OPERATION MANUAL

Standard Signal Generator KSG series

KSG4310

KIKUSUI
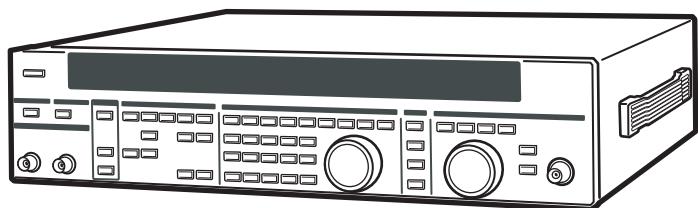
Use of Operation Manual

- Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.
- If you find any incorrectly arranged or missing pages in this manual, they will be replaced. If the manual gets lost or soiled, a new Operation Manual can be purchased. In either case, please contact your Kikusui agent, and provide the "Part No." given on cover.
- This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact your Kikusui agent.

⚠ Safety Precautions

The following safety precautions must be observed to avoid fire hazard, electrical shock, accidents, and other failures. Keep them in mind and make sure that all of them are observed properly. Kikusui assumes no liability against any damages or problems resulting from negligence of the precautions.

Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If it is handled by disqualified personnel, personal injury may result. Be sure to handle it under supervision of qualified personnel (those who have electrical knowledge.)

Purposes of use

- If the product is to be used for purposes not described in this manual, contact your Kikusui agent in advance.
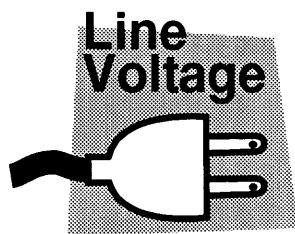
Input power

- Use the product with the specified input power voltage.
- For applying power, use the AC power cable provided. The shape of the plug differs according to the power voltage and areas. Use the cable which is suitable for the line voltage used.

Fuse

- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one. When replacing a fuse, use the one which has appropriate shape, ratings, and specifications.
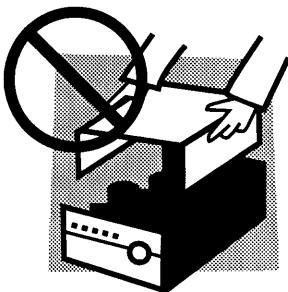
Cover

- There are parts inside the product which may cause physical hazards. Do not remove the external cover. If the cover must be removed, contact your Kikusui agent in advance.
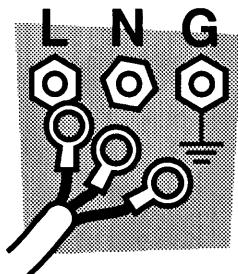
Installation

- When installing products be sure to observe "Conditions at the Installation Location" described in this manual.
- To avoid electrical shock, connect the protective ground terminal to electrical ground (safety ground).
- When applying power to the products from a switchboard, be sure work is performed by a qualified and licensed electrician or is conducted under the direction of such a person.
- Be sure to use the AC power cable provided. Consult your Kikusui agent if other cable than included is to be used for some reason.
- When installing products with casters, be sure to lock the casters.
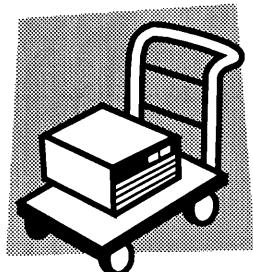
Relocation

- Turn off the power switch and then disconnect all cables when relocating the product.
- Use two or more persons when relocating the product which weights more than 20 kg. The weight of the products can be found on the rear panel of the product and/or in this operation manual.
- Use extra precautions such as using more people when relocating into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- Be sure the operation manual be included when the product is relocated.

Operations

- Check that the AC input voltage setting and the fuse rating are satisfied and that there is no abnormality on the surface of the AC power cable. Be sure to unplug the AC power cable or stop applying power before checking.

- If any abnormality or failure is detected in the products, stop using it immediately. Unplug the AC power cable or disconnect the AC power cable from the switchboard. Be careful not to allow the product to be used before it is completely repaired.
- For output wiring or load cables, use connection cables with larger current capacity.
- Do not disassemble or modify the product. If it must be modified, contact your Kikusui agent.
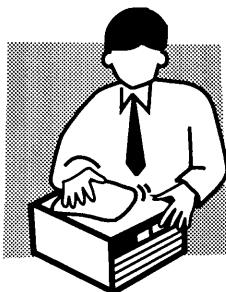
Maintenance and checking

- To avoid electrical shock, be absolutely sure to unplug the AC power cable or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking. If the cover must be removed, contact your Kikusui agent in advance.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

Service

- Internal service is to be done by Kikusui service engineers. If the product must be adjusted or repaired, contact your Kikusui agent.

Safety Symbols

This operation manual and this product use the following safety symbols. Note the meaning of each of the symbols to ensure safe use of the product. (As using symbols depend on the product, all of symbols may not be used.)
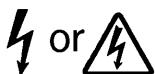
⚡ or ⚠	Indicates the presence of 1000V or higher. Never attempt to touch this part when the power switch of the product is turned on.
▬ WARNING ▬	Indicates the possibility of personal injury or death. Never fail to follow the operating procedure. Do not proceed beyond a WARNING sign until the noted conditions are fully understood and met.
CAUTION	Indicates the existence of damage to the product or connected equipment. Always follow the operating procedure. Do not proceed beyond a CAUTION sign until the indicted conditions are fully understood and met.
NOTE	Indicates additional information such as operating procedure.
Description	Describes technical terms used in this manual.
🚫	Indicates action prohibited.
⚠	Indicates general warning, caution, risk of danger. When this mark is indicated on the product, refer the relevant section of the Operation Manual.
⏚	Indicates a grounding (earth) terminal.
⏚	Indicates a chassis grounding terminal.

Operation Manual Contents

The manual contains the following:

◆ ⚠ Precautions for use

Symbols indicating caution to prevent fire, electric shock or failure. Read thoroughly before use.

◆Safety symbols

Describes symbols used to indicate special safety measures. Read thoroughly before use.

◆Introduction

Gives overview of product features.

◆Chapter 1: Setup

This chapter provides basics about handing the signal generator, from unpacking and setting it up to running it.

◆Chapter 2: Operation

This chapter describes turning on the signal generator and setting panel.

◆Chapter 3: Remote Control

This chapter describes how to control the signal generator externally.

◆Chapter 4: Names and Functions of Controls

This chapter gives description and functions of switches, displays, onnectors, etc., for front and rear panels.

◆Chapter 5: Maintenance and Calibration

This chapter provides information on maintaining and calibrating this product. Periodic maintenance, inspection, and calibration are recommended to keep the product long-lived with unfailing initial performance.

◆Chapter 6: Specifications

This chapter describes the electrical and mechanical specifications of the product, and the options available with it.

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Preface

Description

With a frequency range of 10 kHz to 280 MHz, the KSG4310 standard signal generator, modulates FM, AM, and FM-AM simultaneously. A synthesizer in phase with its built-in crystal reference oscillator assures signal stability ($\pm 2 \times 10^{-7}$ /week). Moreover, built-in FM stereo and AM stereo (Motorola C-QUAM$^{\circledR}$ system) modulators recommend the unit for use as a tool of tuning and testing receivers, operating mainly in the FM and AM broadcast bands, in labs and production lines. The easy-to-use numerically programmable unit maintains a panel memory stores up to 100 different panel settings.

Output amplitudes, ranging from -133 dBm to +19 dBm (50 Ω), can be set with resolutions of 0.1 dB. Two kinds of engineering units are supported: loaded-end 50 Ω/75 Ω units (dBm, dBf, dB μ, mV, μ V) and open-end units (dB μ EMF, mVEMF, μ VEMF).

Six modes of modulation are available: FM, FM stereo, AM, AM stereo, FM-AM, and FM stereo-AM. Maximum deviations available are 300 kHz for FM and 99.9% for AM. Further, internal and external modulation are possible.

FM modulation distortions held to 0.01% or less (1 kHz/75 kHz deviations), coupled with S/N ratios of 90 dB or more (76 MHz to 90 MHz, 98 MHz, 10.7 MHz, demodulation band 300 Hz to 15 kHz, deemphasis 50 μ s), promise high-quality modulation.

Features

■ 100 different panel settings in memory

The panel memory stores up to 100 different operational parameters settings (such as carrier frequency, output level, FM/AM modulation factors, and modulators ON/OFF,) from 00 to 99. You are free to recall them at your option.

■ Iterative recall of grouped addresses

You can define any sequences of panel memory addresses as groups and recall them iteratively.

■ Memory scan feature

Memory addresses can increment automatically at fixed intervals of time, which can be set in seconds between 1 and 60 seconds.

■ AM stereo modulator (Motorola C-QUAM$^{\circledR}$ system)

With carrier frequencies of 400 kHz to 2 MHz, a distortion factor of 0.2% or less (MAIN signal), and a channel separation of 36 dB or more (400 Hz to 4 kHz), the AM stereo modulator provides excellent modulation.

■ AF signal oscillator generating from 50 Hz to 15 kHz

The internal modulation oscillator generates frequencies between from 50 Hz to 15 kHz with a resolution of 50 Hz.

■ External signal indicators

External signal indicators available for both AF/L and R ease the work of setting reference levels.

■ Direct entry of settings

Numeric keys directly enter numeric data, such as frequencies, modulation factors, and output levels. Numeric keys also let you store and recall data to and from the panel memory.

■ Cursor function

Modifications to settings can be made by using numeric keys and, more easily, by using the cursor function and the rotary knob together.

■ ΔFREQ (frequency deviation) function

The 【ΔFREQ】 and 【+/-】 keys ease the task of measuring frequency selectivity characteristics.

■ Output level selection

Output units (dBm, dBf, dBμ, mV, μV, and their respective EMF, except for dBm and dBf) can be selected.

■ Output level ΔdB and offset function

The ΔdB (output level deviation) function is used to measure relative changes in output level. It best demonstrates its power when measuring receiver bandwidths and filter attenuation characteristics.

■ Electronic attenuators

An electronic implementation of most of the step attenuators speeds up measurement tasks, with enhanced reliability.

Chapter 1 Setup

This chapter provides basics about handing the signal generator, from unpacking
and setting it up to running it.

1.1 Unpacking and Packing

■ Unpacking

When the product is delivered to your site, first check it for damage during transit or to see if it is complete all the accessories required. If any damage or deficiency is found, please contact your Kikusui agent.
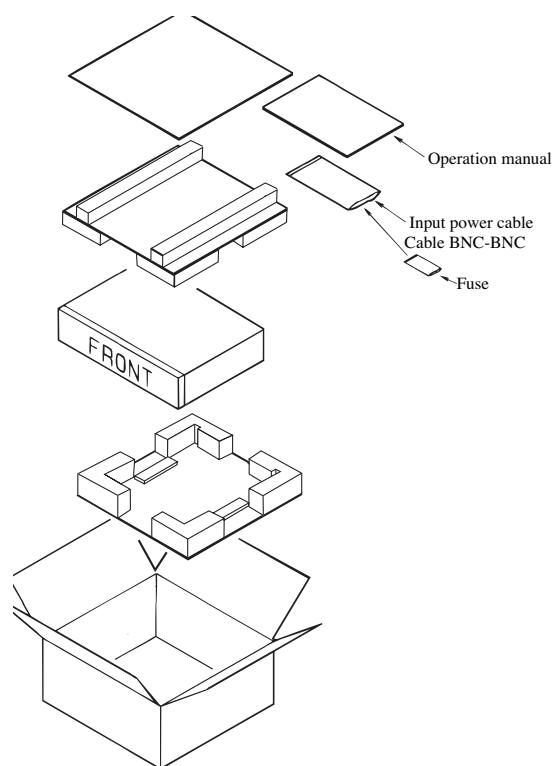
Figure 1-1   Unpacking/packing

Accessories					
	Description		Code	Quantity	Check
				100V or 120V input required model	220V or 240V input required model	
1	Input power cable		85-AA-0003	1		
			85-AA-0005		1	
2	Fuse	T 1.0A 250V		1	2	
		T 0.5A 250V		2	1	
3	Cable BNC-BNC (SA550)		96730	1	1	
4	Operation manual		Z1-001-062	1	1	

■ Packing

Packing should be done by two or more persons. Refer to Fig.1-1: Unpacking/packing to avoid placing cushioning material in the wrong direction.

1.2 Precautions for Installation

Observe the following precautions:

■ **Do not use the product in inflammable atmosphere.**

Do not use the product near combustibles, such as alcohol and thinner, or in inflammable atmosphere to avoid possible explosion or fires.

■ **Avoid high temperatures and exposure to direct sunlight.**

Do not install the product near heaters or sources of heat or in places that are subject to sharp temperature changes.

Operating temperature range	: 0 °C to 40 °C
Optimum (specification guaranteed) temperature range	: 5 °C to 35 °C
Storage temperature range	: -25 °C to 70 °C

■ **Avoid high humidity.**

Do not install the product with high humidity, such as a places near a boiler, humidifier, or tap water.

Operating humidity range   : 20% to 85%

Storage humidity range   : 20 to 90%

Dew may condense on the product even when it is used within the operating humidity range. In the event of dew condensation, allow the product to dry fully before returning it to service.

■ **Avoid placing corrosive atmosphere.**

Do not use the product in corrosive atmosphere or in an environment dominated by sulfuric acid mist. Corrosive could corrode the conductors used in the product or impair the contact of its connectors, resulting in malfunctions or failures or, in the worse case, in fires.

■ **Keep in relatively dust-free environment.**

■ **Do not use the product in a poorly ventilated place.**

Allow adequate spaces around the product to ensure air flow to and from the air holes on its top and bottom side.

■ **Do not use the product in an unstable place.**

Do not set up the product in sloped places or in places that are subjected to vibration.

■ **Do not use the product near sources of intense electromagnetic fields.**

1.3 Checking the Line Voltage and Fuse

━━━━━━━━━━ WARNING ━━━━━━━━━━

- To avoid electrical shock, unplug the product from the AC outlet or turn OFF the power distribution board switch before attempting to check or replace the fuse.

░░░░░░░░░░ CAUTION ░░░░░░░░░░

- Use a fuse of the proper shape, rating, and characteristics for product. Damage to the product could result if a fuse or fuse holder of the wrong rating is used shorted.

1. Turn off [POWER] switch and desconnect the power cable.
2. Remove fuse holder as shown in Figure 1-2.

Remove cover by inserting the point of a flat head screwdriver in here. Then, adjust the voltage selector to the ▼ mark and push in the cover.
(The figure illustrates a choice 100 VAC.)
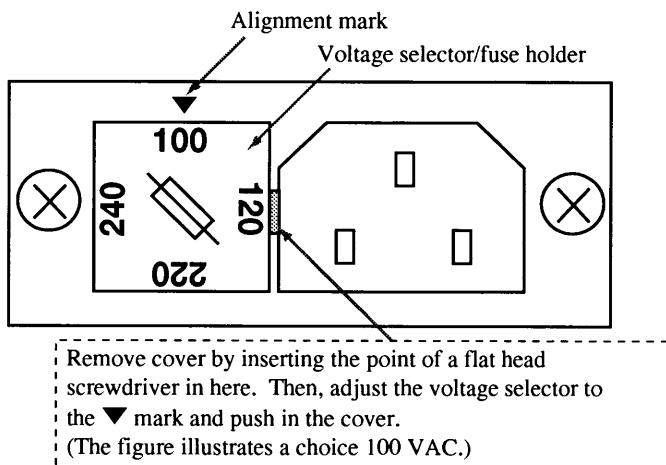
Figure 1-2   Removing Fuse Holder

3. Referring to the LINE VOLTAGE table on the rear panel, check the rating and blowing characteristic of the fuse mounted. If a wrong fuse is used, replace it.

LINE VOLTAGE		FUSE
100	90V to 110V	250VAC
120	104V to 125V	1A (T)
220	194V to 236V	250VAC
240	207V to 250V	0.5A (T)

4. Check the line voltage to use from the LINE VOLTAGE table, adjust the voltage selector to the ▼ mark and push in the cover.

1.4 Grounding

————————— WARNING —————————

- Improper or no grounding may cause electrical shock.

- Connect the ground terminal to electrical ground (safety ground).

To ground this product, connect the 3-P plug to a grounded 3-P receptacle.

2

Chapter 2 Operation

This chapter describes turning on the signal generator and setting panel.

2.1 Turning On the Signal Generator

2.1.1 Power on

<1> Check the 【POWER】 switch is set to OFF.

<2> Referring to the LINE VOLTAGE table on the rear panel, check the line voltage available to the signal generator and the voltage selector setting match.

<3> Connect accessory power cable to AC LINE on the rear-panel.

<4> Connect the plug to prescribed power line.

CAUTION

- Damage to the fuse could result if the line voltage available to the signal generator and the voltage selector setting do not match.

<5> Turn on the 【POWER】 switch.

All the indicators on the front panel will be turned on once before it displays the status of the signal generator in which it had been before it was last turned off.

2.1.2 Initialization

CAUTION

- Initialization will clear the panel memory of its existing contents completely.

While holding down 【2nd】 key in the DATA ENTRY section, press the 【POWER】 switch to initialize. Continue pressing the 【2nd】 key until all the panel LEDs light.

Initialization will clear the panel memory completely and reset it to the default settings listed below.

FREQUENCY indicator	: 280.00000MHz
FREQUENCY STEP	: 100kHz
AMPLITUDE indicator	: -123.0dBm
AMPLITUDE STEP	: 1.0dBm
RF output	: ON
Output impedance	: 50 Ω
FM modulation	: ON
AF	: ON
PILOT	: ON

FM modulation source	: INT
FM internal oscillator frequency	: 1kHz
Stereo modulation mode	: MAIN
Pre-emphasis	: OFF
MODULATION indicator	: 100%
AM modulation	: ON
AM modulation source	: INT
AM internal oscillator frequency	: 1kHz
MEMORY indicator	: 00
Position indicator	: In the FREQUENCY indicator, the 1 MHz position lights; in the AMPLITUDE indicator, the least significant digit position lights.
GPIB address	: 09

2.2 Checking the ROM Version

When making inquiries about your product to us, please tell us the version number of the ROM installed in the product to expedite our handling your inquiries. To check the ROM version number, follow these steps:

<1> Press the 【-】 and 【 · 】 keys following the 【2nd】 key in the DATA ENTRY section.
<2> All the indicators on the front panel will be turned on once before displaying the ROM version number.

Abbreviation of application   Date   Version number
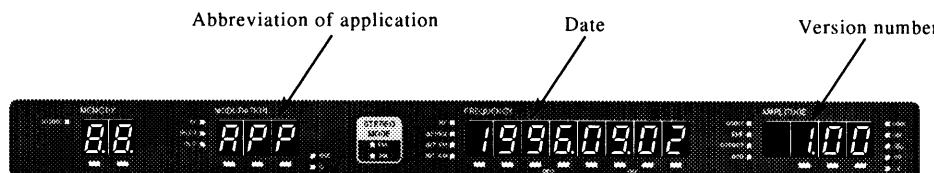
┌──────────────────┐ NOTE ┌──────────────────┐

• The date and ROM version number shown above may differ from those appearing on your product.

