
1kHz	S5
6.3kHz	S6
10kHz	S7
15kHz	S8
Pilot level	PL
Pilot off	P0
Pilot on	P1
Output level	AP
Preemphasis	
OFF	PRE0
25 S	PRE1
50 S	PRE2
75 S	PRE3
Data	
Mumeric value	0～9
Minus sine	−
Decimal point	.
Unit	
%	PC or %
Vp−p	V
Memory	
Memory recall	RC
Memory store	ST

Table 6-4 GP-IB Program Codes for TRI

Classified by function

Function	Program code
Traffic radio information	
Europe system	TEBU
USA system	TUSA
Transmitter identification signal	
Modulation level	SK
SK modulation level off	SKOF
SK modulation level on	SKON
Pilot 57kHz	
Modulation level	57K
75kHz modulation level off	57KOF
75kHz modulation level on	57KON
Announce identification signal	
Modulation level	TDK
Modulation level	TME
DK modulation level off	TDKOF
DK modulation level on	TDKON
Massage signal 1, 2	
ME modulation level off	TME0 TMEOF
ME1 modulation level on	TME1
ME2 modulation level on	TME2
Area identification signal	
Modulation level	TBK
BK modulation level off	TBKOF
BK modulation level on	TBKON
BK A	TBKA
BK B	TBKB
BK C	TBKC
BK D	TBKD
BK E	TBKE
BK F	TBKF

"TOOO" is effectiv for tone output only.

Table 6-4 GP-IB Program Codes for TRI (Cont'd)

Classified by function

Function	Program code
Zone signal	
Modulation level	TZO
ZO modulation level off	TZOOF
ZO modulation level on	TZOON
ZO 1	TZO1
ZO 2	TZO2
ZO 3	TZO3
ZO 4	TZO4
ZO 5	TZO5
ZO 6	TZO6
ZO 7	TZO7
ZO 8	TZO8
ZO 9	TZO9
ZO 10	TZO10
Tone output off	TOF
Tone output on	TON

"TOOO" is effectiv for tone output only.

Table 6-5 GP-IB Program Codes for Stereo Modulation

Alphabetical order

Program code	Explanation	Remarks
AF	Modulation level	Function mode
AP	Output level	Function mode
M1	MAIN signal	Function mode
M2	LEFT signal	Function mode
M3	RIGHT signal	Function mode
M4	SUB signal	Function mode
M5	EXT L/R signal	Modulation source
M6	MONO signal	Function mode
M7 (MO)	Modulation level off	Function mode
P0 (POF)	Pilot off	Function mode
P1 (PON)	Pilot on	Function mode
PC (%)	Modulation level in percent	Unit
PL	Pilot level	Function mode
PRE0	Preemphasis off	Function mode
PRE1	Preemphasis 25 s	Function mode
PRE2	Preemphasis 50 s	Function mode
PRE3	Preemphasis 75 s	Function mode
RC	Memory recall	Function mode
S1	External modulation EXT	Modulation source
S2	Internal modulation 30Hz	Modulation source
S3	Internal modulation 100Hz	Modulation source
S4	Internal modulation 400Hz	Modulation source
S5	Internal modulation 1kHz	Modulation source
S6	Internal modulation 6.3kHz	Modulation source
S7	Internal modulation 10kHz	Modulation source
S8	Internal modulation 15kHz	Modulation source
ST	Memory store	Function mode
V	Output level	Unit
0～9	Numeric value	Data
−	Minus sign	Data
.	Decimal point	Data
% (PC)	Modulation level in percent	Unit