<3> When the check is complete, press the 【LOCAL/(ADRS)】 key to return to the original status.

2.3 Basic Operations

2.3.1 Setting a frequency

Set the RF frequency that is output to the OUTPUT connector in the AMPLITUDE section. Use numeric keys or the rotary knob in the DATA ENTRY section to set a frequency. The frequency set appears on the FREQUENCY indicator in Max. eight digits.

Using numeric keys

<1> Press the 【FREQ/(STEP)】 key in the DATA ENTRY section to set the signal generator in the frequency setup mode. (The 【FREQ/(STEP)】 key and the [RF] lamp will light.)

<2> Using the numeric keys 【0】 to 【9】 and the 【 · 】 key, enter the desired frequency. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. If you do not press the 【MHz/dB/mV】 or 【kHz/%/ μ V】 key to confirm the frequency setting within 5 seconds, the signal generator would return to the status in effect before the 【FREQ/(STEP)】 key was pressed.

<3> When you finish entering the frequency, press the 【MHz/dB/mV】 or 【kHz/%/ μ V】 key to accept the setting. If you attempt to set a frequency out of bounds, the signal generator would return to the status in effect before you pressed the 【FREQ/(STEP)】 key. You can reset the frequency if the 【FREQ/(STEP)】 key in the DATA ENTRY section lights.

e.g.: Set a frequency of 100 MHz.

【FREQ/(STEP)】 ⇨ 【1】 【0】 【0】 ⇨ 【MHz/dB/mV】

Using the rotary knob

You can increase or decrease the digit in the FREQUENCY indicator under which the cursor lights.

<1> If the cursor in the FREQUENCY indicator is not lit, use the 【◀◀】 or 【◀◀】 key to move it into the FREQUENCY indicator, or press the 【FREQ/(STEP)】 key in the DATA ENTRY section.

<2> Using the 【◀】 or 【▶】 key, move the cursor to the desired digit.

<3> Turn the rotary knob in the DATA ENTRY section clockwise to increase the frequency or counterclockwise to decrease it. A frequency setting out of bounds would be reset to the original frequency.

Setting a frequency step

Set a frequency step for setting an RF frequency with the 【▲】 or 【▼】 key in the FREQ section.

<1> Press the 【FREQ/(STEP)】 key following the 【2nd】 key in the DATA ENTRY section to set the signal generator in the frequency step setup mode. (The 【FREQ/(STEP)】 key and the 【RF】 lamp will light.)

<2> Using numeric keys or the rotary knob, enter a frequency step. If you do not press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key to confirm the frequency step setting within 5 seconds, the signal generator would return to the frequency step setup mode.
With the rotary knob, there is no need to press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key.

<3> When you finish entering the frequency step, wait for 5 seconds or press the 【FREQ/(STEP)】 key in the DATA ENTRY section and the RF frequency will appear on the FREQUENCY indicator. Using the 【▲】 or 【▼】 key in the FREQ section, increment or decrement the RF frequency.

e.g.: Set a frequency step of 5 MHz.

〔2nd〕 ⇨ 〔FREQ/(STEP)〕 ⇨ 〔5〕 ⇨ 〔MHz/dB/mV〕

Setting a frequency deviation

When you press the 【ΔFREQ】 key in the FREQ section to set a frequency, you can generate the frequency equal to the sum or difference between that frequency setting and the frequency that had been in effect before you pressed the 【ΔFREQ】 key. The [ΔFREQ] lamp lights when the frequency deviation feature is enabled.

<1> Press the 【ΔFREQ】 key in the FREQ section to set the signal generator in the frequency deviation setup mode. (The [Δ FREQ] lamp will light.)

<2> Using numeric keys or the rotary knob, enter a frequency deviation. If you do not press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key to confirm the frequency deviation setting within 5 seconds, the signal generator would return to the status in effect before you pressed the 【ΔFREQ】 key.
With the rotary knob, there is no need to press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key.

<3> When you finish entering the frequency deviation, press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key in the DATA ENTRY section to accept the setting and the frequency deviation will appear on the FREQUENCY indicator. Use the 【+/-】 key in the FREQ section to switch polarity.

<4> While the [Δ FREQ] lamp lights, the frequency incremented by the deviation setting is generated. Press the 【ΔFREQ】 key again to exit the frequency deviation setup mode and return to the status in effect before you pressed the 【ΔFREQ】 key.

e.g.: Set a frequency deviation of -10 kHz.

〔ΔFREQ〕 ⇨ 〔1〕 〔0〕 ⇨ 〔kHz/%/μV〕 ⇨ 〔+/-〕

2.3.2 Setting an output level

Set the RF output level that is output to the OUTPUT connector in the AMPLITUDE section. Use numeric keys in the DATA ENTRY section or the rotary knob in the AMPLITUDE section to set an output level.

The output level set appears on the AMPLITUDE indicator in four digits.

Output levels can be set in the following ranges:

Output impedance 50 Ω	: -133 dBm to 19 dBm
Output impedance 50 Ω + AM modulation	: -123 dBm to 13 dBm
Output impedance 75 Ω	: -134.8 dBm to 17.2 dBm
Output impedance 75 Ω + AM modulation	: -124.8 dBm to 11.2 dBm

Using numeric keys

<1> Press the 【AMP/(STEP)】 key in the DATA ENTRY section to set the signal generator in the output level setup mode. (The 【AMP/(STEP)】 key will light.)

<2> Using the numeric keys 【0】 to 【9】 and the 【 · 】 key, enter the desired output level. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. To set a negative value, press the 【-】 key before entering that value. If you do not press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key to confirm the output level setting within 5 seconds, the signal generator would return to the status in effect before you pressed the 【AMP/(STEP)】 key.

<3> When you finish entering the output level, press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key and the output level will appear on the AMPLITUDE indicator.

e.g.: Set an output level of -100 dBm.

【AMP/(STEP)】 ⇨ 【−】 ⇨ 【1】 【0】 【0】 ⇨ 【MHz/dB/mV】

Using the rotary knob

You can increase or decrease the digit in the AMPLITUDE indicator under which the cursor lights.

<1> Press the 【AMP/(STEP)】 key in the DATA ENTRY section to set the signal generator in the output level setup mode. (The 【AMP/(STEP)】 key will light.)

<2> Using the 【▶/OFFSET】 key in the AMPLITUDE section, move the cursor to the desired digit.

<3> Turn the rotary knob in the AMPLITUDE section clockwise to increase the output level or counterclockwise to decrease it.
With the rotary knob, there is no need to press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key.

Setting an output level step

<1> Press the 【AMP/(STEP)】 key in the DATA ENTRY section following the 【2nd】 key to set the signal generator in the output level step setup mode.

<2> Using numeric keys or the rotary knob, enter an output level step.

<3> When you finish entering the output level step, wait for 5 seconds or press the 【AMP/(STEP)】 key and the output level will appear on the AMPLITUDE indicator. Using the 【▲】 or 【▼】 key in the AMPLITUDE section, increment or decrement the output panel.

e.g.: Set an output level step of 2 dB.

　　【2nd】 ⇨ 【AMP/(STEP)】 ⇨ 【2】 ⇨ 【MHz/dB/mV】

Setting an output level offset

<1> Press the 【▶/(OFFSET)】 key in the AMPLITUDE section following the 【2nd】 key in the DATA ENTRY section to set the signal generator in the output level offset setup mode (setup range: ±30.0 dB). (The [OFFSET] lamp will light.)

<2> Using numeric keys or the rotary knob, enter an output level offset. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value.

<3> When you finish entering the output level offset, press the 【MHz/dB/mV】 key and the output level offset will appear on the AMPLITUDE indicator, followed by output level in effect prior to its entry plus the output level offset.
With the rotary knob, there is no need to press the 【MHz/dB/mV】 key.
To cancel the offset, press the 【▶/(OFFSET)】 key in the AMPLITUDE section again following the 【2nd】 key in the DATA ENTRY section. The [OFFSET] lamp will put out and the AMPLITUDE indicator will return to the original output level.

e.g.: Set an output level offset of -5 dB.

　　【2nd】 ⇨ 【▶/(OFFSET)】 ⇨ 【−】 ⇨ 【5】 ⇨ 【MHz/dB/mV】

Setting an output level deviation

When you press the 【ΔdB/(CONT)】 key in the AMPLITUDE section to set an output level, you can generate the output level equal to the sum or difference between that output level setting and the output level that had been in effect before you pressed the 【ΔdB/(CONT)】 key. The [ΔdB/(CONT)] lamp lights when the output level deviation feature is enabled.

<1> Press the 【ΔdB/(CONT)】 key in the AMPLITUDE section to set the signal generator in the output level deviation setup mode. (The [Δ dB/(CONT)] lamp will light.)

<2> Using numeric keys or the rotary knob, enter an output level deviation. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. To set a negative value, press the 【-】 key before entering that value. If you do not press the 【MHz/dB/mV】 or 【kHz/%/μ V】 key to confirm the output level deviation setting within 5 seconds, the signal generator would return to the status in effect before you pressed the 【ΔdB/(CONT)】 key.

<3> To cancel the output level deviation, press the 【ΔdB/(CONT)】 key again. The [Δ dB] lamp will put out and the AMPLITUDE indicator will return to the original output level.

e.g.: Set an output level deviation of -2 dB.

【ΔdB/(CONT)】 ⇨ 【−】 ⇨ 【2】 ⇨ 【MHz/dB/mV】

Turning ON and OFF the output level display

Use the 【OFF/(75 Ω)】 key in the AMPLITUDE section to turn ON or OFF the output level.

ON : Displays the output level on the AMPLITUDE indicator.

OFF : Displays "OFF" on the AMPLITUDE indicator.

Switching output impedances

Press the 【OFF/(75 Ω)】 key in the AMPLITUDE section following the 【2nd】 key in the DATA ENTRY section to select the output impedance between 50 and 75 Ω.

Output impedance 75 Ω : The [75 Ω] lamp in the AMPLITUDE section is lit

Output impedance 50 Ω : The [75 Ω] lamp in the AMPLITUDE section is off.

Setting units

· Press the 【UNIT/(EMF)】 key in the AMPLITUDE section and the indicator lamps in the AMPLITUDE section will light in turn in the order described below. Select the desired position. [mV] and [μV] are mutually exclusive and only one can be selected at a time. When EMF ([EMF] being lit) is ON, [dBm] and [dBf] cannot be selected.

[dBm] ⇨ [dBf] ⇨ [dBμ] ⇨ [mV] (or[μV]) ⇨ [0dBm]···

· Press the 【UNIT/(EMF)】 key in the AMPLITUDE section following the 【2nd】 key in the DATA ENTRY section and the [EMF] lamp will light, with the engineering unit on display being converted to the one that is lit. [dBm] and [dBf], however, are not converted.

════════════════ NOTE ════════════════

· Only the engineering unit dB (decibel) can be entered for offset Δ dB.

Setting CONT mode

When the CONT mode is turned ON, ATT switching is suppressed in an output level range of -10 dB, thereby averting momentary interruptions in the RF output generated with ATT switching.

Press the 【ΔdB/(CONT)】 key in the AMPLITUDE section following the 【2nd】 key in the DATA ENTRY section and then the CONT mode will be set. Do the same a second time to turn OFF the CONT mode.

While the CONT mode is ON, you can set no RF level in excess of the range setting.

2.3.3 Setting modulations

Use numeric keys or the rotary knob in the DATA ENTRY section to set a modulation. The modulation thus set appears on the MODULATION indicator in three digits.

Setting an FM frequency deviation

The table below lists the FM maximum frequency deviation.

Maximum frequency deviation	RF frequency
10% of RF frequency	10kHz ≦RF≦ 150kHz
15kHz	150kHz ＜RF≦ 2MHz
300kHz	2MHz ＜RF≦ 280MHz

<1> Press the 【FM DEV】 key in the DATA ENTRY section to set the signal generator in the FM frequency deviation setup mode. (The [FM DEV] lamp will light.)
<2> Using numeric keys or the rotary knob, enter a frequency deviation. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. If you do not press the 【kHz/%/μV】 key to confirm the frequency deviation setting within 5 seconds, the signal generator would return to the numeric entry mode.
With the rotary knob, there is no need to press the 【kHz/%/μV】 key.

e.g.: Set an FM frequency deviation of 75 kHz.

【FM DEV】 ⇨ 【7】 【5】 ⇨ 【kHz/%/μV】

Turning ON and OFF modulation

Press the 【FM ON】 or 【AM ON】 key in the MODULATION section to turn ON or OFF the FM or AM modulator. The FM or AM modulator is ON when the associated indicator lamp lights.

Press the 【FM ON】 or 【AM ON】 key again to turn OFF or OFF the FM or AM modulator with the indicator lamp will put off .

Setting an AM modulation factor

Use numeric keys or the rotary knob in the DATA ENTRY section to set an AM modulation factor.

Valid AM modulation factors range from 0.1% to 99.9%.

<1> Press the 〔AM DEPTH〕 key in the DATA ENTRY section to set the signal generator in the AM modulation factor setup mode. (The [AM DEPTH] and [%] lamps will light.)

<2> Using numeric keys or the rotary knob, enter an AM modulation factor. If you committed an error at entry, clear it by pressing the 〔CLR〕 key and then enter the correct value. If you do not press the 〔kHz/%/ μ V〕 key to confirm the AM modulation factor setting within 5 seconds, the signal generator would return to the status in effect before you pressed the 〔AM DEPTH〕 key.

<3> Press the 〔kHz/%/ μ V〕 key to display the AM modulation factor on the MODULATION indicator. With the rotary knob, there is no need to press the 〔kHz/%/ μ V〕 key.

e.g.: Set an AM modulation factor of 50%.

〔AM DEPTH〕 ⇨ 〔5〕 〔0〕 ⇨ 〔kHz/%/ μ V〕

2.3.4 Setting stereo modulation

Turning ON and OFF the stereo modulation mode and switching modes

Press the 【MAIN】 , 【LEFT】 , 【RIGHT】 , or 【SUB/(L/R)】 key to turn ON the stereo modulation mode. Press the 【MONO】 key to turn OFF the stereo modulation mode.

FM stereo and AM stereo are switched automatically according to the carrier frequency.

Carrier frequency	Stereo modulation mode
400 kHz to 2.00000 MHz	AM stereo modulation (STEREO MODE [AM] lamp is lit)
2.00001 MHz to 280 MHz	FM stereo modulation (STEREO MODE [FM] lamp is lit)

Use the 【MAIN】 , 【LEFT】 , 【RIGHT】 , or 【SUB/(L/R)】 key in the MODULATION section to select a mode of your choice.

【MAIN】	: Main channel output
【LEFT】	: Left channel output
【RIGHT】	: Right channel output
【SUB/(L/R)】	: Sub channel output
【2nd】 + 【SUB/(L/R)】	: EXT L/R output

Press the 【SUB/(L/R)】 key following the 【2nd】 key in the DATA ENTRY section to set EXT L/R.

Setting a stereo modulation factor

<1> Press the 【FM DEV】 key in the MODULATION section to set the signal generator in the stereo modulation factor setup mode.

<2> Using numeric keys or the rotary knob, enter a stereo modulation factor. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. If you do not press the 【kHz/%/μ V】 key to confirm the stereo modulation factor setting within 5 seconds, the signal generator would return to the numeric entry mode.

With the rotary knob, there is no need to press the 【kHz/%/μ V】 key.

e.g.: Set a stereo modulation factor of 95%.

【FM DEV】 ⇨ 【9】 【5】 ⇨ 【kHz/%/μ V】

Turning ON and OFF the pilot signal

Press the 【PILOT/(LEVEL)】 key in the MODULATION section to turn ON the pilot signal. Press the 【PILOT/(LEVEL)】 key again to turn it OFF.

Setting a pilot level

<1> Press the 【PILOT/(LEVEL)】 key in the MODULATION section following the 【2nd】 key in the DATA ENTRY section to set the signal generator in the pilot level setup mode. (The [PILOT)] lamp in the MODULATION section will light.)

<2> Using numeric keys or the rotary knob, enter a pilot level. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. If you do not press the 【kHz/%/μ V】 key to confirm the pilot level setting within 5 seconds, the signal generator would return to the numeric entry mode.

With the rotary knob, there is no need to press the 【kHz/%/μ V】 key.

e.g.: Set a pilot level of 5%.

【2nd】 ⇨ 【PILOT/(LEVEL)】 ⇨ 【5】 ⇨ 【kHz/%/μV】

Turning ON and OFF the AM clip

Press the 【CLIP/(LEVEL)】 key in the MODULATION section to turn ON the AM negative peak clipper. Press the 【CLIP/(LEVEL)】 key again to turn it OFF.

Setting an AM clipping level

<1> Press the 【CLIP/(LEVEL)】 key in the MODULATION section following the 【2nd】 key in the DATA ENTRY section to set the signal generator in the AM clipping level setup mode. (The [CLIP] lamp in the MODULATION section will light.)

<2> Using numeric keys or the rotary knob, enter an AM clipping level. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value. If you do not press the 【kHz/%/μ V】 key to confirm the AM clipping level setting within 5 seconds, the signal generator would return to the numeric entry mode.

With the rotary knob, there is no need to press the 【kHz/%/μ V】 key.

e.g.: Set an AM clipping level of 95%.

【2nd】 ⇨ 【CLIP/(LEVEL)】 ⇨ 【9】 【5】 ⇨ 【kHz/%/μV】

2.3.5 Setting modulation source

Switching source

- Press the 【INT FM/(FREQ)】 key in the MODULATION section and you can switch
  FM external and internal signals. The internal signal is selected when the lamp lights.
- Press the 【INT AM/(FREQ)】 key in the MODULATION section and you can switch
  AM external and internal signals. The internal signal is selected when the lamp lights.

═══════════════════ NOTE ═══════════════════

- You cannot use the FM and AM external signals at the same time.

Turning ON and OFF the AF signal

Press the 【AF】 key to turn ON or OFF the AF signal (both internal and external) as a
modulation source. The AF signal is ON when the indicator lamp lights. Press the 【AF】
key again to turn it OFF.

Setting internal signal frequency

Two internal signal oscillators are available: FM and AM. Oscillation frequency can be set in
a range of 50 Hz to 15 kHz, with a resolution of 50 Hz.

<1> Press the 【INT FM/(FREQ)】 or 【INT AM/(FREQ)】 key in the MODULATION
section following the 【2nd】 key in the DATA ENTRY section to set the signal
generator in the internal signal frequency setup mode.

<2> Using numeric keys or the rotary knob, enter a modulation source frequency. If you
committed an error at entry, clear it by pressing the 【CLR】 key and then enter the
correct value. If you do not press the 【kHz/%/μ V】 key to confirm the modulation
source frequency setting within 5 seconds, the signal generator would return to the
numeric entry mode.
With the rotary knob, there is no need to press the 【kHz/%/μ V】 key.

e.g.: Set an FM modulation source frequency of 1 kHz.

【2nd】 ⇨ 【INT FM/(FREQ)】 ⇨ 【1】 ⇨ 【kHz/%/μV】

Modulating with External Signal

■ Modulating with a single signal

<1> Press the 【INT FM/(FREQ)】 or 【INT AM/(FREQ)】 key in the MODULATION section to select an external signal. (The [INT FM] or [INT AM] lamp will put off.)

<2> Input an appropriate level (approx. 3 Vp-p) to the AF/L connector. Adjust the input level of the external signal source so both the [HIGH] and [LOW] lamps above the AF/L connector are put out.

■ Modulating with two signals (stereo)

<1> Press the 【SUB/(L/R)】 key in the MODULATION section following the 【2nd】 key in the DATA ENTRY section to select EXT L/R input. (The 【LEFT】 and 【RIGHT】 key lamps will light.)

The input connectors are as follows:

    AF/L connector   : L (left) stereo signal input
    R connector   : R (right) stereo signal input

─────────────── Description ───────────────

· If you adjust the input level of the external signal source so both the 【HIGH】 and 【LOW】 lamps above the AF/L connector are off, setup errors will be narrowed to ±2%. Since the modulation level is internally set in relation to this value, there is no need to adjust the input level of the external signal source even when you change the modulation level or mode.

2.3.6 Setting a pre-emphasis

The key in the PRE-EMPHASIS section lets you set a pre-emphasis for external AF input and AF signal that are subjected to FM modulation.

Each time you press the key, the lamps will light in turn in the order described below. Select the desired position.

Off (OFF) ⇨ [25 us] ⇨ [50 us] ⇨ [75 us] ⇨ Off ..

Figure 2-1 shows the standard pre-emphasis characteristics. Setting a pre-emphasis produces a drop of 20 dB in the modulation level of the internal signal in the flat region below 400 Hz to avoid modulator saturation.
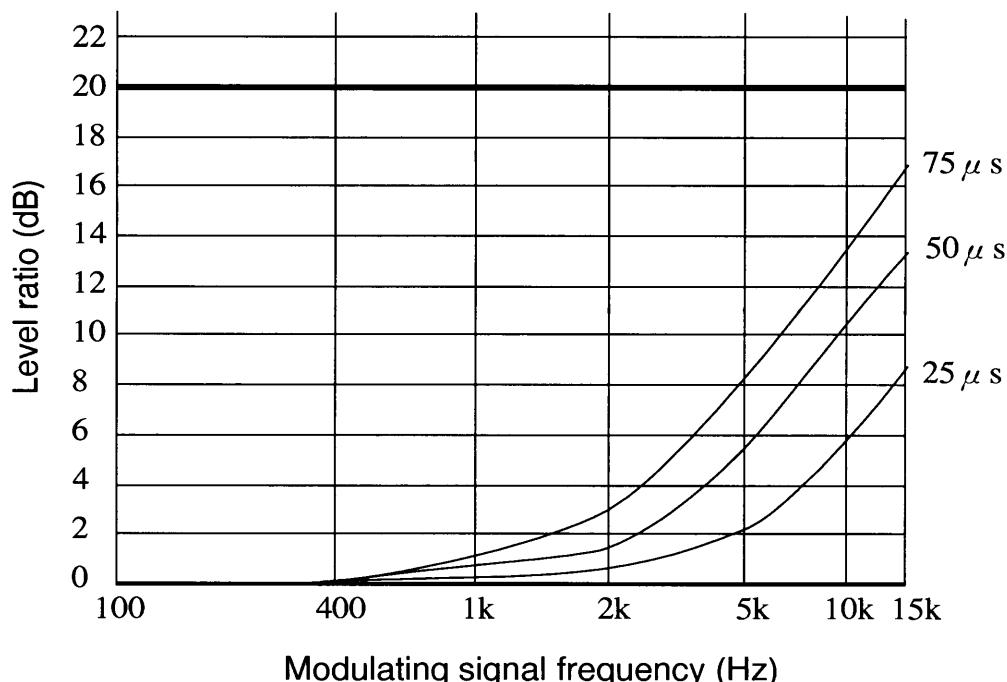
Figure 2-1   Pre-emphasis Characteristic Diagram

e.g.

If a pre-emphasis is set for an internal signal of 400 Hz having a stereo modulation level of 100% (67.5 kHz), a modulation level of 10% (6.75 kHz) would result. Consequently, the overall modulation resulting from the pre-emphasis setting would be 20% (14.25 kHz) which is the stereo level of 10% plus the pilot level of 10%.

This signal generator does not reduce the modulation level of meet external signals. Input a signal of 400 Hz or more to the signal generator with pre-emphasis ON, reduce its input level to allow for the pre-emphasis characteristics.

(The modulator would be saturated a signal higher than 400 Hz or more is inputted to it at the specified level.)

2.3.7 Setting memory

The panel memory stores up to 100 different panel settings, from 00 to 99. Further, you can block memory addresses into 10 groups and recall addresses within each in sequence. The signal generator is shipped with an address grouping of 00 to 99.

Storing to memory

<1> Press the 【RCL/(STORE)】 key in the MEMORY section following the 【2nd】 key in the DATA ENTRY section and the 【STORE】 lamp in the MEMORY indicator will light.

<2> Using the numeric keys 【0】 to 【9】 , enter a two-digit address.
You may use the 【▲/(GRP RCL)】 or 【▼/(GRP SET)】 key in the MEMORY section to store to the address just next or previous to the address on display while the 【STORE】 lamp being lit.

<3> When the storing is complete, the 【STORE】 lamp goes off.

e.g.: Store to address 9

【2nd】 ⇨ 【RCL/(STORE)】 ⇨ 【0】 【9】

Store to address 10.

【2nd】 ⇨ 【RCL/(STORE)】 ⇨ (MEMORY indicator09 ⇨) 【▲/(GRP RCL)】

Recalling from memory

<1> Press the 【RCL/(STORE)】 key in the MEMORY section and, using the numeric keys 【0】 to 【9】 , enter a two-digit address.
You may use the 【▲/(GRP RCL)】 or 【▼/(GRP SET)】 key in the MEMORY section to recall from the address just next or previous to the address currently on display.

e.g.: Recall address 9, then address 10.

【RCL/(STORE)】 ⇨ 【0】 【9】 ⇨ 【▲/(GRP RCL)】

Setting memory groups

Press the 【▼/(GRP SET)】 key in the MEMORY section following the 【2nd】 key in the DATA ENTRY section and then proceed to enter a group number, a starting address, and an ending address. The values thus entered will appear on the FREQUENCY indicator. Group numbers can be set in a range of 01 to 10.

Group   Starting   Ending
number   address   address
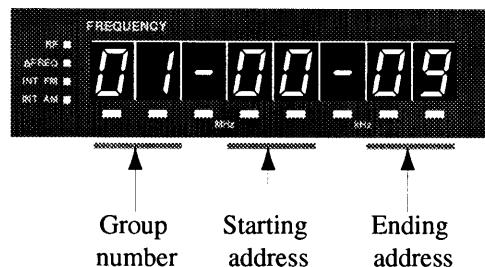
There are three ways to set:

· **Entering a starting address and an ending address**

　　【2nd】 ⇨ 【▼/(GRP SET)】 ⇨ Group number ⇨ 【-】 ⇨ Starting address ⇨
　　【-】 ⇨ Ending address

· **If the ending address is the same as the current address**

　　【2nd】 ⇨ 【▼/(GRP SET)】 ⇨ Group number ⇨ 【-】 ⇨ Starting address ⇨
　　【-】 ⇨ 【-】

· **If the starting address is the same as the current address**

　　【2nd】 ⇨ 【▼/(GRP SET)】 ⇨ Group number ⇨ 【-】 ⇨ 【-】 ⇨ Ending address

Calling a memory group

<1> Press the 【▼/(GRP SET)】 key in the MEMORY section following the 【2nd】 key in the DATA ENTRY section.

<2> Using the numeric keys 【0】 to 【9】 , enter a desired two-digit group number.

<3> Then, press the 【-】 key twice to display the starting address and the 【-】 key to display the ending address.

e.g.: Recall group 09.

【2nd】 ⇨ 【0】 【9】 ⇨ 【-】 【-】 (Starting address display)

⇨ 【-】 (Ending address display)

After you have called a group, you can use the 【▲/(GRP RCL)】 or 【▼/(GRP SET)】 key to recall addresses from the group in sequence.

Pressing the 【▲/(GRP RCL)】 key while the ending address is on display returns you to the starting address.

Calling memory group 0

Memory group 0 is a special group.

Start address is fixed in 00, and end address is fixed in 99.

<1> Press the 【▼/(GRP SET)】 key in the MEMORY section following the 【2nd】 key in the DATA ENTRY section.

<2> Press the numeric key 【-】 or 【0】 【-】 .

Setting a memory scan

You can set an interval of time from for scanning from one address to the next. The valid interval range is from 0.2 to 60.0 seconds.

Sample scan

Run address 01 ⇨ Interval⇨ Run address 02

■ Setting an interval

<1> Recall the address at which an interval is set.

<2> Press the 【1/(INTVL)】 key following the 【2nd】 key in the DATA ENTRY section, and the currently interval will appear on the MODULATION indicator.

<3> Using the numeric keys 【0】 to 【9】 and the 【 · 】 key, enter the desired value. If you committed an error at entry, clear it by pressing the 【CLR】 key and then enter the correct value.

If you do not press the [MHz/dB/mV] or [kHz/%/μV] key to confirm the interval setting within 5 seconds, the signal generator would return to the status in effect before you pressed the [1/(INTVL)] key.

<4> The signal generator displays the setting for about 5 seconds before it returns to the status in effect in which it had been before you pressed the [1/(INTVL)] key.

<5> Press the [RCL/(STORE)] key in the MEMORY section following the [2nd] key in the DATA ENTRY section and enter the address recalled in <1> to save the interval setting.

e.g.: Set an interval of 1.5 second for address 01 and an interval of 1 second for address 02.

[RCL/(STORE)] ⇨ [0] [1] ⇨ [2nd] ⇨ [1/(INTVL)] ⇨ [1] [·] [5]
⇨ [MHz/dB/mV] ⇨ [2nd] ⇨ [RCL/(STORE)] ⇨ [0] [1]

Then, set select address 02.

⇨ [▲/(GRP RCL)] ⇨ [2nd] ⇨ [1/(INTVL)] ⇨ [1] ⇨ [MHz/dB/mV] ⇨
[2nd] ⇨ [RCL/(STORE)] ⇨ [0] [2]

■ Starting and ending a memory scan

· Starting a memory scan

<1> Call the desired memory group.
<2> Press the [▲/(GRP SET)] key in the MEMORY section following the [2nd] key in the DATA ENTRY section to start a sequential recall from the specified group.

· Ending a memory scan

Press the [RCL/(STORE)] key in the MEMORY section while the memory scan is in progress.

3

Chapter 3 Remote Control

This chapter describes how to control the signal generator externally.

3.1 GPIB Control
3.2 Control Using the EXT I/O Connector
3.3 Sample Program

3.1 GPIB Control

3.1.1 Summary

The GPIB interface supported by the KSG4310 is controlled by IEEE 488 standard interface. It's electrical and mechanical specifications conform to IEEE std488.1-1987.

3.1.2 Setting up the signal generator

<1> Connect the GPIB cable to the signal generator while it is turn off.

<2> Turn on the 【POWER】 switch.

<3> Press the 【LOCAL/(ADRS)】 key in the GPIB section following the 【2nd】 key in the DATA ENTRY section and the GPIB address will appear on the MEMORY indicator. (The default address is 09.)

<4> Check the GPIB address. To change the GPIB address, see the next item.

Setting a GPIB address

Set a GPIB address in two digits from 00 to 30.

<1> Press the 【LOCAL/(ADRS)】 key in the GPIB section following the 【2nd】 key in the DATA ENTRY section to set the signal generator in the GPIB address setup mode.

<2> Using the numeric keys 【0】 to 【9】 , enter the desired GPIB address in two digits. If you committed an error at entry, retry from <1> afterwards. If no key entry is made within a period of 5 seconds, the signal generator would return to the status in effect in which it had been before you pressed the 【LOCAL/(ADRS)】 key.

<3> The signal generator displays the setting for about 5 seconds before it returns to the status in effect in which it had been before you pressed the 【LOCAL/(ADRS)】 key.

e.g.: Set a GPIB address of 05.

　　　【2nd】 ⇨ 【LOCAL/(ADRS)】 ⇨ 【0】 【5】

──────────────── NOTE ────────────────

• Once a GPIB address is set, it is backed up until the memory is initialized.

3.1.3 GPIB basic operation

Messages and terminators

■ **Program message**

The text of data that is transmitted from the controller to a device is called a program message. Program messages are grouped into two types: command messages, which carry device data, and query messages, which request response messages.

■ **Response message**

The text of data that is transmitted from a device to the controller is called a response message.

■ **Message structure**

Each message is composed of a program header and data.

■ **Terminator**

· Program message terminator

The terminator used to mark the end of a program message is called a program message terminator.

· Response message terminator

The terminator used to mark the end of a response message is called a response message terminator.
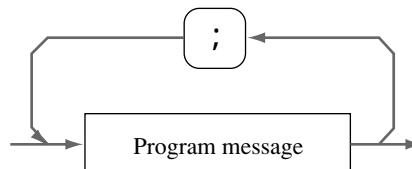
Message

- An intervening space (ASCII: 20h) is required between the program header and data.

```
──────▶  Program header  ──▶  Space (ASCII: 20h)  ──▶  Data  ──────▶
```

- If a message contains two or more records of data, they are separated from one another by a comma (,) (ASCII: 2Ch).

```
──────▶  Program header  ──▶  Space (ASCII: 20h)  ──▶  Data  ──────▶
```
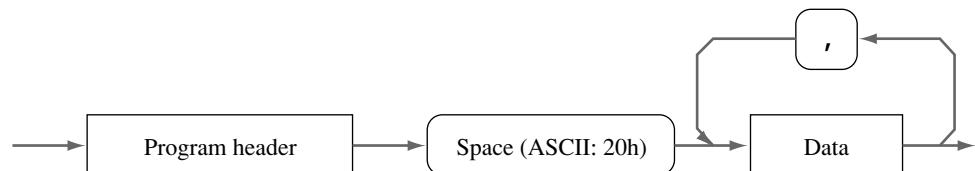
- Program messages are separated from one another by a colon (;) (ASCII: 3Bh).

```
──▶  Program message  ──▶
```

═══════════════ NOTE ═══════════════

- By suffixing a "@" at the end of a program message or a query message, the GP-IB can be held off until the execution of the message is complete. However, in the event of a program message terminator with only EOI, use "@@".

- The kinds of program message terminators listed can be used without needing programming. (A CR alone, without an EOI, cannot be used.)

  LF

  LF+EOI

  EOI

  CR+EOI

- Only LF + EOI can be used as a response message terminator.

Suffix Units

Item	Unit	Mnemonic
Frequency	Hz	HZ
	kHz	KHZ
	MHz	MHZ
Level	dB	DB
	dBm	DBM
	dBf	DBF
	dB μ V	DBUV
	mV	MV
	μ V	UV
Impedance	Ω	OHM
Percentage	%	PCT
Time constant	μ s	US
Time	s	S

Table 3-1

Set values on the indicator

In the local status, the setting items such as the frequency step and the output level step return to the previous display about 5 seconds later after they were set.

In case of setting through GPIB, the displays of the above-mentioned items do not return. The signal generator continues displaying the set value of the item which was set last.

The indicator will return to the ordinary operation when you set the remote status to the local status.

Local status

The output level of -100 dBm is displayed on the AMPLITUDE indicator.

↓

Set the output level step to -10 dBm.

↓

The output level of -100 dBm is displayed on the AMPLITUDE indicator about 5 seconds later.

Remote status

Set the output level to -100 dBm.

↓

Set the output level step to -10 dBm.

↓

The output level step value continues being indicated on the AMPLITUDE indicator.

3.1.4 Device message

FREQ:CW

Set an RF frequency.

■ **Program message**

$\longrightarrow$ (FREQ:CW) $\longrightarrow$ (*Space*) $\longrightarrow$ | RF frequency setting | $\longrightarrow$

■ **Program data**

RF frequency setting	
Minimum	10.0kHz
Maximum	280.0MHz
Resolution	10Hz
Data type	Real
Suffix multiplier	k, M, no
Suffix unit	Hz

Table 3-2

e.g.: Set an RF frequency of 100 MHz.

FREQ:CW 100MHZ

FREQ:CW 100000000

FREQ:CW 1E8

■ **Response message**

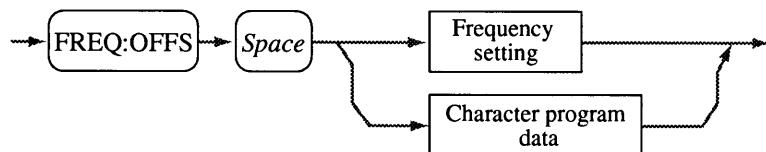FREQ:CW? ... Returns the current RF frequency.

e.g.: The current RF frequency setting is 100 MHz.

A value of 100000000 is returned.

FREQ:OFFS

Set a $\varDelta$ frequency.

■ **Program message**

```
──▶(FREQ:OFFS)─▶(Space)──────▶┌─────────────┐───────────────────▶
                          \     │ Frequency   │                /
                           \    │  setting    │               /
                            \   └─────────────┘              /
                             \  ┌─────────────┐             /
                              ▶ │ Character   │────────────/
                                │ program data│
                                └─────────────┘
```

■ **Program data**

$\varDelta$ frequency setting	
Minimum	-190MHz
Maximum	190MHz
Resolution	10Hz
Data type	Real
Suffix multiplier	k, M, no
Suffix unit	Hz
Character program data	ON, OFF, POS, NEG

POS: Positive, NEG: Negative

Table 3-3

e.g.: Set a $\varDelta$ frequency of -10 kHz.

FREQ:OFFS ON;FREQ:OFFS 10KHZ;FREQ:OFFS NEG

FREQ:OFFS ON;FREQ:OFFS -10000

FREQ:OFFS ON;FREQ:OFFS 1E4;FREQ:OFFS NEG

■ **Response message**

FREQ:OFFS? ... Returns the current $\varDelta$ frequency.

e.g.: The current $\varDelta$ frequency setting is -10 kHz.

A value of -10000,ON is returned.

═══════════════════ NOTE ═══════════════════

• Running FREQ:OFFS OFF sets a $\varDelta$ frequency of 0 Hz.

FREQ:STEP

Set a step frequency.