Table 6-6 GP-IB Program Codes for TRI

Alphabetical order

Program code	Explanation	Remarks
57K	TRI signal pilot	Function mode
57KOF	TRI signal off	Function mode
57KON	TRI signal on	Function mode
TBK	Area identification signal mod. level	Function mode
TBKA	Area identification signal A	Function mode
TBKB	Area identification signal B	Function mode
TBKC	Area identification signal C	Function mode
TBKD	Area identification signal D	Function mode
TBKE	Area identification signal E	Function mode
TBKF	Area identification signal F	Function mode
TBKOF	Area modulation level off	Function mode
TBKON	Area modulation level on	Function mode
TDK	Announce modulation level	Function mode
TDKOF	Announce modulation level off	Function mode
TDKON	Announce modulation level on	Function mode
TEBU	Europe system	Function mode
TME	Massage signal modulation level	Function mode
TME0	Massage signal modulation level off	Function mode
TME1	Massage signal modulation level on	Function mode
TME2	Massage signal modulation level on	Function mode
PC(%)	Modulation level in percent	Unit
SK	Transmitter level	Function mode
SKOF	Transmitter level off	Function mode
SKON	Transmitter level on	Function mode
TOF	Tone output signal off	Function mode
TON	Tone output signal on	Function mode
TUSA	USA system	Function mode

"TOOO" is effectiv for tone output only.

Table 6-6 GP-IB Program Codes for TRI

Alphabetical order

Program code	Explanation	Remarks
TZO	Zone signal modulation level	Function mode
TZO1	Zone signal 1	Function mode
TZO2	Zone signal 2	Function mode
TZO3	Zone signal 3	Function mode
TZO4	Zone signal 4	Function mode
TZO5	Zone signal 5	Function mode
TZO6	Zone signal 6	Function mode
TZO7	Zone signal 7	Function mode
TZO8	Zone signal 8	Function mode
TZO9	Zone signal 9	Function mode
TZO10	Zone signal 10	Function mode

"TOOO" is effectiv for tone output only.

Table 6-7 GP-IB Function Setting Method

Item	Program code	Data	Unit
Modulation level	AF	○○○	PC(%)
	AF	○○.○	%(PC)
Pilot level	PL	○○	PC(%)
Output level	AP	○.○○	V
Modulation function	M1 - 7	---	---
Modulation source	S1 - 8	---	---
Pilot on/off	P0, P1	---	---
	POF, PON	---	---
Preemphasis	PRE0 - 3	---	---
TRI system	TEBU, TUSA	---	---
TRI identification signal			
Modulation level	SK, 75K	○○.○	PC(%)
Modulation level off/on	SKOF, SKON	---	---
Modulation level	75KOF, 57KON	---	---
Announce signal			
Modulation level	TDK, TME	○○	PC(%)
Modulation level off/on	DKOF · ON, ME0 · 1 · 2	---	---
Area signal			
Modulation level	TBK, TZ0	○○	PC(%)
Modulation level off/on	BKOF · ON, ZOON · OF	---	---
Area identification signal			
A - F, 1 - 10	BKA - F, Z01 - 10	---	---
Tone output off/on	TOF, TON	---	---
Memory			
Memory recall	RC	○○	---
Memory store	ST	○○	---

"T○○○" is effectiv for tone output only.

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.

6.3.5 Basic Data Setting Method

Modulation level 90%, pilot level 10%, 3Vp-p output level, 1kHz internal modulation frequency are to be set.
In the following examples, HP9816 is used:

Example 1: OUTPUT 709; "AF90PC, PL10%, AP3V,S5"

Output command	Modulation level data	Pilot level data	Output level data	Modulation source data

Normally, CRLF or EOI is sent.

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

```
OUTPUT 709; "AF90PC"
OUTPUT 709; "PL10%"
OUTPUT 709; "AP3V"
OUTPUT 709; "S5"
```

Example 3: To set the modelation level at 30%
① "AF30PC"

Example 4: To set the pilot level at 8%
① "PL8%"

Example 5: To set the output level at 5Vp-p
① "AP5V"

Example 6: To set the modelation function at LEFT signal
① "M2"

Example 7: To set the internal modulation frequency at 400 Hz
① "S4"

Example 8: To turn off modelation level
① "M7" ② "M0"

Example 9: To turn off modelation level

① "P0" ② "P0F"

Example 10: To recall memory address "36"

① "RC36"