■ **Program message**
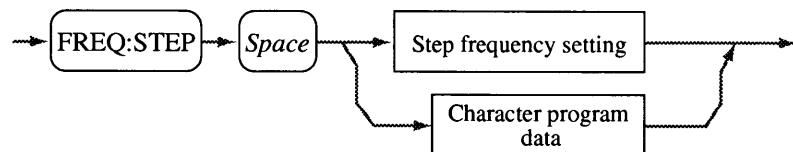
■ **Program data**

Step frequency setting	
Minimum	10Hz
Maximum	190MHz
Resolution	10Hz
Data type	Real
Suffix multiplier	k, M, no
Suffix unit	Hz
Character program data	UP, DO

DO: Down

Table 3-4

e.g. 1:   Set a step frequency of 2 kHz.

FREQ:STEP 2KHZ

FREQ:STEP 2000

FREQ:STEP 2E3

e.g. 2:   Increment an RF or Δ frequency by one step.

FREQ:STEP UP

────────────── NOTE ──────────────

• If the Δ frequency is ON, it is incremented or decremented.

• If the Δ frequency is OFF, it is incremented or decremented.

■ **Response message**

FREQ:STEP? ... Returns the current step frequency setting.

e.g.:   The current step frequency setting is 2 kHz.

A value of 2000 is returned.

POW:LEV

Set an RF output level.

■ **Program message**

→ (POW:LEV) → (*Space*) → [RF output level setting] →

■ **Program data**

RF output level setting	
Minimum	See Table 3-6.
Maximum	See Table 3-6.
Resolution	0.1dB
Data type	Real
Suffix multiplier	m, μ , no
Suffix unit	dBm, dBf, dBV, dB μ V, V

Table 3-5

Impedance / Unit	50 Ω	75 Ω
dBm	-133.0 to 19.0	-134.8 to 17.2
dBf	-13.0 to 139.0	-14.8 to 137.2

EMF / Unit	OFF	ON
dB μ V	-26.0 to 126.0	-20.0 to 132.0
mV	0.000050 to 1995	0.0001 to 3981
μ V	0.050 to 1995000	0.100 to 3981000

Table 3-6

e.g.: Set an RF output level of -100 dBm.

POW:LEV -100DBM

POW:LEV -100

POW:LEV -1E2

■ **Response message**

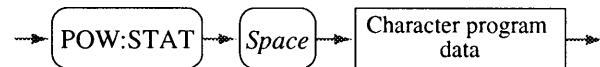POW:LEV? ... Returns the current RF output level.

e.g.: The current RF output level setting is -100 dBm.

A value of -100.0DBM is returned.

POW:STAT

Turn ON or OFF RF output.

■ **Program message**

→(POW:STAT)→(*Space*)→| Character program data |→

■ **Program data**

RF output level setting	
Data type	Character
Character program data	ON, OFF

Table 3-7

e.g.: Turn ON RF output.

POW:STAT ON

■ **Response message**

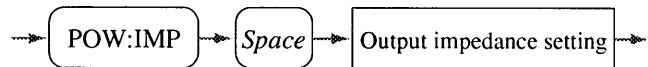POW:STAT? ... Returns the current ON/OFF status of the RF output.

e.g.: The current RF output setting is ON.

A value of ON is returned.

POW:IMP

Set an RF output impedance.

■ Program message

—▶ (POW:IMP) —▶ (*Space*) —▶ | Output impedance setting | —▶

■ Program data

Output impedance setting	
Minimum	50 Ω only
Maximum	75 Ω only
Data type	Integer
Suffix unit	Ω

Table 3-8

e.g.:   Set an RF output impedance of 75 Ω.

POW:IMP 75OHM

POW:IMP 75

■ Response message

POW:IMP? ... Returns the current RF output impedance.
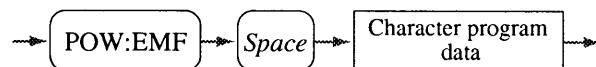
e.g.:   The current RF output impedance setting is 75 Ω.

A value of 75 is returned.

POW:EMF

Turn ON or OFF the output level EMF indicator.

Functional only if the RF output unit is dB μ V, mV, or μ V.

■ Program message

$\rightarrow$ (POW:EMF) $\rightarrow$ (Space) $\rightarrow$ [Character program data] $\rightarrow$

■ Program data

EMF indicator ON/OFF	
Data type	Character
Character program data	ON, OFF

Table 3-9

e.g.:   Turn ON the EMF indicator.

POW:EMF ON

■ Response message

POW:EMF? ... Returns the current ON/OFF status of the EMF indicator.

e.g.:   The current EMF indicator setting is ON.

A value of ON is returned.

POW:ATT:AUTO

Turn ON or OFF the continuous (CONT) mode.

■ Program message

```
──▶ ( POW:ATT:AUTO ) ──▶ ( Space ) ──▶ [ Character program data ] ──▶
```

■ Program data

CONT mode ON/OFF	
Data type	Character
Character program data	ON, OFF

Table 3-10

e.g.:   Turn ON the CONT mode.

POW:ATT:AUTO ON

■ Response message

POW:ATT:AUTO? ... Returns the current ON/OFF status of the CONT mode.
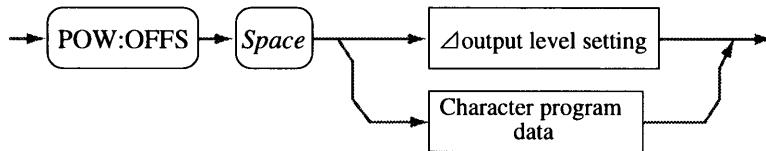
e.g.:   The current CONT mode setting is ON.

A value of ON is returned.

POW:OFFS

Set the relative output level of Δ dB output.

■ Program message

■ Program data

ΔdB setting	
Minimum	-152dB
Maximum	152dB
Resolution	0.1dB
Data type	Real
Suffix unit	dB
Character program data	ON, OFF

Table 3-11

e.g.: Set a relative output level of -10 dB.

POW:OFFS ON;POW:OFFS -10DB

POW:OFFS ON;POW:OFFS -10

POW:OFFS ON;POW:OFFS -1E1

■ Response message

POW:OFFS? ... Returns the current relative output level of the Δ dB output.

e.g.: The current Δ dB output setting is -10 dB.

A value of -10.0 ON is returned.

─────────────── NOTE ───────────────

• Running POW:OFFS OFF sets a Δ dB output level of 0 dB.

POW:STEP

Set a step output level.

■ Program message
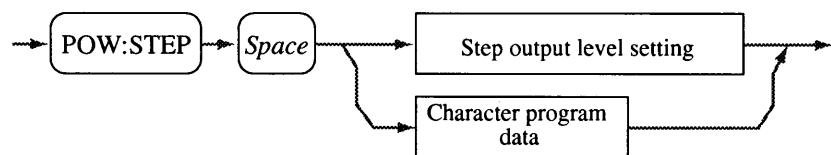
■ Program data

Step output level setting	
Minimum	0.1dB
Maximum	142.0dB
Resolution	0.1dB
Data type	Real
Suffix unit	dB
Character program data	UP, DO

DO: Down

Table 3-12

e.g. 1:   Set a step output level of 2 dB.

POW:STEP 2DB

POW:STEP 2

e.g. 2:   Increment an RF or $\varDelta$ dB level by one step.

POW:STEP UP

──────────────── NOTE ────────────────

- If $\varDelta$ dB is ON, the $\varDelta$dB level is incremented or decremented.

- Otherwise, the RF output level is incremented or decremented.

■ Response message

POW:STEP? ... Returns the current step output level setting.

e.g.:   The current step output level setting is 2 dB.

A value of 2.0 is returned.

POW:LEV:OFFS

Set an output level offset.

■ Program message

→ (POW:LEV:OFFS) → (*Space*) → | Output level offset setting | →
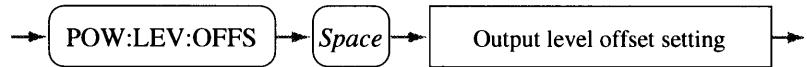
■ Program data

Output offset setting	
Minimum	-30.0dB
Maximum	30.0dB
Resolution	0.1dB
Data type	Real
Character program data	ON, OFF

Table 3-13

e.g.: Turn ON output with its output level offset being set to -5 dB.

POW:LEV:OFFS -5;POW:LEV:OFFS ON

■ Response message

POW:LEV:OFFS? ... Returns the current offset of the output level.

e.g.: The current output level setting is OFF, with an output level offset of -3 dB.

A value of -3.0,OFF is returned.

POW:UNIT

Change the unit of the RF output level.

■ Program message

→（POW:UNIT）→（Space）→| Character program data |→
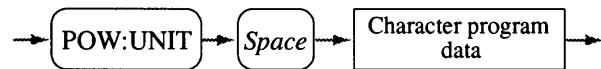
■ Program data

RF output level unit change	
Data type	Character
Character program data	DBM, DBF, DBUV, MV, UV

Table 3-14

e.g.:   Set the unit of the RF output level of dB μ V.

POW:UNIT DBUV

MOD:STAT

Turn ON or OFF the AF modulator.

■ Program message

$$\rightarrow \boxed{\text{MOD:STAT}} \rightarrow \boxed{Space} \rightarrow \boxed{\begin{array}{c}\text{Character program}\\\text{data}\end{array}} \rightarrow$$

■ Program data

AF modulator ON/OFF setting	
Data type	Character
Character program data	ON, OFF

Table 3-15

e.g.:   Turn ON the AF modulator.

MOD:STAT ON

■ Response message

MOD:STAT? ... Returns the current ON/OFF status of the AF modulator.

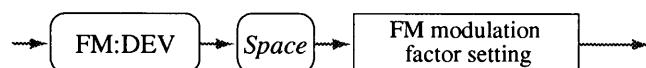e.g.:   The current AF modulator setting is ON.

A value of ON is returned.

FM:STAT

Turn ON or OFF the FM modulator.

This device message has no effect when AM stereo modulator is turned ON.

■ Program message

$$\longrightarrow \boxed{\text{FM:STAT}} \longrightarrow \boxed{\textit{Space}} \longrightarrow \boxed{\begin{array}{c}\text{Character program}\\ \text{data}\end{array}} \longrightarrow$$
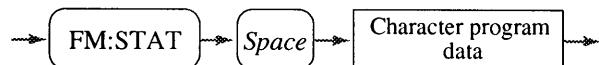
■ Program data

FM modulator ON/OFF setting	
Data type	Character
Character program data	ON, OFF

Table 3-16

e.g.: Turn ON the FM modulator.

FM:STAT ON

■ Response message

FM:STAT? ... Returns the current ON/OFF status of the FM modulator.

e.g.: The current FM modulator setting is ON.

A value of ON is returned.

FM:DEV

Set an FM modulation factor.

The kHz/Hz setting takes effect when the signal generator is in the MONO FM modulation mode.

The % setting takes effect when the signal generator is in any mode except the MONO FM modulation mode.

■ Program message

```
──► FM:DEV ──► Space ──► FM modulation
                         factor setting ──────►
```

■ Program data

FM modulation factor setting	
Minimum	0.00 Hz or 0.0%
Maximum	If the RF frequency is less than 150 kHz: 10% of the RF frequency
	If the RF frequency is from 150 kHz to 2.0 MHz: 15.0 kHz
	If the RF frequency is 2.00001 MHz or more: 300 kHz or 125.0%
Resolution	0Hz to 99.9kHz : 0.1kHz
	100kHz to 300kHz : 1kHz
	0.0% to 99.9% : 0.1%
	100% to 125% : 1%
Data type	Real
Suffix multiplier	k, no
Suffix unit	Hz, %

Table 3-17

e.g. 1:　Set an FM modulation factor of 12.3 kHz.

　　　　FM:DEV 12.3KHZ

　　　　　　· Functional when the signal generator is in the MONO FM modulation mode.

　　　　　　· Not functional when the signal generator is in any mode except the MONO FM modulation mode. A value of -15 (illegal instruction) will be set in the error queue.

e.g. 2:　Set an FM modulation factor of 12.3%.

　　　　FM:DEV 12.3PCT

　　　　　　· Functional when the signal generator is in any mode except the MONO FM modulation mode.

· Not functional when the signal generator is in the MONO FM modulation mode. A value of -15 (illegal instruction) will be set in the error queue.

e.g. 3:   An engineering unit is not expressly specified.

   FM:DEV 12.3

· An FM modulation factor of 12.3 kHz is assumed when the signal generator is in the MONO FM modulation mode. However, since 12.3 kHz is below the resolution setting, a value of -19 (any other error) will be set in the error queue.

· An FM modulation factor of 12.3 kHz is assumed even when the signal generator is in any mode except the MONO FM modulation mode. However, since the FM modulation mode is not MONO, a value of -15 (illegal instruction) will be set in the error queue.

■ Response messages

FM:DEV? ... Returns the current FM modulation factor setting.

e.g. 1:   The signal generator is in the MONO FM modulation mode, with an FM modulation factor setting of 75 kHz.

   A value of 75000 is returned.

e.g. 2:   The signal generator is in any mode except the MONO FM modulation mode, with an FM modulation factor setting of 10%

   A value of 10.0PCT is returned.

FM:INT:FREQ

Set an FM internal signal frequency.

■ Program message

```
──▶( FM:INT:FREQ )──▶( Space )──▶| FM internal signal  |──▶
                                 | frequency setting    |
```

■ Program data

FM internal signal frequency setting	
Minimum	50Hz
Maximum	15.0kHz
Resolution	50Hz
Data type	Real
Suffix multiplier	k, no
Suffix unit	Hz

Table 3-18

Example: Set an FM internal signal frequency of 1 kHz.

    FM:INT:FREQ 1KHZ

    FM:INT:FREQ 1000

    FM:INT:FREQ 1E3

■ Response message

FM:INT:FREQ? ... Returns the current FM internal signal frequency setting.

    e.g.:   The current FM internal signal frequency setting is 500 Hz.

            A value of 500 is returned.

FM:SOUR

Select an internal signal or an external signal for the FM modulation source.

■ **Program message**

```
──▶( FM:SOUR )──▶( Space )──▶┌──────────────┐──▶
                              │Character program│
                              │     data      │
                              └──────────────┘
```
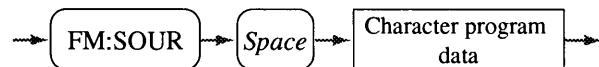
■ **Program data**

FM modulation source setting	
Data type	Character
Character program data	INT, EXT

INT: Internal, EXT: External

Table 3-19

e.g.: Select an internal signal for the FM modulation source.

FM:SOUR INT

■ **Response message**

FM:SOUR? ... Returns the current status of the FM modulation source.

e.g.: The current FM modulation source setting is EXT.

A value of EXT is returned.

FM:PIL

Set an FM pilot signal.

■ Program message
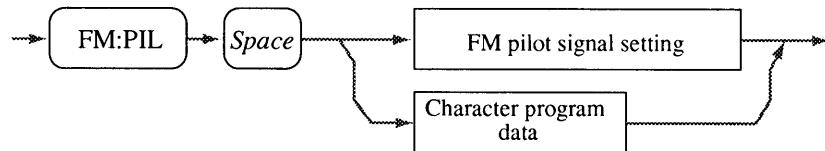
■ Program data

FM pilot signal setting	
Minimum	0.0%
Maximum	15.0%
Resolution	0.1%
Data type	Real
Suffix unit	%
Character program data	ON, OFF

Table 3-20

e.g.: Turn ON an FM pilot signal with a setting of 10%.

FM:PIL 10PCT;FM:PIL ON

FM:PIL 10;FM:PIL ON

■ Response message

FM:PIL? ... Returns the current status of the FM pilot signal.

e.g.: The current FM pilot signal setting is OFF at 10%.

A value of 10.0,OFF is returned.

FM:STER:MODE

Set an FM stereo mode.

■ Program message

```
→[ FM:STER:MODE ]→[ Spece ]→[ Character program data ]→
```

■ Program data

FM stereo mode setting	
Data type	Character
Character program data	MO, MA, LE, RI, SUB, LR

MO: Mono, MA: Main, LE: Left, RI: Right, LR: External L/R

Table 3-21

e.g.: Set the FM stereo mode MAIN.

FM:STER:MODE MA

■ Response message

FM:STER:MODE? ... Returns the current status of the FM stereo mode.

e.g.: The current FM stereo mode setting is RIGHT.

A value of RI is returned.

FM:PRE

Set a pre-emphasis.

■ Program message

~▶(FM:PRE)▶(Space)▶| Pre-emphasis setting |▶

■ Program data

Pre-emphasis setting	
Setting	0, 25, 50, 75
Data type	Integer
Suffix multiplier	μ
Suffix unit	s

Table 3-22

e.g.:   Set a pre-emphasis of 50 μ s.

FM:PRE 50US

FM:PRE 50

■ Response message

FM:PRE? ... Returns the current pre-emphasis setting.

e.g.:   The current pre-emphasis setting is 25 μ s.

A value of 25 is returned.

AM:STAT

Turn ON or OFF the AM modulator.

■ **Program message**

$$\rightarrow \boxed{\text{AM:STAT}} \rightarrow \boxed{\textit{Space}} \rightarrow \boxed{\begin{array}{c}\text{Character program}\\ \text{data}\end{array}} \rightarrow$$
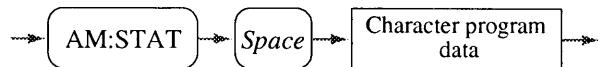
■ **Program data**

AM modulator ON/OFF setting	
Data type	Character
Character program data	ON, OFF

Table 3-23

e.g.:　Turn ON the AM modulator.

　　　AM:STAT ON

■ **Response message**

AM:STAT? ... Returns the current ON/OFF status of the AM modulator.

e.g.:　The current AM modulator setting is ON.

　　　A value of ON is returned.

AM:DEP

Set an AM modulation factor.

■ Program message

```
─▶( AM:DEP )─▶(Space)─▶┌──────────────┐────────▶
                        │ AM modulation│
                        │factor setting│
                        └──────────────┘
```
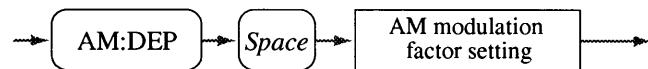
■ Program data

AM modulation factor setting	
Minimum	0.0%
Maximum	MONO : 99.9%
	MAIN, SUB : 100%
	LEFT, RIGHT, L/R : 80.0%
Resolution	0.1%
Data type	Real
Suffix unit	%

Table 3-24

e.g.: Set an AM modulation factor of 30%.

AM:DEP 30PCT

AM:DEP 30

■ Response message

AM:DEV? ... Returns the current AM modulation factor setting.

e.g.: The current AM modulation factor setting is 10%.

A value of 10 is returned.

AM:INT:FREQ

Set an AM internal signal frequency.

■ Program message

```
──►[ AM:INT:FREQ ]──►[ Space ]──►│ AM internal signal        │──────►
                                 │ frequency setting          │
```
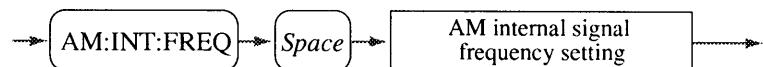
■ Program data

AM internal signal frequency setting	
Minimum	50Hz
Maximum	15.0kHz
Resolution	50Hz
Data type	Real
Suffix multiplier	k, no
Suffix unit	Hz

Table 3-25

e.g.: Set an AM internal signal frequency of 1 kHz.

AM:INT:FREQ 1KHZ

AM:INT:FREQ 1000

AM:INT:FREQ 1E3

■ Response message

AM:INT:FREQ? ... Returns the current AM internal signal frequency setting.

e.g.: The current AM internal signal frequency is 500Hz.

A value of 500 is returned.

AM:SOUR

Select an internal signal or an external signal for the AM modulation source.

■ Program message

$\longrightarrow$ (AM:SOUR) $\longrightarrow$ (*Space*) $\longrightarrow$ | Character program data | $\longrightarrow$
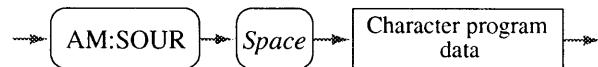
■ Program data

AM modulation source setting	
Data type	Character
Character program data	INT, EXT

INT: Internal, EXT: External

Table 3-26

e.g.: Select an internal signal for the AM modulation source.

AM:SOUR INT

■ Response message

AM:SOUR? ... Returns the current status of the AM modulation source.

e.g.: The current AM modulation source is EXT.

A value of EXT is returned.

AM:PIL

Set an AM pilot signal.

■ Program message

```
→ ( AM:PIL ) → ( Space ) ─┬─→ [ AM pilot signal setting ] ─┬─→
                          └─→ [ Character program  ] ──────┘
                                  data
```
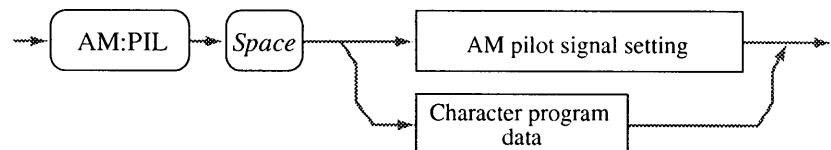
■ Program data

AM pilot signal setting	
Minimum	0.0%
Maximum	10.0%
Resolution	0.1%
Data type	Real
Suffix unit	%
Character program data	ON, OFF

Table 3-27

e.g.: Turn ON an AM pilot signal with a setting of 2%.

AM:PIL 2PCT;AM:PIL ON

AM:PIL 2;AM:PIL ON

■ Response message

AM:PIL? ... Returns the current status of the AM pilot signal.

e.g.: The current AM pilot signal is ON at 2%.

A value of 2.0,ON is returned.

AM:STER:MODE

Set an AM stereo mode.

■ Program message

```
──▶ AM:STER:MODE ──▶ Space ──▶ Character program data ──▶
```

■ Program data

AM stereo mode setting	
Data type	Character
Character program data	MO, MA, LE, RI, SUB, LR

MO: Mono, MA: Main, LE: Left, RI: Right, LR: External L/R

Table 3-28

e.g.:   Set the AM stereo mode to SUB.

AM:STER:MODE SUB

■ Response message

AM:STER:MODE? ... Returns the current status of the AM stereo mode.

e.g.:   The current AM stereo mode is LEFT.

A value of LE is returned.

AM:CLIP

Set a negative peak clipper.

■ Program message
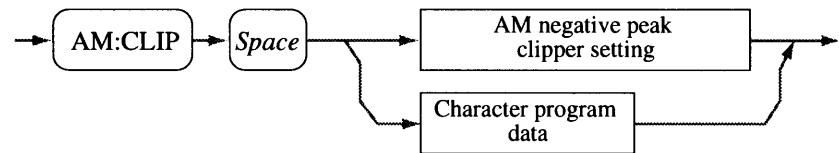
■ Program data

Negative peak clipper setting	
Minimum	85.0%
Maximum	105%
Resolution	0.1% (within 100%)
	1% (100% or more)
Data type	Real
Suffix unit	%
Character program data	ON, OFF

Table 3-29

e.g.: Turn ON a negative peak clipper with a setting of 95%.

AM:CLIP 95PCT;AM:CLIP ON

AM:CLIP 95;AM:CLIP ON

■ Response message

AM:CLIP? ... Returns the current status of the negative peak clipper.

e.g.: The current negative peak clipper setting is ON at 90%.

A value of 90.0,ON is returned.

MEM:REC

Set an address that is recalled from memory.

■ Program message

```
→( MEM:REC )→( Space )→| Memory address |→
```
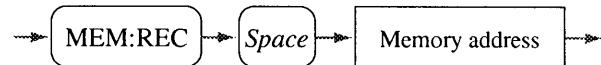
■ Program data

Recall from memory	
Minimum	0
Maximum	99
Resolution	1
Data type	Integer

Table 3-30

e.g.: Recall address 10 from memory.

MEM:REC 10

MEM:STO

Set an address that is stored to memory.

■ **Program message**

```
--►( MEM:STO )--►( Space )--►| Memory address |--►-
```
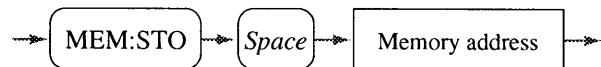
■ **Program data**

Store to memory	
Minimum	0
Maximum	99
Resolution	1
Data type	Integer

Table 3-31

e.g.:   Store address 10 to memory.

MEM:STO 10

MEM:GRO

Activate a memory group.

■ Program message

```
→ ( MEM:GRO ) → ( Space ) → | Memory group | →
```
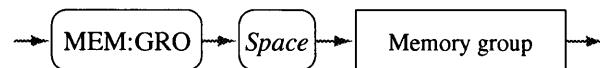
■ Program data

Memory group specification	
Minimum	0
Maximum	10
Resolution	1
Data type	Integer

Table 3-32

e.g.: Activate memory group 5.

MEM:GRO 5

■ Response message

MEM:GRO? ... Returns the memory group that is currently active.

e.g.: The currently active memory group is 2.

A value of 2 is returned.

MEM:BEG and MEM:END

Set a memory group beginning address and an ending address.

■ Program message

MEM:BEG

```
→( MEM:BEG )→(Space)→| Beginning address |→
```

MEM:END

```
→( MEM:END )→(Space)→| Ending address |→
```
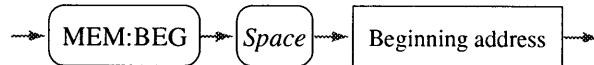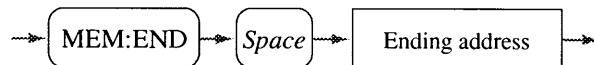
■ Program data

MEM:BEG

Memory scan beginning address	
Minimum	0
Maximum	98
Resolution	1
Data type	Integer

Table 3-33

MEM:END

Memory scan ending address	
Minimum	1
Maximum	99
Resolution	1
Data type	Integer

Table 3-34

e.g.:   Assign addresses 01 to 20 to memory group 5.

MEM:GRO 5;MEM:BEG 1;MEM:END 20

■ Response messages

MEM:BEG? ... Returns the beginning address of the currently active memory group.

    e.g.:   The current beginning address setting is 0.

            A value of 0 is returned.

MEM:END? ... Returns the ending address of the currently active memory group.

    e.g.:   The current ending address setting is 5.

            A value of 5 is returned.

MEM:AUTO

Set the interval of an address in a memory group and a scan group.

■ Program message
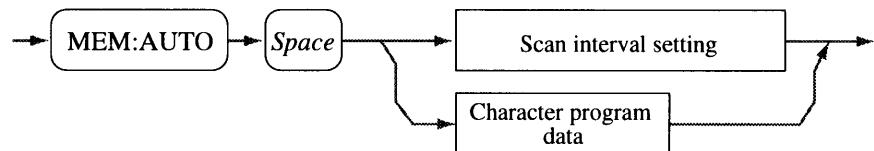
■ Program data

Memory scan setting	
Minimum	Interval: 0.2 s
Maximum	Interval: 60.0 s
Resolution	0.1s
Data type	Real or character
Character program data	ON, OFF

Table 3-35

e.g.: Set the interval of address 0 to 1 second.

MEM:REC 0;MEM:AUTO 1S;MEM:STO 0

■ Response messages

MEM:AUTO?

If a memory scan is in progress   : Only the status is returned.

If a memory scan is not in progress: The interval and status of the current memory
group are returned.

e.g. 1:   A memory scan is in progress.

A value of ON is returned.

e.g. 2:   A memory scan is not in progress, with the interval of the current memory
group being 1 second.

A value of 1.0,OFF is returned.

MEM:COPY

Write to memory.

■ Program message

```
→[MEM:COPY]→[Space]→[Memory number]→[@]→[Binary memory data]→
                                      (ASCII : 40h)
```
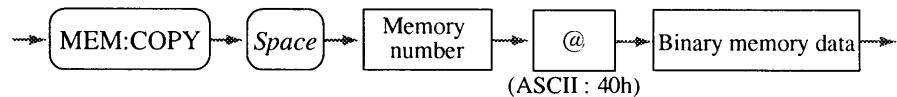
■ Program data

Writing to memory	
Minimum	0
Maximum	99
Resolution	1
Data type	Integer
Binary data	160 bytes

Table 3-36

· The end of memory data is assumed when the binary date byte length reaches 160 bytes or an EOI signal is encountered.

· Writing to preset memory is suppressed if an EOI signal is encountered before the byte length of the binary data reaches 160 bytes.

─────────── NOTE ───────────

• Do not run MEM:COPY while a memory scan is in progress.

MEM:COPY?

Read from memory.

■ Program message

$\longrightarrow$ (MEM:COPY?) $\longrightarrow$ (Space) $\longrightarrow$ [Memory number]

■ Program data

Reading from memory	
Minimum	0
Maximum	99
Resolution	1
Data type	Integer

Table 3-37

■ Response message

160 bytes of memory data are returned.

═══════════════ NOTE ═══════════════

• Do not run MEM:COPY? while a memory scan is in progress.

PORT1 and PORT2

Read from I/O ports or write to I/O port.

PORT1 is read-only.

■ Program message

PORT2

■ Program data

Reading and writing to and from I/O ports	
Minimum	0h
Maximum	FFh
Resolution	1h
Data type	Hex

Table 3-38

e.g.:   Write data 0x55 (decimal 85) to I/O port 2.

PORT2 #H55

■ Response messages

PORT1? ... Reads data from I/O port 1.

e.g.:   The data on port 1 is 0xAA.

A value of #HAA is returned.

PORT2? ... Reads data from I/O port 2.

e.g.:   The data on port 2 is 0xFF.

A value of #HFF is returned.

ERROR?

Read an error code from the error queue.

■ Program message

```
→ ( ERROR? ) →
```

■ Response messages

Message code	Explanation
0	No error
-11	Syntax error
-12	Out of bounds error
-13	Illegal keyword
-14	Illegal unit
-15	Illegal instruction
-16	Illegal data type
-18	Error buffer full
-19	None of the above

Table 3-39   Error Messages

*RST

Reset the signal generator to its default settings (except for the GPIB address). Current settings are retained in memory. For the default settings, see Section 2.1.2, "Initialization."

■ **Program message**

→○ *RST ○→

*IDN?

Return the model name of the signal generator.

KIKUSUI ELECTRONICS CORP., KSG4310, 0, 1.00

Company name   Model name Version number

Serial number (not used)

■ **Program message**

→○ *IDN? ○→
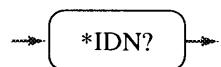
*ESE

Set or reset the individual bits of the event status enable register. The default is 0h.

Running *RST resets the bits to their initial value.

■ Program message

→(*ESE)→(*Space*)→[Data]→
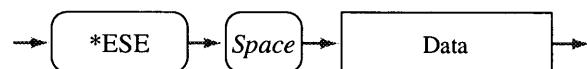
■ Program data

Event status enable register set/reset	
Minimum	0h
Maximum	FFh
Resolution	1h
Data type	Hex

Table 3-40

■ Response message

*ESE? ... Returns the contents of the event status enable register.

   e.g.:   The data is 0xFF.

         A value of #HFF is returned.

*ESR?

Return the contents of the event status register. The individual are reset when read.

■ **Program message**

—▶(*ESR?)▶—

■ **Response message**

*ESR? ... Returns the contents of the event status register.

    e.g.: The data is 0xFF.

          A value of #HFF is returned.

*SRE

Set or reset the individual bits of the service request enable register. Bit 6, however, cannot be set.

■ **Program message**

—▶(*SRE)▶(Space)▶[Data]▶—
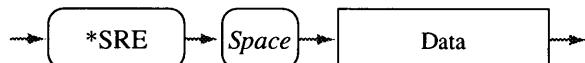
■ **Program data**

Service request enable register set/reset	
Minimum	0h
Maximum	FFh
Resolution	1h
Data type	Hex

Table 3-41

■ **Response message**

*SRE? ... Returns the contents of the service request enable register.

    e.g.: The data is 0xFF.

          A value of #HFF is returned.

*STB?

Return the contents of the status byte.

■ **Program message**

—▶(*STB?)—▶
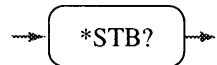
■ **Response message**

e.g.: The data is 0xFF.

A value of #HFF is returned.

*CLS

Reset the status byte register and the event status register.

■ **Program message**

—▶(*CLS)—▶
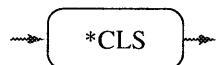
About Status Register

The format of status data is shown below.
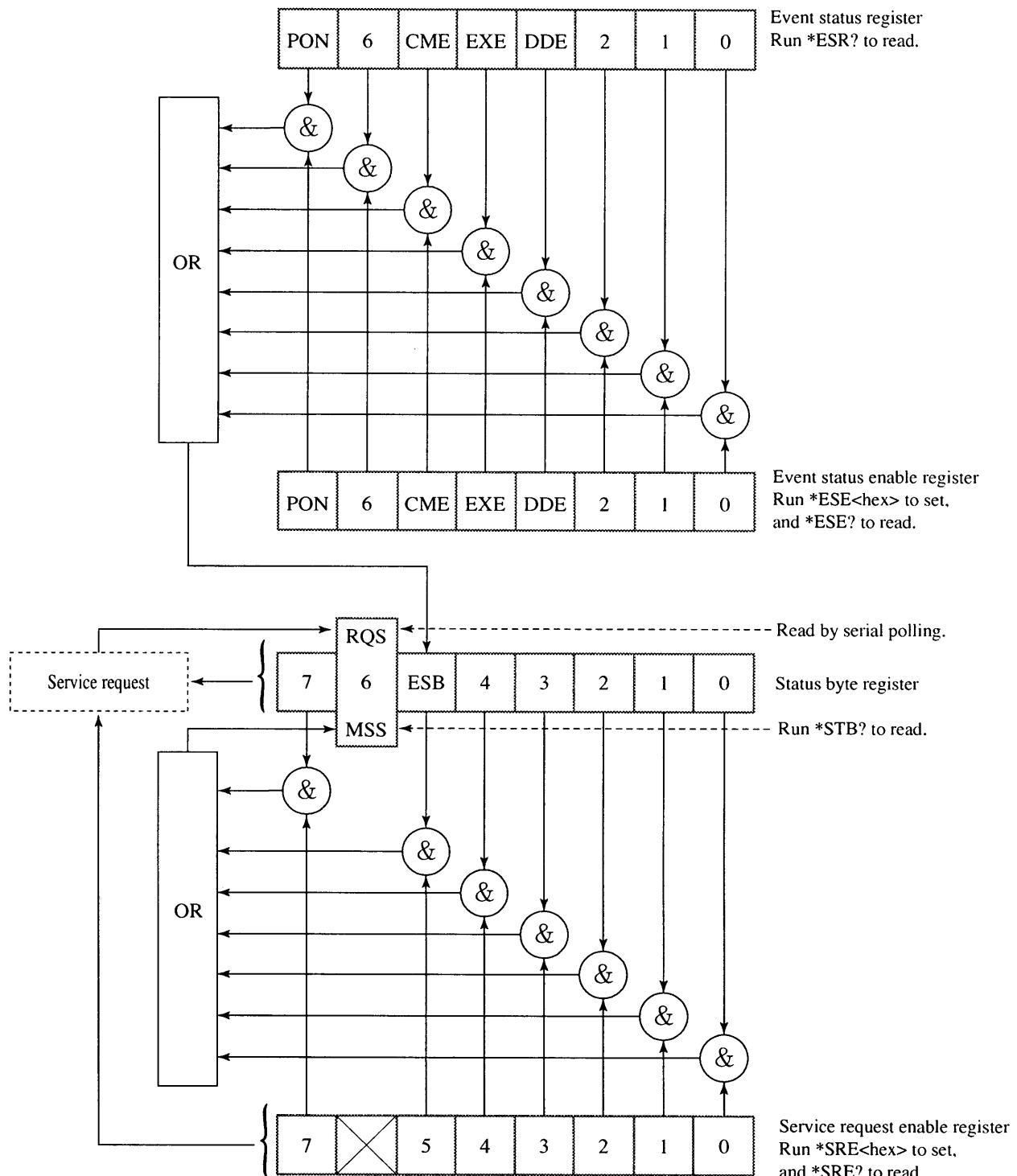
Figure 3-1   Status Data Format

Details of Event Status Register and Event Status Enable Register

Bit	Register name	Explanation
7	PON (Power ON)	Indicates that the signal generator is turned on.
6		Not used with this signal generator.
5	CME (Command Error)	Any one of the following events has been encountered while decoding a message: · Syntax error in the message received · Illegal character data received · Illegal suffix unit received · Illegal data type received
4	EXE (Execution Error)	Any one of the following events has been encountered while running a message: · Received data out of bounds · Received message not supported
3	DDE (Device Dependent Error)	Device-specific error
2		Not used with this signal generator.
1		Not used with this signal generator.
0		Not used with this signal generator.

Table 3-42　Event Status Register and Event Status Enable Register

NOTE

- The individual bits of the event status register and the event status enable register are set when they are 1 and are reset when they are 0.

- Run *ESR? to read the event status register and *CLS to reset it.

Details of Status Byte Register and Service Request Enable Register

Bit	Register name	Explanation
7		Not used with this signal generator.
6	RQS (Request)	Signifies the generation of a service request. This bit is reset when read by serial polling.
6	MSS (Master Summary Status)	ORed result of the status byte register and service request enable register, which is read by running *STB.
5	ESB (Standard Event Status Bit)	ORed result of the event status register and event status enable register, which is read by serial polling or running *STB?.
4		Not used with this signal generator.
3		Not used with this signal generator.
2		Not used with this signal generator.
1		Not used with this signal generator.
0		Not used with this signal generator.

Table 3-43　Status Byte Register and Service Request Enable Register

---

```
┌──────────────── NOTE ┌────────────────┐
```

•The individual bits of the status byte register and the service request
enable register are set when they are 1 and are reset when they are
0.

· Run *CLS to reset the status byte register.

Generating a POWER ON SRQ and Recognizing a POWER-ON Event

<1> Set PON (bit 7) of the event status enable register. The message *ESE #H90 is
transmitted to the KSG4310.

<2> Turn the KSG4310 off and then on, and it will generate an SRQ signal.