Example 11: To store data at memory address "36"

① "ST36"

6.3.6 Connector Pin Allocation Diagram

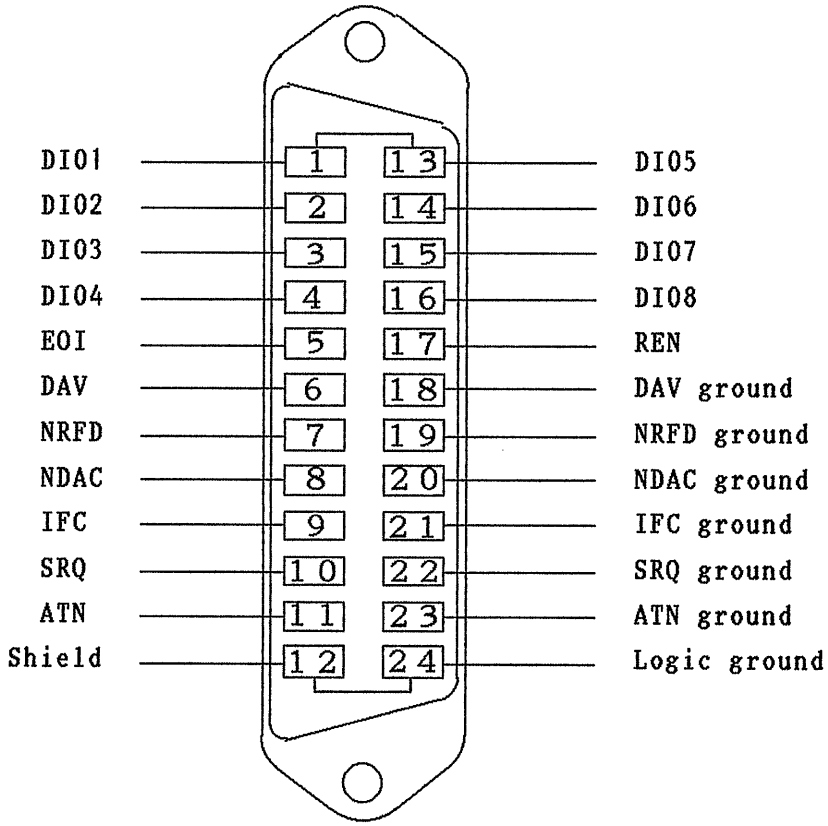


Figure 6-2

6.3.7 Reference (Program example)

An example of a program for HP 9816 is given below. This program is to set the data of modulation level, pilot level, and modulation source, to store the data into the multiplex 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 multiplex signal generator, code the program in the most suitable way for the system.

```
10    Dev=709                                  Interface select code
                                               *100+Device address
20    Mod_level=10                             10%
30    Mod_level_step=10                        10%
40    Pilot_level=10                           10%
50    Pilot_step=-1                            -1%
60    CLEAR Dev                                Clear selected device
70    WAIT 2
80    FOR N=0 TO 9
90       Mod=Mod_level+Mod_level_step*N
100      Pilot=Pilot_level+Pilot_step*N
110      OUTPUT Dev;"AF";Mod;"PC"              Set modulation level
120      OUTPUT Dev;"PL";Pilot;"PC"            Set pilot level
130      OUTPUT Dev;"S5"                       Set 1kHz internal
                                               modulation frequency
140      OUTPUT Dev;"ST";N                     Store data into memory
150   NEXT N
160   FOR N=0 TO 9
170      OUTPUT Dev;"RC";N                     Recall data memory
180      WAIT 2
190   NEXT N
200   END
```

7. BACKUP BATTERY AND INITIALIZING CPU

The KSG3210 uses a memory backup battery, and the battery may discharge all its electricity when the multiplex signal generator is not used for a long time.

Turn on the power for the multiplex 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 GB 50H-3X of Japan Storage Battery Co., Ltd.

[Battery position and replacement method]

Remove the top panel of the instrument, and two 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 andfasten 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 (S1).