<3> Read the status byte by serial polling. Check RQS (bit 6) of the status byte. If RQS has
been set, it means that a service request has been generated from the KSG4310.

<4> Check ESB (bit 5) of the status byte. If ESB has been set, read the event status register.
The message *ESR? is transmitted to the KSG4310 to read the event status register.

<5> Check PON (bit 7) of the event status register. If PON has been set, it means that a
POWER-ON event has been generated from the KSG4310.

```
┌──────────────── NOTE ┌────────────────┐
```

•Since the event status register is reset when read by running *ESR?,
none of its bits are set if it is read again by running *ESR?.

KSG4300 Support Program Messages

The KSG4310 supports the KSG4300 program messages. The following two items, however, are not supported:

- Crystal oscillator ON/OFF function (X1, X2)

- External AM or external FM signal (S1AM, S1FM)

■ Support program messages

Function	Command program header	Program data	Query program header	Remarks
RF frequency	FR	<10.0kHz to 280.0MHz>[<{HZ | KZ | MZ}>]	FR?	
Output level	AP	<-133.0dBm to 19.0dBm>[<DB>]	AP?	
Modulating signal source setup	S	<{2 | 3 | 4}> <{AM | FM}>		2 : 400 Hz internal signal 3 : 1 kHz internal signal 4 : AF external signal
Output ON/OFF	R	<{0 | 1}>	R?	0 : OFF 1 : ON
Output impedance	Z	<{50 | 75}>	Z?	
AM modulation factor	AM	{<0.0% to 99.9%>[<PC>] | {ON | OFF}}	AM?	
FM modulation factor	FM	{<{0.0Hz to 300.0kHz}>[<{HZ | KZ}>] | {ON | OFF}}	FM?	
Output unit setting EFM dB μ	EM			
Output unit setting dB μ	DU			
Output unit setting dBm	DM			
Recall from memory	RC	<0 to 99>		
Store to memory	ST	<0 to 99>		
AM modulator OFF	AMS5			
FM modulator OFF	FMS5			

Table 3-44   Program Messages

3.1.5 GPIB specifications

GPIB interface

Function	Subset	Description
Source handshake	SH1	All functions operable
Acceptor handshake	AH1	All functions operable
Talker	T4	All functions operable, except for the talk-only function
Listener	L2	All functions operable, except for the listen-only function
Service request	SR1	All functions operable
Remote local	RL1	All functions operable
Parallel poll	PP0	No functions operable
Device clear	DC1	All functions operable
Device trigger	DT0	No functions operable
Controller	C0	No functions operable
Device driver	E1	Open collector driver

Table 3-45   GPIB Interface Functions

GPIB Connector
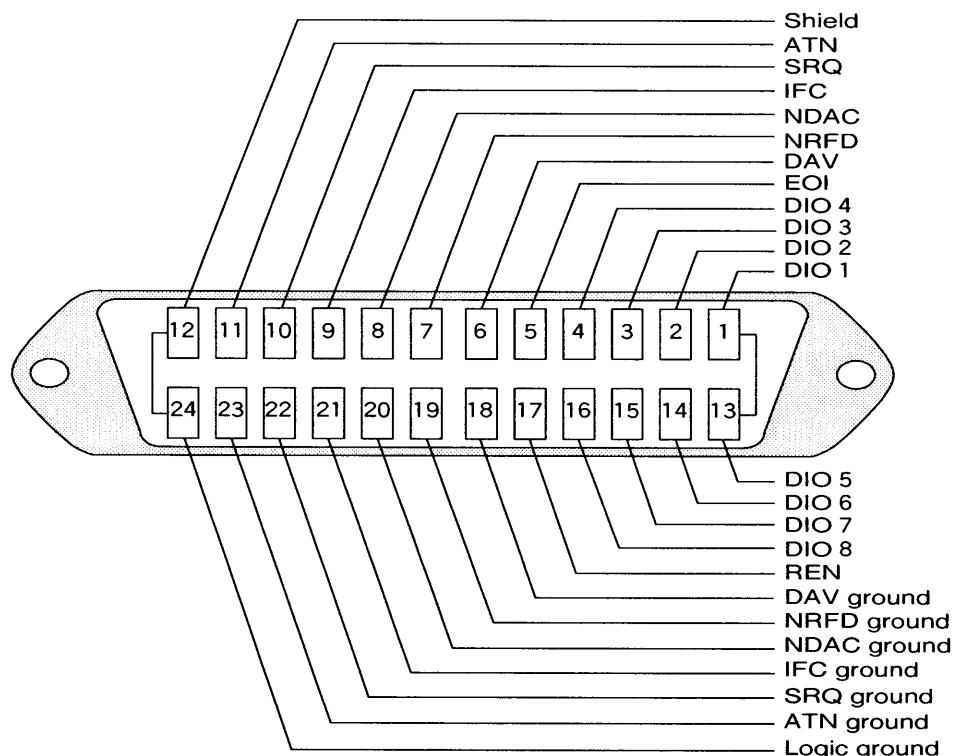
Figure 2-3   GPIB Connector

3.2 Control Using the EXT I/O Connector

3.2.1 Summary

The KSG4310 supports an external control interface providing the three functions mentioned below. External control is effected by way of the rear-panel EXT I/O connector

Panel memory recall

Addresses stored in the panel memory can be recalled under external control, by using the INC and DEC pins of the EXT I/O connector.

8-bit input port

8-bit input data on PI0 to PI7 of the EXT I/O connector can be read through a panel operation or the GPIB interface.

8-bit output port

8-bit data can be transferred to PO0 to PO7 of the EXT I/O connector through a panel operation or the GPIB interface.

3.2.2 EXT I/O connector pin definitions

The EXT I/O connector is a 25-pin D-Sub connector (female) having the TTL signal level.
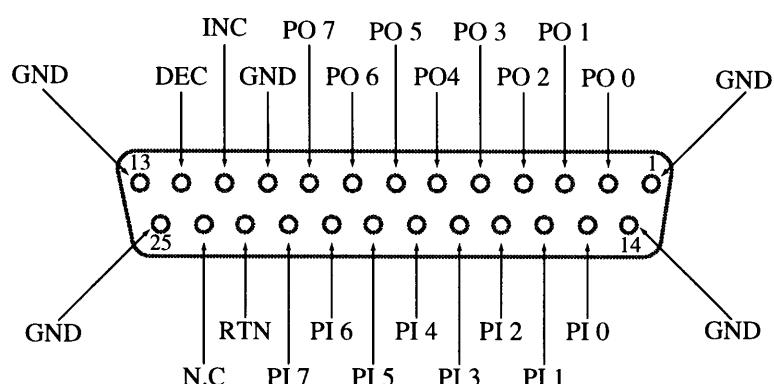
Figure 3-3   EXT I/O Connector Pin Configuration

Pin number	Name	Direction	Function
1	GND	—	Ground
2~9	PI0~PI7	IN	8-bit input port
10	GND	—	Signal ground
11	INC	IN	Memory address increment
12	DEC	IN	Memory address decrement
13	GND	—	Ground
14	GND	—	Ground
15~22	PO0~PO7	OUT	8-bit output port
23	RTN	IN	Memory address return
24	N.C	—	Reserved; to be left open
25	GND	—	Ground

Table 3-46   EXT I/O Pin Assignments

─────────── NOTE ───────────

- Use a shielded 25-pin D-Sub connector and cable to guard against malfunctioning caused by noises or other influences.

- The input port is pulled up by 10 kΩ.

3.2.3 Recalling from panel memory

The INC, DEC or RTN pin of the EXT I/O connector can be connected to a GND pin to recall a increased/decreased memory address.

─────────── NOTE ───────────

- The currently active address of memory group is incremented or decremented with the INC, DEC or RTN pin of the EXT I/O connector.

- Do not connect the INC, DEC and RTN pins to a GND pin at the same time.

- Allow a recall interval of 0.2 second or more.

Incrementing addresses

Connect the INC pin (pin 11) to a GND pin (pin 1, 13, 14, or 25) to set a low on the INC pin. A low on the INC pin for 1 ms or more increments the address by one.

Decrementing addresses

Connect the DEC pin (pin 12) to a GND pin (pin 1, 13, 14, or 25) to set a low on the DEC pin. A low on the DEC pin for 1 ms or more decrements the address by one.

Returning addresses

Connect the RTN pin (pin 23) to a GND pin (pin 1, 13, 14, or 25) to set a low on the RTN pin. A low on the RTN pin for 1 ms or more recalls the start address of the currently active memory group.
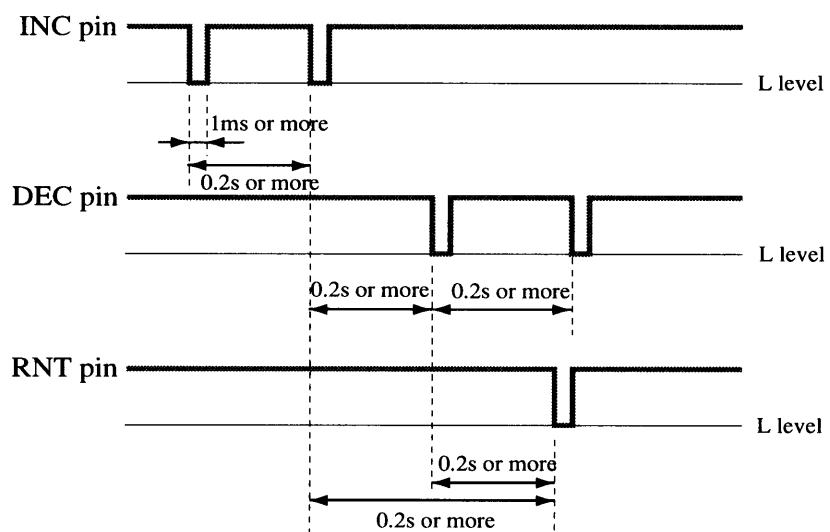
Figure 3-4   Timing Chart

3.2.4 Data input and output

Data input

High or low input signals on PI0 to PI7 of the EXT I/O connector can be displayed on the FREQUENCY indicator through a panel operation.

<1> Input 8-bit signals (TTL level) to PI0 to PI7 of the EXT I/O connector.

<2> Press the [2nd] , [2/(EXT IN)] , and [MHz/dB/mV] keys in this order.

<3> The 8-bit input data in effect right after the depression of the [MHz/dB/mV] key appears in binary code on the FREQUENCY indicator for 3 seconds. The input data is displayed in positive logic from left to right in the order of PI7, PI6···PI0.

Data output

8-bit input data can be transferred to PO0 to PO7 of the EXT I/O connector through a panel operation.

<1> Press the 【3/(EXT OUT)】 key following the 【2nd】 key.

<2> Using the 【1】 and 【0】 keys, enter binary codes from MSB to LSB, and press the 【MHz/dB/mV】 key.

The 8-bit data thus entered is displayed on the FREQUENCY indicator from left to right in the order of PO7, PO6 · · PO0.

8-bit data may also be set for each address in panel memory.

<3> High or low signals are transferred to PO0 to PO7 of the EXT I/O connector in positive logic.

3.3 Sample Program

This section contains sample programs for controlling the KSG4310 via National Instruments' GPIB interface card by programming in Microsoft Visual Basic.

3.3.1 Sample 1

Sample program for controlling the KSG4310 to run AM rejection ratio measurement as provided for in EIAJ.

```
Private Sub cmdStart_Click()
' Measuring method of AM rejection retio
    Dim bd As Integer
    Dim szDevName As String
    Dim szCmd As String
    Dim dLevel As Double

    szDevName$ = "DEV9"
    Call ibfind(szDevName$, bd)

    Call ibwrt(bd, "FREQ:CW 83.0MHZ")
    Call ibwrt(bd, "POW:LEV -60.0DBM")
    Call ibwrt(bd, "POW:IMP 75OHM")
    Call ibwrt(bd, "MOD:STAT ON")
    Call ibwrt(bd, "AM:DEP 30.0PCT")
    Call ibwrt(bd, "AM:INT:FREQ 400HZ")
    Call ibwrt(bd, "AM:STAT OFF")
    Call ibwrt(bd, "FM:STER:MODE MO")
    Call ibwrt(bd, "FM:DEV 75.0KHZ")
    Call ibwrt(bd, "FM:INT:FREQ 1.0KHZ")
    '
    Call ibwrt(bd, "FM:STAT ON")
    MsgBox "Measure level"

    Call ibwrt(bd, "AM:STAT ON")
    MsgBox "Measure level"

    For dLevel = -80# To -100# Step -20#
        szCmd = "POW:LEV " + Str$(dLevel) + "DBM"
        Call ibwrt(bd, szCmd)
        Call ibwrt(bd, "AM:STAT OFF")
        MsgBox "Measure level"

        Call ibwrt(bd, "AM:STAT ON")
        MsgBox "Measure level"
    Next dLevel
    MsgBox "Complete"
End Sub
```

3.3.2 Sample 2

Sample program for controlling the KSG4310 to run stereo channel separation measurement as provided for in EIAJ.

```
Private Sub cmdStart_Click()
' Measuring method of stereo channel separation
    Dim bd As Integer
    Dim szDevName As String
    Dim szCmd As String
    Dim nFreqVal As Integer
    Dim dDeviation As Double

    szDevName$ = "DEV9"
    Call ibfind(szDevName$, bd)

    Call ibwrt(bd, "FREQ:CW 83.0MHZ")
    Call ibwrt(bd, "POW:LEV -60.0DBM")
    Call ibwrt(bd, "POW:IMP 75OHM")
    Call ibwrt(bd, "MOD:STAT ON")
    Call ibwrt(bd, "AM:DEP 30.0PCT")
    Call ibwrt(bd, "AM:INT:FREQ 400HZ")
    Call ibwrt(bd, "AM:STAT OFF")
    Call ibwrt(bd, "FM:STER:MODE LE")
    Call ibwrt(bd, "FM:STAT ON")
    '
    For dDeviation = 30# To 100# Step 70#    ' 30% and 100%
        szCmd = "FM:DEV " + Str$(dDeviation) + "PCT"
        Call ibwrt(bd, szCmd)
        '
        ' 100Hz, 500Hz, 1kHz, 2kHz, 5kHz, 10kHz and 15kHz
        Call ibwrt(bd, "FM:INT:FREQ 100HZ")
        MsgBox "Measure level"
        '
        Call ibwrt(bd, "FM:INT:FREQ 500HZ")
        MsgBox "Measure level"
        '
        For nFreqVal = 1 To 2 Step 1      ' 1kHz and 2kHz
            szCmd = "FM:INT:FREQ " + Str$(nFreqVal) + "KHZ"
            Call ibwrt(bd, szCmd)
            MsgBox "Measure level"
        Next nFreqVal
        For nFreqVal = 5 To 15 Step 5    ' 5kHz, 10kHz and 15kHz
            szCmd = "FM:INT:FREQ " + Str$(nFreqVal) + "KHZ"
            Call ibwrt(bd, szCmd)
            MsgBox "Measure level"
        Next nFreqVal
    Next dDeviation
    MsgBox "Complete"
End Sub
```

Chapter 4

Names and Functions of Controls

This chapter gives description and functions of switches, displays, connectors, etc., for front and rear panels.

4.1 Description of front panel
4.2 Description of rear panel

4.1 Description of front panel

Labels pointing to the front panel diagram:

- 4 STEREO MODE indicator
- 5 FREQUENCY indicator
- 6 AMPLITUDE indicator
- 1 POWER switch
- 2 MEMORY indicator
- 3 MODULATION indicator
- 14 AMPLITUDE
- 13 FREQ
- 12 DATA ENTRY
- 11 MODULATION
- 10 MEMORY
- 9 PRE-EMPHASIS
- 8 GPIB
- 7 AF INPUT
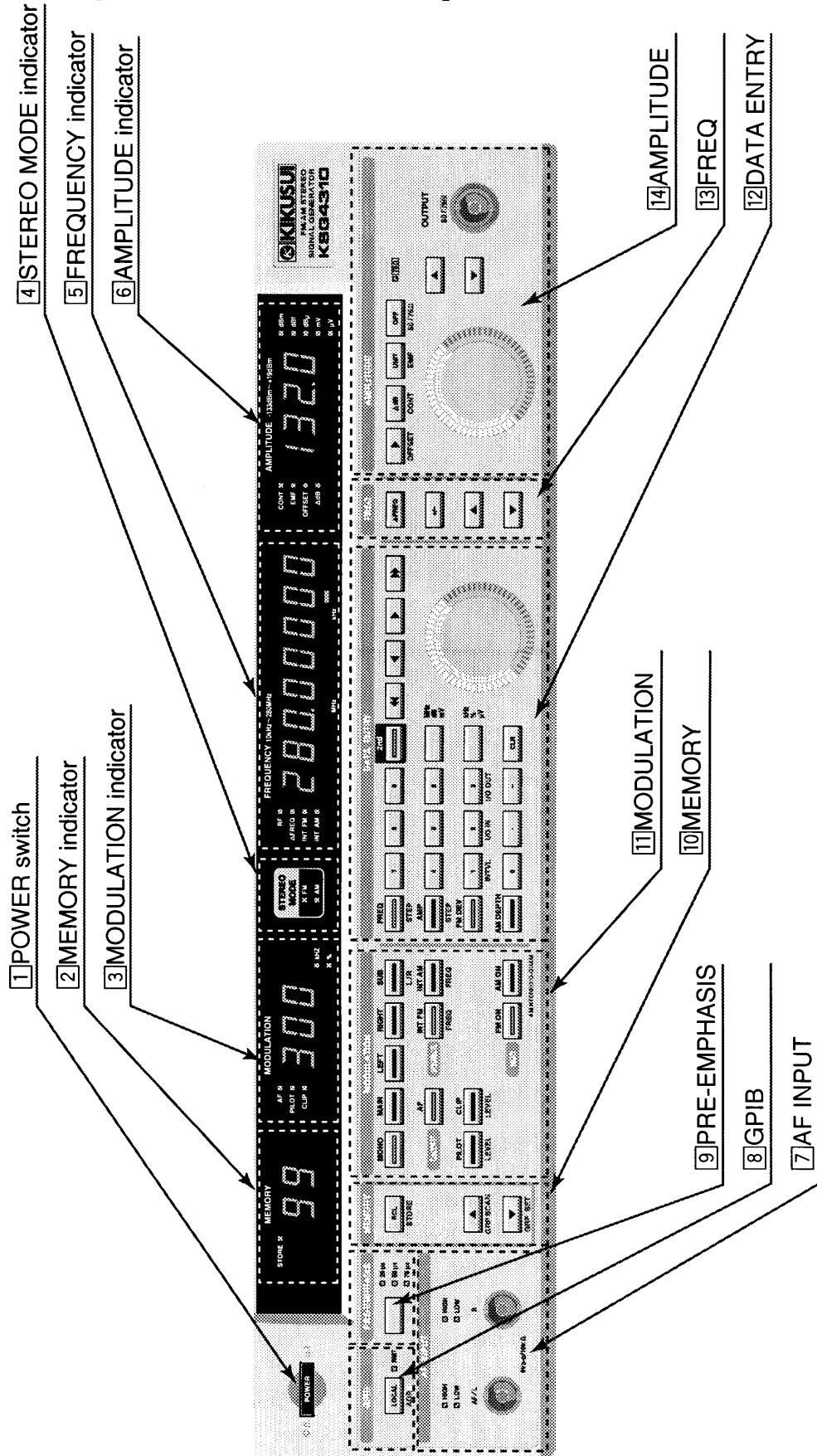
☐ POWER switch

Turns on and off the signal generator. Press the 【POWER】 switch to turn on the signal generator. Press the 【POWER】 switch again to turn it off. When the signal generator is turned on, the front panel will turn on all the indicators and will then display the status of the signal generator in which it had been before it was last turned off.

Press the 【POWER】 switch while holding down the 【2nd】 key in the DATA ENTRY section to initialize. Initialization will clear the panel memory completely and reset it to the default settings listed below.

FREQUENCY indicator	: 280.00000MHz
FREQUENCY STEP	: 100kHz
AMPLITUDE indicator	: -123.0dBm
AMPLITUDE STEP	: 1.0dBm
RF output	: ON
Output impedance	: 50 Ω
FM modulator	: ON
AF	: ON
PILOT	: ON
FM modulation source	: INT
FM internal oscillator frequency	: 1kHz
Stereo modulation mode	: MAIN
Pre-emphasis	: OFF
MODULATION indicator	: 100%
AM modulator	: ON
AM modulation source	: INT
AM internal oscillator frequency	: 1kHz
MEMORY indicator	: 00
Digit indicator	: In the FREQUENCY indicator, the 1 MHz digit lights; in the AMPLITUDE indicator, the least significant digit lights.
GPIB address	: 09

☐ MEMORY indicator

1. Display

    The panel memory stores up to 100 different of panel settings (from 00 to 99, in 10 groups).

2. [STORE] lamp

    Lights to indicate when the signal generator is waiting for storing to the address on display.

③ **MODULATION indicator**

1. Display

   Indicates an FM frequency deviation, AM modulation factor, stereo modulation factor, negative peak clipping level, or pilot level in three digits.

2. [AF] lamp

   Lights to indicate when an AF frequency deviation or modulation factor is on display.

3. [PILOT] lamp

   Lights to indicate when a pilot level is on display.

4. [CLIP] lamp

   Lights to indicate when a negative peak clipping level is on display.

5. [kHz] lamp

   Lights to indicate the engineering unit of an FM frequency deviation on display.

6. [%] lamp

   Lights to indicate the engineering unit of a modulation factor, negative peak clipping level, or pilot level on display.

7. Digit position indicator lamp

   Using a rotary knob, you can move the digit position at which this lamp is lit.

④ **STEREO MODE indicator**

   Lights to indicate which stereo modulation mode is currently in effect, FM or AM.

   [FM] lit : Enables FM stereo modulation.

   [AM] lit : Disables AM stereo modulation.

⑤ **FREQUENCY indicator**

1. Display

   Indicates frequencies in eight digits.

2. [RF] lamp

   Lights to indicate when an RF frequency is on display.

3. [ΔFREQ] lamp

   Lights to indicate when a frequency deviation is on display.

4 [INT FM] lamp

   Lights to indicate when an FM internal signal frequency is on display.

5. **[INT AM] lamp**

    Lights to indicate when an AM internal signal frequency is on display.

6. **Digit position indicator lamp**

    Using a rotary knob, you can move the digit position at which this lamp is lit.

6 AMPLITUDE indicator

1. **Display**

    Indicates output levels or output deviations in four digits.

2. **[CONT] lamp**

    Lights to indicate when the signal generator is in the continuously variable output level mode.

3. **[EMF] lamp**

    Lights to indicate when an EMF is on display in an engineering unit other than dBm and dBf.

4. **[OFFSET] lamp**

    Lights to indicate when the signal generator is in the output level offset display mode.

5. **[ΔdB] lamp**

    Lights to indicate when an output deviation is enabled.

6. **[dBm] lamp**

    Lights to indicate that the output on display is in the engineering unit dBm.

7. **[dBf] lamp**

    Lights to indicate that the output on display is in the engineering unit dBf.

8. **[dB μ] lamp**

    Lights to indicate that the output on display is in the engineering unit dB μ.

9. **[mV] lamp**

    Lights to indicate that the output on display is in the engineering unit mV.

10. **[μV] lamp**

    Lights to indicate that the output on display is in the engineering unit μV.

11. **Digit position indicator lamp**

    Using a rotary knob, you can move the digit position at which this lamp is lit.

7 AF INPUT

1. AF/L connector

   · Input connector to effect modulation with an external signal.
   · Use as an L (left-side) stereo signal input connector to effect modulation through EXT L/R (use the R connector as a right-side stereo signal input connector).

2. R connector

   Use as an R (right-side) stereo signal input connector to effect modulation through EXT L/R (use the AF/L connector as a left-side stereo signal input connector).

3. [HIGH] and [LOW] lamps

   Provide a visual indication of the validity of the input level of the external signal connected to the AF/L or R connector. The external signal has a valid input level if both lamps are off.

8 GPIB

1. 【LOCAL】 key

   Returns the signal generator to the panel-controlled state when it is in the remote state ([RMT] lamp are lit). The 【LOCAL】 key does not work in the local lockout state.

2 [RMT] lamp

   Lights when the signal generator is in the remote state (REMOTE) and goes off when it is in the local state.

3. 【2nd】 and 【LOCAL】 keys

   Press the 【LOCAL/(ADRS)】 key following the 【2nd】 key to set a GPIB address (which appears on the MEMORY indicator).

9 PRE-EMPHASIS

Sets a pre-emphasis state. When you press this key, pre-emphasis states will change in turn in the following sequence:

OFF ⇨ 25 μ s ⇨ 50 μ s ⇨ 75 μ s ⇨ OFF ···

All off	: Pre-emphasis off
25 μ s lit	: Pre-emphasis 25 μ s
50 μ s lit	: Pre-emphasis 50 μ s
75 μ s lit	: Pre-emphasis 75 μ s

10 MEMORY

1. 【RCL/(STORE)】 key

   Recalls or stores panel memory data.

2. 【▲/(GRP RCL)】 key

Increments an address setting step by step. Press the 【▲/(GRP RCL)】 key following the 【2nd】 key to begin scanning for active groups.

3. 【▼/(GRP SET)】 key

Decrements an address setting step by step. Press the 【▼/(GRP SET)】 key following the 【2nd】 key to group addresses.

11 **MODULATION**

1. 【MONO】 key

Sets modulation to MONO.

2. 【MAIN】 key

Press to perform stereo modulation on the main channel.

3. 【LEFT】 key

Press to perform stereo modulation on the left channel.

4. 【RIGHT】 key

Press to perform stereo modulation on the right channel.

5. 【SUB/(L/R)】 key

Press to perform stereo modulation on the subchannel. Press the 【SUB/(L/R)】 key following the 【2nd】 key to set EXT L/R.

6. 【AF】 key

Turns on or off the AF signal.

7. 【PILOT/(LEVEL)】 key

Press to display a pilot level on the MODULATION indicator.

8. 【CLIP/(LEVEL)】 key

Press to turn on or off the negative peak clipper. Press the 【CLIP/(LEVEL)】 key following the 【2nd】 key to set a negative peak clipping level.

9. 【INT FM/(FREQ)】 key

Chooses the FM modulation AF signal source between the internal oscillator and the external oscillator. Press the 【INT FM/(FREQ)】 key following the 【2nd】 key to set an internal oscillator frequency.

10. 【INT AM/(FREQ)】 key

Chooses the AM modulation AF signal source between the internal oscillator and the external oscillator. Press the 【INT AM/(FREQ)】 key following the 【2nd】 key to set an internal oscillator frequency.

11. 【FM ON】 key

Turns on or off the FM modulator.

12. 【AM ON】 key

Turns on or off the AM modulator.

12 DATA ENTRY

1. 【FREQ/(STEP)】 key

Sets a carrier frequency.

2. 【AMP/(STEP)】 key

Sets an output level.

3. 【FM DEV】 key

Sets an FM modulating frequency deviation.

4. 【AM DEPTH】 key

Sets an AM modulation factor.

5. Numeric keys

Use to enter digits (0 to 9) and symbols (., -).

6 【2nd】 key

When you press a panel key marked blue following the 【2nd】 key, the function marked in blue is carried out.

7 【MHz/dB/mV】 key

Press to decide on MHz, dB, or mV as the engineering unit at setting data.

8 【kHz/%/μ V】 key

Press to decide on kHz, %, or μ V as the engineering unit at setting data.

9 【CLR】 key

Press to clear an indicator at setting data.

10 【◀】 and 【▶】 keys

Use to select the digit position at which data is set with the rotary knob.

11 【◀◀】 and 【▶▶】 keys

Use to move the cursor from the MODULATION indicator to the FREQUENCY indicator or vice versa.

12. Rotary knob

Use to edit the value at the cursor position.

⎡13⎦ **FREQ**

1. **【ΔFREQ】** key

   Press to use a frequency deviation.

2. **【+/-】** key

   Press to switch the polarity at frequency deviation setup.

3. **【▲】** and **【▼】** keys

   Use to increment and decrement a frequency step by step.

⎡14⎦ **AMPLITUDE**

1. **【▶/OFFSET】** key

   Use to move the cursor on the AMPLITUDE indicator. Press the **【▶/OFFSET】** key following the **【2nd】** key to set an output level offset.

2. **【ΔdB/CONT】** key

   Press to use an output level deviation. Press the **【dB/CONT】** key following the **【2nd】** key to turn on or off the continuously variable output level that varies the output level in a range of 10.0 dB.

3. **【UNIT/EMF】** key

   Press to change engineering units (dBm⇨dBf⇨dB μ ⇨mV⇨ μ V⇨dBm⇨...). Press the **【UNIT/EMF】** key following the **【2nd】** key to convert the engineering unit to match the unit being lit (except for dBm and dBf).

4. **【OFF/75 Ω】** key

   Turns on or off the RF output. Press the **【OFF/75 Ω】** key following the **【2nd】** key to select the output impedance between 50 and 75 Ω.

5. [75 Ω] lamp

   Lights when the 75 Ω output impedance is selected. (The 50 Ω output impedance is selected when this lamp is off.)

6. **【▲】** and **【▼】** keys

   Use to vary the output level step by step.

7. OUTPUT connector

   RF signal output connector.

8. Rotary knob

   Use to edit the value at the cursor position.

4.2 Description of rear panel
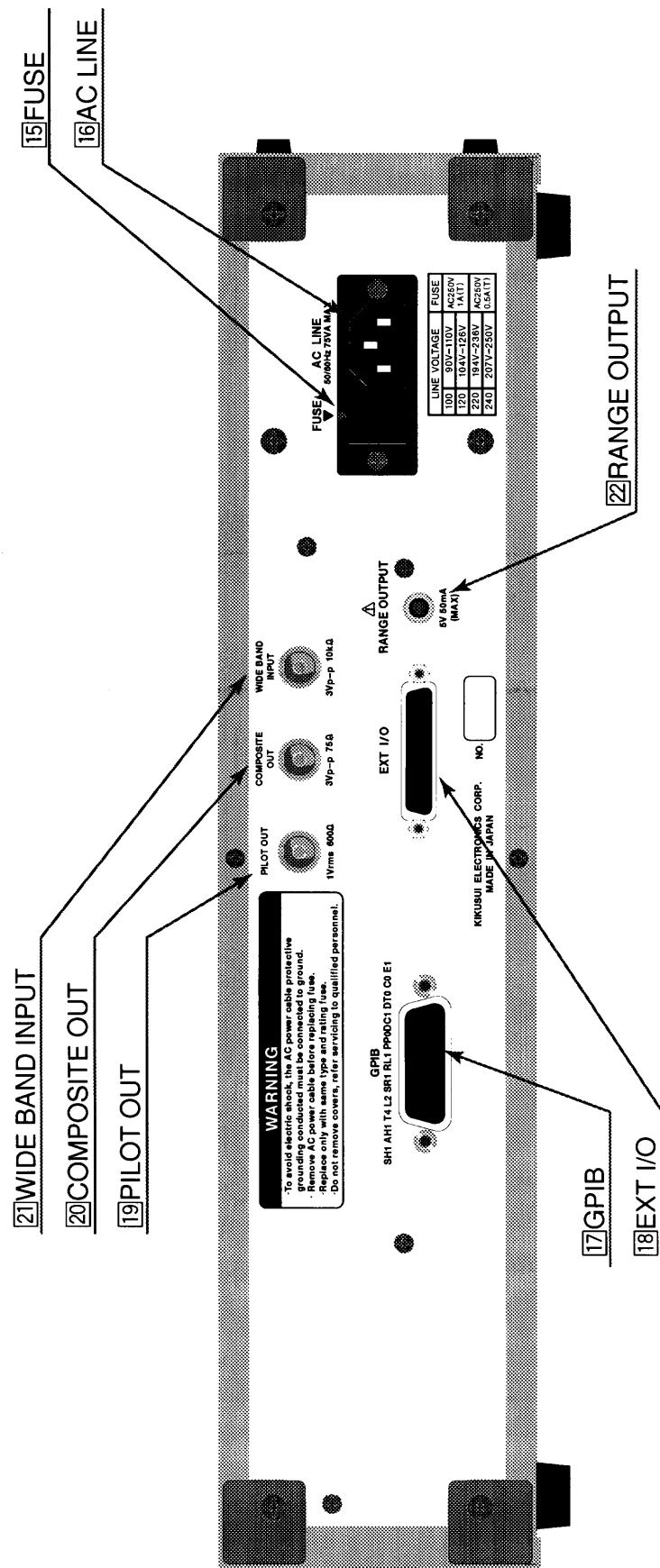
▯15▮ FUSE

Input power fuse holder/voltage selector. Use a fuse matched to the line voltage at your location. Adjust the voltage selector to the ▼ mark and push in the cover. The relationship between line voltages and compatible fuses can be found in the LINE VOLTAGE table on the rear panel.

▯16▮ AC LINE

Input power cable connector.

▯17▮ GPIB

GPIB control connector (36-pin connector).

▯18▮ EXT I/O

External control connector (25-pin D-Sub connector).

▯19▮ PILOT OUT

Generates a PILOT signal (BNC connector).

▯20▮ COMPOSITE OUTPUT

Generates a composite signal (BNC connector).

▯21▮ WIDE BAND INPUT

External modulating signal wide-band input connector (BNC connector).

▯22▮ RANGE OUTPUT

The output signal is set to "1" (5 V, 50 mA) when the carrier frequency is within the range from 35 MHz to 280 MHz; it is set to "0" when the carrier frequency is within the range from 50 kHz to 35 MHz. (Pin connector).

Chapter 5

Maintenance and Calibration

This chapter provides information on maintaining and calibrating this product. Periodic maintenance, inspection, and calibration are recommended to keep the product long-lived with unfailing initial performance.

5.1 Cleaning

If the panel or any other exterior surface of the product is smeared, clean the surface by wiping lightly with a soft cloth moistened with a neutral detergent solution.

CAUTION

- Turn OFF the [POWER] switch before cleaning.

- Never use organic solvents, such as thinner and benzine, for cleaning. Use of organic solvents could result in surface discoloration, marking erasure, clouded display and so on.

5.2 Inspection

Check the power cable for ruptures in the covering, play or cracks in the plug and so on.

WARNING

- Ruptures in the covering or any other defect in the power cable could cause electrical shock hazards. Discontinue using the power cable immediately.

For purchasing accessories, please contact your Kikusui agent.

5.3 Calibration

This product was calibrated at shipment. However, recalibration is required after long-term usage.

For calibration, please contact your Kikusui agent.

5.4 Replacing the Backup Battery

An internal battery backs up the contents of the panel memory even if the signal generator is turned off. If the panel settings in effect before the signal generator was turned off and those after it is turned on differ, the battery should be replaced.

Battery life varies, depending on usage; generally it should be replaced after three years from shipment.

For replacement, please contact your Kikusui agent.

Chapter 6 Specifications

This chapter describes the electrical and mechanical specifications of the product, and the options available with it.

6.1 Specifications
6.2 Options

6.1 Specifications

1) RF output

Frequency	
Frequency range	10kHz~280MHz
Resolution setting	10Hz
Settling time	300 ms or shorter [after frequency switching]
Frequency accuracy	$\pm 2 \times 10^{-6}$ [1 hour after POWER ON]
Frequency statability	$\pm 2 \times 10^{-7}$/Week [48 hours after POWER ON]

Output level	
Setup range	-133 dBm to +19 dBm [50Ω]
	-123 dBm to +13 dBm [50Ω, at AM modulation]
	-134.8 dBm to +17.2 dBm [75Ω]
	-124.8 dBm to +11.2 dBm [75Ω, at AM modulation]
Resolution setting	0.1dB
Level accuracy	± 1dB [output setting : 0dBm (50Ω) , frequency : 400 kHz or more]
	± 2dB [output setting+19dBm to -120dBm, frequency : 400 kHz or more]
	± 2.5dB [none of the above]
Setup unit	dBm, dBf, dBμV, mV, μV and their respective EMF, except for dBm and dBf
Output connector	BNC connector on PANEL
Output impedance	Selectable between 50 and 75Ω
VSWR	1 : 1.2 or less [50Ω, -10 dBm or less]

Signal purity	
Spurious output	Harmonics : -30 dBc or less
	Non-harmonics : -60 dBc or less
Residual modulation	

FM components
90dB or more [76MHz to 90MHz, 98.0±1MHz]
87dB or more [10.7±1MHz]
80dB or more [2MHz to 280MHz]
S/N ratio relative to a 1 kHz modulated wave and a 75 kHz deviation
Bandwidth 300Hz to 15kHz, de-emphasis 50 μs

AM components
60dB or more [400kHz to 2MHz]
55dB or more [150kHz to 280MHz]
S/N ratio relative to a 1 kHz modulated wave and 30% modulation
Demodulation bandwidth 50 Hz to 15 kHz

2) Modulators

FM modulator		
External modulating frequency characteristics	50Hz to 15kHz±0.5dB or less	[RF=76MHz to 90MHz, and 98.0, 10.7±1MHz] [Dev.75kHz front-panel input]
	50Hz to 80kHz±1.0dB or less	[RF=76MHz to 90MHz, and 98.0, 10.7±1MHz] [Dev.75kHz rear-panel WB input]
	50Hz to 80kHz±1.5dB or less	[RF=2MHz to 280MHz] [Dev.75kHz rear-panel WB input]
Distortion factor	0.01% or less 0.1% or less	[RF=76MHz to 90MHz, and 98.0, 10.7±1MHz] [RF=2MHz to 280MHz]
	75 kHz deviation, 1 kHz and 400 Hz internal oscillator Demodulation bandwidth 50 Hz to 15 kHz, De-emphasis 50 μs	
AM on FM	0.5% or less [75 kHz deviation, RF = 76 MHz to 90 MHz, and 98.0, 10.7 ±1 MHz, AF =1 kHz]	
Maximum frequency deviation	10% of RF frequency	[10kHz ≦ RF ≦ 150kHz]
	15kHz	[150kHz < RF ≦ 2MHz]
	300kHz	[2MHz < RF ≦ 280MHz]

	Resolution setting	100Hz、1kHz （Dev.≧100kHz）
	Accuracy	Reading×0.08＋1digit

FM stereo (*1)		
Frequencies that can be modulated	2.00001MHz to 280MHz	
External modulating frequency characteristics	50Hz to 15kHz ±0.5dB or less, 1 kHz reference	
Distortion factor	0.02% or less 0.05% or less	[Internal oscillator 1 kHz, 400 Hz] [External input 50 Hz to 15 kHz]
	Dev.75kHz Demodulation bandwidth 50 Hz to 15 kHz, De-emphasis 50 μs	
Separation	60dB or more [AF=50Hz to 15kHz]	
Pre-emphasis	25 μs, 50 μs, 75 μs, OFF	
Main and sub signals		

	Modulation factor	0 to 125% 100%=Dev67.5kHz
	Resolution	0.1%、1% （≧100%）
	Accuracy	Reading×0.05＋2%

Pilot signal

	Frequency	19kHz±0.01%
	Amplitude range	0 to 15%, 0.1%step 100%=Dev75kHz
	Accuracy	Reading×0.05＋ 1 %
	Output connector	BNC connector on rear-panel (shared with AM stereo)
	Output amplitude	1Vrms、±5%
	Output impedance	Approx. 600 Ω

Composite output

	Connector	BNC connector on rear-panel
	Amplitude	Approx. 3 Vp-p
	Output impedance	Approx, 75 Ω

*1 Unless otherwise noted, the FM stereo characteristics are specified in terms of RF ranges of 76 MHz to 90 MHz, 98.0, and 10.7 ±1 MHz.