APPENDIX

Examples of Use

When Connected to FM Standard Signal Generators

The following is an explanation for when this unit is used as an SG's multiplex signal generator source.
A frequency deviation of 75kHz (100%) is stipulated for FM broadcasting. Also, the receiver's standard test modulation level is shown in diagrams 1 and 2.
All explanations here in assume a stereo modulation frequency of 1kHz.
By means of the ⑬ YE, ⑪ SET (MONO) keys, set output level 3.00Vp-p (monophonic signal 100%). The pilot signal cuts off automatically.
Use with the SG's MODULATION EXT LEVEL HI, LO adjusted to the appropriate level.
Next, by means of the ⑬ YE, ⑪ 100% (LEFT) key, it becomes the stereo modulation 100% modulation level (MAIN channel + SUB channel 90%, pilot signal10%).

A. Standard Test Modulation Level

JIS C 6104 Standard Test Modulation

JIS C 6104 FM Broadcast Receiver Test Method		Modulation Mode						
		Frequency Deviation Due to the MAIN Channel (kHz)		Frequency Deviation Due to the SUB Channel (kHz)		Frequency Deviation Due to the PILOT Channel (kHz)	Total	
							30% Modulation (kHz)	100% Modulation (kHz)
Modulation Level		30%	100%	30%	100%	10%		
Modulation Signal	MONO	22.5 (30%)	75 (100%)	0	0	0	22.5 (30%)	75 (100%)
	MAIN	20.25 (27%)	67.5 (90%)					
	LEFT or RIGHT	10.125 (13.5%)	33.75 (45%)	10.125 (13.5%)	33.75 (45%)	7.5 (10%)	27.75 (37%)	
	SUB	0	0	20.25 (27%)	67.5 (90%)			

Diagram 1

IHF-T-200 Standard Test Modulation

IHF-T-200 FM Broadcast Receiver Test Method		Modulation Mode			
		Frequency Deviation Due to the MAIN Channel (kHz)	Frequency Deviation Due to the SUB Channel (kHz)	Frequency Deviation Due to the PILOT Channel (kHz)	Total
Modulation Level		100%			
Modulation Signal	M O N O	75 (100%)	0	0	75 (100%)
	M A I N	68.25 (91%)			
	LEFT or RIGHT	34.125 (45.5%)	34.125 (45.5%)	6.75 (9%)	
	S U B	0	68.25 (91%)		

Diagram 2

B. When Using One Signal

1. When using JIS C 6104 standard test signal modulation level 100%

1) Signal supply to the SG
Connect the ⑧ COMPOSITE OUTPUT connector and the SG external modulation input connector.

(A) When using the internal generator 1kHz key

1) When the ⑬ YES, ⑪ SET (MONO) keys are operated, a monophonic modulation level 100%, output level 3.00Vp-p signal is output from the ⑧ COMPOSITE OUTPUT connector. Adjust the ⑨ rotary knob so that both the SG's EXT LEVEL HI, LO indicators go out.

2) When the ⑬ YES, ⑪ 100% (LEFT) keys are pressed, modulation level 90% and pilot level 10% ·· a total of 100% ·· are set.

3) By switching the ⑪ MODULATION FUNCTION's MONO - SUB keys, a composite signal (100%) like that of diagram 1, or a monophonic signal is generated and supplied to the receiver.

(B) When using 1 kHz from an external signal source

1) Press the ⑬ YES, ⑩ % (PILOT) keys, and set pilot level 10% using the ⑨ rotary knob.

2) Turn the ⑫ EXT key on.

3) Connect the external signal source to the ⑮ AF/L connector. With the external signal source output frequency at 1 kHz, set the output level at the appropriate level so that both the ④ MODULATION's EXT LEVEL HI, LO indicators go out.

4) By switching the ⑪ MODULATION FUNCTION's MONO - SUB keys, a composite signal (100%) like that of diagram 1, or a monophonic signal is generated and supplied to the receiver.

2. When using JIS C 6104 standard test 30% modulation level

This unit is easily switched to the 30% modulation level by means of the ⑬ YES, ⑪ 30% (RIGHT) keys.
As shown in diagram 1, because the 30% modulation level is 30% of the 90% modulation level, 90% × 0.3 = 27%, and with pilot level 10% is a total of 37%.
Accordingly, FM deviation is 75kHz × 0.37 = 27.75kHz.
Also, in the case of monophonic, there is not pilot signal, so it becomes 100% × 0.3 = 30%, and the SG's frequency deviation is 75kHz × 0.3 = 22.5kHz.

1) Setting modulation level 30%

a) Press the ⑬ YES, ⑪ SET (MONO) keys to set output level 3.00Vp-p(monophonic modulation level 100%), and use the ⑨ rotary knob to adjust the SG modulation level to the appropriate level.

b) When the ⑬ YE, ⑪ 30% (RIGHT) keys are pressed, stereo modulation level 27% is set, and this unit indicates 37%.
At this time the SG modulation input level LO indicator illuminates, but there is no problem.

2) Selection of the composite signal using the MODULATION FUNCTION key
By switching the ⑪ MODULATION FUNCTION's MONO - SUB keys, a composite signal (30%) like that of diagram 1, or a monophonic signal is generated and supplied to the receiver.

3. When using IHF-T-200 standard test signal modulation level 100%
In the case of IHF-T-200, the pilot level is stipulated at 9%

1) Setting the SG modulation input level
Press the ⑬ YE, ⑨ SET (MONO) keys and use the ⑨ rotary knob to adjust the SG's modulation input level HI, LO to the appropriate level.

2) Use the ⑬ YE, ⑪ 100% (LEFT) keys to set modulation level 100% and pilot level 10% ·· a total composite signal of 100%.

3) Setting the pilot level
Press the ⑬ YE, ⑩ % (PILOT) keys, and set pilot level 9% using the ⑨ rotary knob.

4) Setting the modulation level
Press the ⑪ MODULATION FUNCTION's MAIN - SUB keys and set the total modulation level to 100% using the ⑨ rotary knob. At this time, the modulation level 91% and pilot level 9% are set.

5) Selection of the composite signal using the MODULATION FUNCTION key. By switching the ⑪ MODULATION FUNCTION's MONO - SUB keys, a composite signal like that of diagram 2, or a monophonic signal is generated and supplied to the receiver.

C. When Modulating Using Two Signals

When using two signals, by pressing the ⑫ MODULATION SOURCE EXT L/R key, it is possible to use two external signal sources ·· L signal and R signal ·· to generate stereo modulation signals.

1. When using JIS C 6104 standard test signal modulation level 100%

1) Setting the SG modulation input level and the L, R signal modulation levels.
Press the ⑬ YE, ⑪ SET (MONO) keys to set output level 3.00Vp-p (monophonic modulation level 100%), and use the ⑨ rotary knob to adjust the SG modulation input level.

2) Setting the L, R signal modulation levels

a) Press the ⑬ YE, ⑪ 100% (LEFT) keys to set the stereo 100% modulation level.

b) Press the ⑫ EXT L/R key.

c) Connect the L side external signal source to the ⑮ AF/L input connector, set the external signal source output frequency to 1kHz, and adjust the output level to the ④ EXT LEVEL HI, LO appropriate level.

d) Next, after also connecting the R side external signal source to the ⑮ AF/L input connector, adjust the external signal source output level to the ④ EXT LEVEL HI, LO appropriate level, and then reconnect to the ⑭ R input connector.
In the above manner, a 100% composite signal comprised by the two different signals is output.