AM modulator	
External modulating frequency characteristics	50Hz to 10kHz ±0.5dB or less [30% modulation, RF = 400 kHz to 2 MHz, AF = 1 kHz] 50Hz to 10kHz ±1.0dB or less [30% modulation, RF = none of the frequencies above, AF = 1 kHz]
Distortion factor	0.1% or less [30% modulation, RF = 400 kHz to 2 MHz, AF = 1 kHz] 1.0% or less [30% modulation, RF = none of the frequencies above, AF = 1 kHz] Demodulation bandwidth 50 Hz to 15 kHz
FM on AM	75Hz or less [30% modulation, RF = 400 kHz to 2 MHz, AF = 1 kHz]
Modulation factor	0 to 99.9% 0.1% step Accuracy : Reading×0.05+2% [400 kHz to 2 MHz, 80% or less] Reading×0.08+2% [none of the frequencies above]

AM stereo (Motorola C-QUAM® system) TM			
Frequencies that can be modulated	400kHz to 2MHz		
External input connector	Left and right external signal input BNC connectors on panel (shared with FM stereo)		
External modulating frequency characteristics	50 Hz to 10 kHz,±0.5 dB or less, 1 kHz reference		
Main signal		Modulation factor	0 to 100%, resolution 0.1%
		Modulation accuracy	Reading×0.05+2%
		Distortion factor	0.2% or less [50%, AF = 1 kHz, demodulation bandwidth 50 Hz to 15 kHz]
Sub signal		Modulation factor	0 to 100%, resolution 0.1%
		Modulation accuracy	Reading×0.05+2%
		Distortion factor	1% or less [50%, AF = 1 kHz, demodulation bandwidth 50 Hz to 15 kHz]
L and R signals		Modulation factor	0 to 80%, resolution 0.1%
		Modulation accuracy	Reading×0.05+2%
		Distortion factor	1% or less [50%, AF = 1 kHz, demodulation bandwidth 50 Hz to 15 kHz]
Separation	36dB or more [AF=400Hz to 4kHz]		
Cross talk	-40dB or less [Main→Sub AF=1kHz 50% modulation] -46dB or less [Sub→Main AF=1kHz 50% modulation]		
Variable N.P.C range	95%±5% resolution 0.1%		
Pilot signal		Frequency	25Hz±0.01%
		Amplitude range	0 to 10%、0.1%step
		Modulation accuracy	Reading×0.05+1%
		Output connector	BNC connector on rear-panel (shared with FM stereo)
		Output amplitude	1Vrms、±5%
		Output impedance	Approx. 600Ω

3)   Simultaneous FM and AM modulation

RF frequency	Simultaneous modulation operable at 2.00001 MHz or more

4)   Modulating signals

Internal signals (two signals lines, one for AM and one for FM)	
Frequency setting	50 Hz to 15 kHz sinusoidal wave, resolution 50 Hz
Frequency accuracy	±0.01%

External signals		
External input connector	External signals input	Left and right external BNC connectors on front-panel
	Input voltage	Specified modulation factor at 3 Vp-p
	Input Impedance	Approx. 10kΩ
	Input frequency range	30Hz to 15kHz
WB input connector (wide band)	WB input	BNC connector on rear-panel
	Input voltage	Specified modulation factor at 3 Vp-p
	Input impedance	Approx. 10kΩ
	Input frequency range	30Hz to 100kHz

5) Others/General

Memory feature	Capable of storing and recalling up to 100 different repertoires of operational parameters (panel settings) to and from memory.
External control interface	<table><tr><td colspan="2">EXT I/O connector</td></tr><tr><td>Shape</td><td>25-pin D-Sub connector</td></tr><tr><td>Signal level</td><td>TTL level</td></tr><tr><td>Control</td><td>8-bit I/O （programmable and readable via GPIB） Memory UP/DOWN/RTN</td></tr></table> <table><tr><td colspan="2">Range out connector</td></tr><tr><td>Shape</td><td>Pin connector</td></tr><tr><td>Signal level</td><td>5 V, 50 mA (source)</td></tr></table>
GPIB interface	IEEE488.1 SH1、AH1、T4、L2、SR1、RL1、PP0、DC1、DT0、C0、E1
Radiated interference	1 μV or lower［measured at a point 25 mm apart from the casing, using a two-turn loop antenna 25 mm in diameter］

General	
Guaranteed temperature and humidity ranges	5℃ to 35℃、20% to 85%Rh （no dew condensation）
Operating temperature and humidity ranges	0℃ to 40℃、20% to 85%Rh （no dew condensation）
Storage temperature and humidity ranges	-25℃ to 70℃、20% to 90%Rh （no dew condensation）
External dimensions	W430×H99×D380 (MAX) W445×H110×D440
Weight	Approx. 10kg
AC Input voltage	100, 115, 215, and 230 VAC, selectable
Power consumption	75 VA max. (65 W)
Accessories	<table><tr><td rowspan="2">Description</td><td colspan="2">Quantity</td><td rowspan="2">Code</td></tr><tr><td>100V or 120V input required model</td><td>220V or 240V input required model</td></tr><tr><td>Operation manual</td><td>1</td><td>1</td><td>Z1-001-062</td></tr><tr><td>Cable BNC-BNC</td><td>1</td><td>1</td><td>96730</td></tr><tr><td rowspan="2">Power cable</td><td>1</td><td></td><td>85-AA-0003</td></tr><tr><td></td><td>1</td><td>85-AA-0005</td></tr><tr><td>Fuse T 1.0 A, 250 V</td><td>1</td><td>2</td><td></td></tr><tr><td>Fuse T 0.5 A, 250 V</td><td>2</td><td>1</td><td></td></tr></table>

5) External dimensions

MAX 440

380

MAX 20

MAX 110
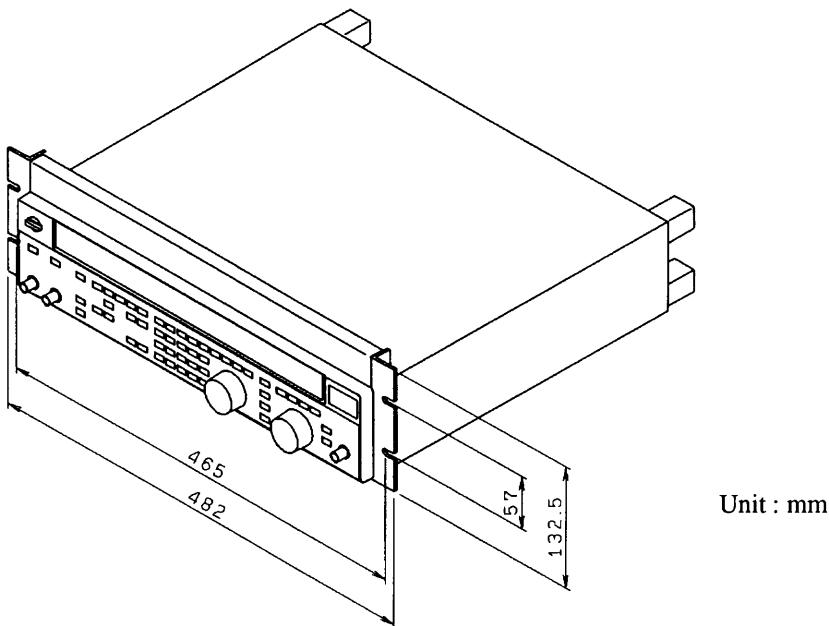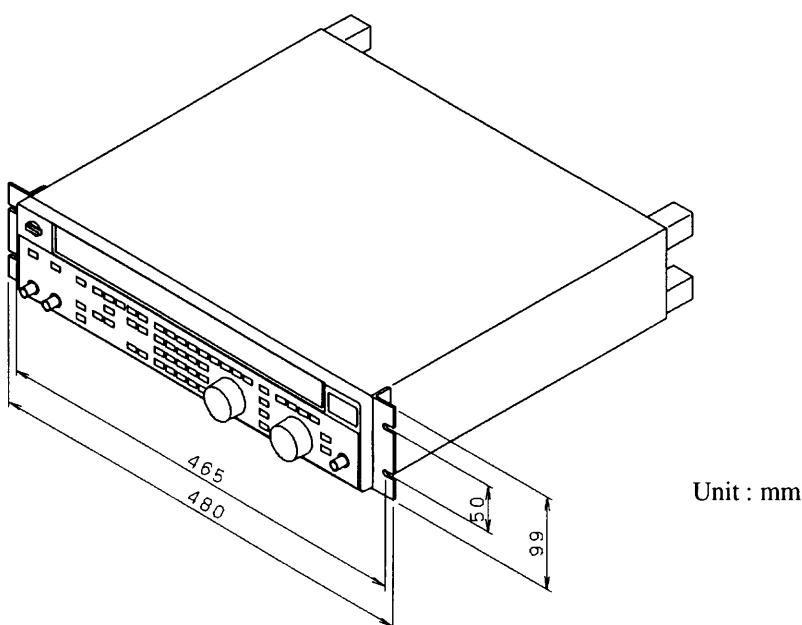
99

MAX 445

430

MAX 5

Unit : mm

6.2 Options

The following rack-mounting brackets for the KSG4310 FM/AM are available.

- EIA standard rack mounting bracket
    KRB3-KSG
- JIS standard rack mounting bracket
    KRB100-KSG

Unit : mm

KRB3-KSG (EIA standard rack mounting bracket)

Unit : mm

KRB100-KSG (JIS standard rack mounting bracket)

Index

Setup item	Numeric keys	Knob	▲▼	Key-in sequence	Setup range	Key top	LED	Setting	Remarks
Frequency	○			[FREQ/(STEP)] ⇨ Numeric keys ⇨ [MHz] or [kHz]	10kHz to 280MHz	FREQ	RF	FREQUENCY	
		○		[FREQ/(STEP)] (⇨ [▶▶]) ⇨ [◀] or [▶] ⇨ Rotary knob					
			○	[FREQ/(STEP)] ⇨ [▲] or [▼]					
Frequency step	○			[2nd] ⇨ [FREQ/(STEP)] ⇨ Numeric keys ⇨ [MHz] or [kHz]	10Hz to 100MHz	FREQ	RF	FREQUENCY	Use [▲] or [▼] in the FREQ section to increment or decrement the RF frequency setting.
		○		[2nd] ⇨ [FREQ/(STEP)] (⇨ [▶▶]) ⇨ Rotary knob					
Frequency deviation	○			[ΔFREQ] ⇨ Numeric keys ⇨ [MHz] or [kHz] ⇨ [+·−]	10Hz to 100MHz		ΔFREQ	FREQUENCY	Deviations are marked by ".". Use [+/-] to switch polarity.
		○		[ΔFREQ] (⇨ [▶▶]) ⇨ [◀] or [▶] ⇨ Rotary knob ⇨ [+·−]					
			○	[ΔFREQ] ⇨ [▲] or [▼] ⇨ [+·−]					
Output level	○			[AMP/(STEP)] ⇨ Numeric keys ⇨ [dB]	50Ω: (-133dBm to 19dBm)	AMP		AMPLITUDE	
		○		[AMP/(STEP)] ⇨ [▶/(OFFSET)] ⇨ Rotary knob	50Ω+AM: (-123dBm to 13dBm)				
			○	[AMP/(STEP)] ⇨ [▲] or [▼]	75Ω: (-134.8dBm to 17.2dBm)				
					75Ω+AM: (-124.8dBm to 11.2dBm)				
Output level step	○			[2nd] ⇨ [AMP/(STEP)] ⇨ Numeric keys ⇨ [dB]		AMP		AMPLITUDE	Use [▲] or [▼] in the AMPLITUDE section to increment or decrement an output level setting.
		○		[2nd] ⇨ [AMP/(STEP)] ⇨ [▶/(OFFSET)] ⇨ Rotary knob					
Output level offset	○			[2nd] ⇨ [▶/(OFFSET)] ⇨ Numeric keys ⇨ [dB]		AMP	OFFSET	AMPLITUDE	
		○		[2nd] ⇨ [▶/(OFFSET)] ⇨ Rotary knob					
Output level deviation	○			[ΔdB/(CONT)] ⇨ Numeric keys ⇨ [dB]			ΔdB	AMPLITUDE	Deviations are marked by ".".
		○		[ΔdB/(CONT)] ⇨ [▶/(OFFSET)] ⇨ Rotary knob					
			○	[ΔdB/(CONT)] ⇨ [▲] or [▼]					
Turning ON and OFF the output level display				[OFF/(75Ω)]					ON : Displays the output level. OFF : Displays "OFF."
Switching output impedances				[2nd] ⇨ [OFF/(75Ω)]	75Ω / 50Ω		75Ω		The 50-Ω output impedance is selected when the [75Ω] lamp is off.
Setting units				[UNIT/(EMF)]	dBm, dBf, dB μ, mV, μV				
Setting EMF units				[2nd] ⇨ [UNIT/(EMF)]	Converted automatically (except for dBm and dBf)		EMF		
Turning ON and OFF the CONT mode				[2nd] ⇨ [ΔdB/(CONT)]			CONT		
FM frequency deviation	○			[FM DEV] ⇨ Numeric keys ⇨ [kHz]		FM DEV	AF kHz	MODULATION	
		○		[FM DEV] (⇨ [◀◀]) ⇨ [◀] or [▶] ⇨ Rotary knob	Maximum frequency deviation — RF frequency; 10% of RF frequency — 10kHz ≤ RF ≤ 150kHz; 15kHz — 150kHz < RF ≤ 2MHz; 300kHz — 2MHz < RF ≤ 280MHz				
Turning ON and OFF modulation				[FM ON] or [AM ON]		FM ON AM ON			
AM modulation factor	○			[AM DEPTH] ⇨ Numeric keys ⇨ [%]	0.1% to 99.9%	AM DEPTH	AF %	MODULATION	
		○		[AM DEPTH] (⇨ [◀◀]) ⇨ [◀] or [▶] ⇨ Rotary knob					

Quick Reference

Setup item	Procedure Numeric keys	Procedure Knob	Procedure ▲▼	Key-in sequence	Setup range	Indication Key top	Indication LED	Indication Setting	Remarks
Turning ON and OFF stereo modulation				[MAIN] / [LEFT] / [RIGHT] / [SUB/(L/R)]	Carrier frequency : Stereo modulation mode / 400kHz to 2.00000MHz : AM stereo modulation / 2.00001MHz to 280MHz : FM stereo modulation	MAIN LEFT RIGHT SUB/(L/R)	AM FM		MONO turns OFF modulation.
EXT L/R				[2nd] ⇨ [SUB/(L/R)]					
Stereo modulation factor	○	○		[FM DEV] ⇨ Numeric keys ⇨ [%] / [FM DEV] (⇨ [◀◀]) ⇨ [◀] or [▶] ⇨ Rotary knob	0% to 125%		AF %	MODULATION	
Turning ON and OFF the pilot signal				[PILOT/LEVEL]		PILOT			
Pilot level	○	○		[2nd] ⇨ [PILOT/LEVEL] ⇨ Numeric keys ⇨ [%] / [2nd] ⇨ [PILOT/LEVEL] (⇨ [◀◀]) ⇨ [◀] or [▶] ⇨ Rotary knob	0 to 10% (resolution 0.1%)		PILOT %	MODULATION	
Turning ON and OFF the negative peak clipper				[CLIP/(LEVEL)]		CLIP			
Setting a negative peak clipping level	○	○		[2nd] ⇨ [CLIP/(LEVEL)] ⇨ Numeric keys ⇨ [%] / [2nd] ⇨ [CLIP/(LEVEL)] (⇨ [◀◀]) ⇨ [◀] or [▶] ⇨ Rotary knob			CLIP %	MODULATION	
Switching modulation sources				[INT FM/(FREQ)] or [INT AM/(FREQ)]		INT FM INT AM	INT FM INT AM		On : Internal signal / Off : External signal
Turning ON and OFF the AF signal				[AF]		AF			Turning ON and OFF the pilot signal
FM Internal modulation signal frequency				[2nd] ⇨ [INT FM/(FREQ)] ⇨ Numeric keys ⇨ [kHz] / [2nd] ⇨ [INT FM/(FREQ)] (⇨ [▶▶]) ⇨ [◀] or [▶] ⇨ Rotary knob	50 Hz to 15 kHz (resolution 50 Hz)	INT FM	INT FM	FREQUENCY	
AM Internal modulation signal frequency				[2nd] ⇨ [INT AM/(FREQ)] ⇨ Numeric keys ⇨ [kHz] / [2nd] ⇨ [INT AM/(FREQ)] (⇨ [▶▶]) ⇨ [◀] or [▶] ⇨ Rotary knob	50 Hz to 15 kHz (resolution 50 Hz)	INT AM	INT AM	FREQUENCY	
Pre-Emphsis					OFF, 25 μs, 50 μs, 75 μs				
Storing to memory				[2nd] ⇨ [RCL/(STORE)] ⇨ Numeric keys	00 to 99	STORE			
Recalling from memory				[RCL/(STORE)] ⇨ Numeric keys	00 to 99				