2. When using two signals to generate 30% modulation level signals

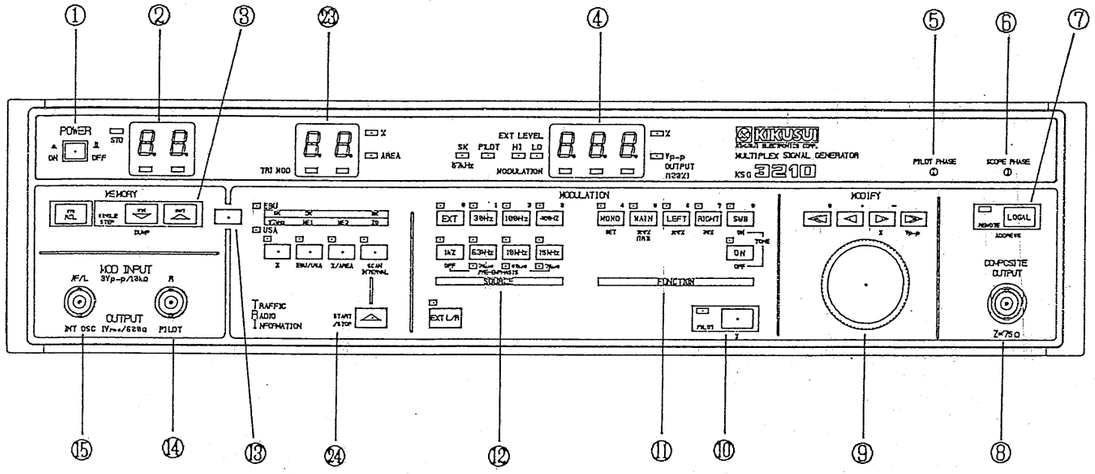
1) Setting the SG modulation level and the L, R signal modulation levels

a) Press the ⑱ YE, ⑪ SET (MONO) keys. Output level 3.00Vp-p (monophonic modulation level 100%) is set. Adjust the SG modulation input level using the ⑨ rotary knob.

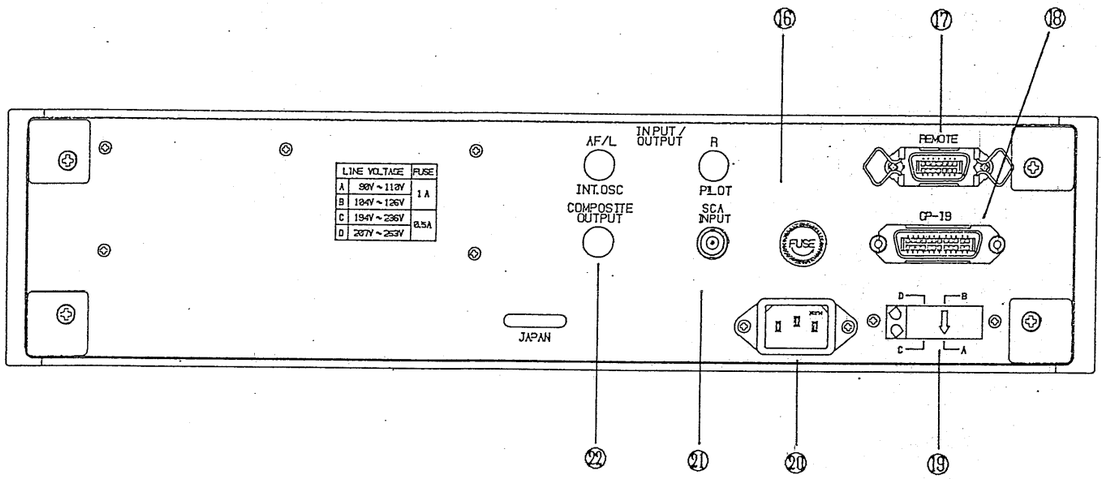
b) Set the L, R input levels in the same manner as articles C. 2) c), d) above.

c) Set to 37% using the ⑱ YE, ⑪ 30% (RIGHT) keys. In the case of 37% modulation, the SG EXT LEVEL HI, LO indicator LO illuminates, but there is no problem.

d) Press the ⑫ EXT L/R keys.
In the above manner, a 30% composite signal comprised by the two different signals is output.



Front Panel



Rear Panel