OPERATION MANUAL

MULTIPLEX SIGNAL GENERATOR
(with Radio Data Signal,
Traffic Radio Infomation)

KSG 3400A

Second Edition

KIKUSUI ELECTRONICS CORPORATION
(KIKUSUI PART NO. Z1-000-592)

M-94071

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.
(Revision should be applied to items indicated by a check mark ☑.)

☐ Input voltage

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

☐ Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

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

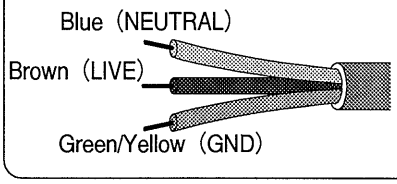
☐ AC power cable

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

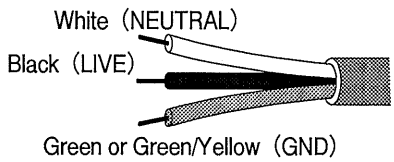
WARNING

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

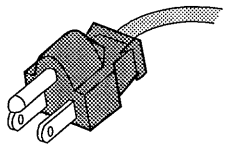
☐ Without a power plug



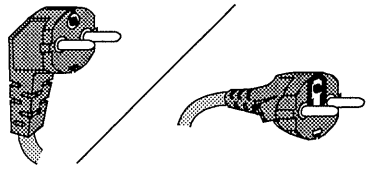
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

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

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

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1. GENERAL DESCRIPTION

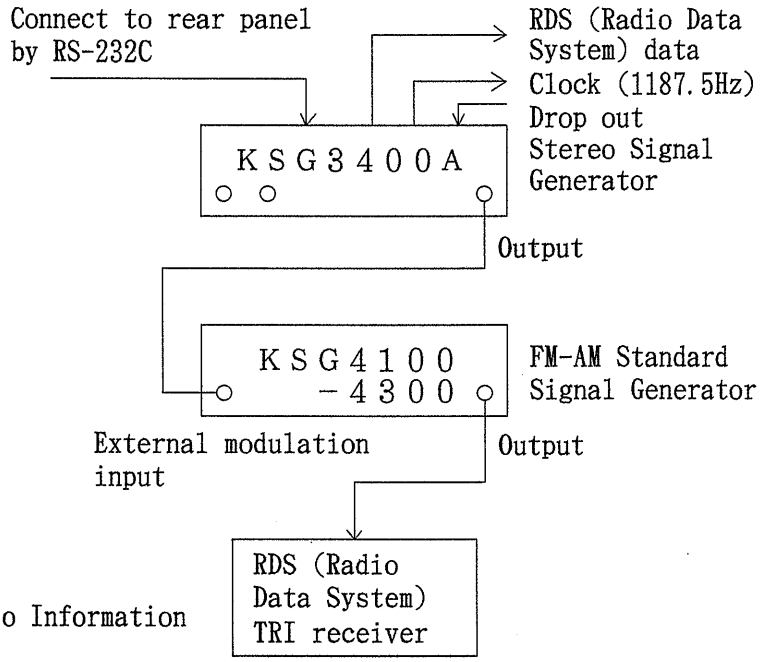
1.1 Outline

The KSG3400A Radio Data Signal Generator generates a stereo signal composed of TRI (=ARI) signal and RDS (Radio Data System) signal, and it has the EON (Enhanced Other Networks) functions described in the EBU Tech. 3244-E & Supplement No.4. It can be used not only as a modulator of FM broadcasting equipment but also for studying, developing, adjusting, inspecting, and measuring the ICs and adapters for stereo demodulation (including RDS) and high-grade FM stereo receivers and tuners with RDS.

By applying the signal output from the KSG3400A to the KSG4100 - 4300 FM-AM Standard Signal Generator, a composite signal consisting of a stereo signal, RDS (Radio Data System) signal, and TRI signal can be supplied to the stereo receiver, RDS receiver, and TRI receiver from high frequency output.

The RDS and clock signal (1187.5 Hz) are output from the rear panel of the KSG3400A via TTL level, and may be used for testing the logic circuit of the RDS receiver.

The instruments should be connected as follows:



TRI : Traffic Radio Information

The data to be generated/edited is displayed on the liquid crystal display (LCD) of the KSG3400A via the RS-232C interface and may be modified on realtime basis.

Up to 100 types of data may be stored in the memory of the KSG3400A.

1.2 Features

o Stereo signal section

(1) The separation of the left and right channels is higher than 72dB (measured value) in the middle band.

(2) Since the pilot signal phase is highly stabel, the calibration that was required by conventional signal generators is unnecessary.

(3) The internal modulation oscillators provide seven waveforms, and the distortion of the waveforms is as low as 0.005% or less (measured value). Since these internal modulation oscillator signals can be taken out of the KSG3400A, the instrument can be used as a low distortion spot oscillator.

o RDS (Radio Data System) signal

(1) Data can be generated and edited on the LCD of the KSG3400A, and the EON (Enhanced Other Networks) data can also be generated and edited on the LCD easily.

(2) If a supporting software is used, the data can be generated and edited on the large screen of the personal computer PC9801.

(3) Data consists of data sets, such as PI, PS, AF, and group type sequences for sending the data sets. Each data set and group type sequence may be generated and edited separately.

(4) Depending on the input data, the KSG3400A extracts necessary codes from the data sets automatically, generates group data, and outputs the required data on a realtime basis.

(5) The check words and offset words are generated automatically.

(6) The data sets and group type sequences may be inserted and deleted.

(7) The phase of the 57kHz sub-carrier can be set to 0° or 90° (for the third harmonic of the 19kHz pilot signal). Further, the phase of the 57kHz sub-carrier can be changed within the range of ±10° by the unit of 1°.

(8) Excellent 57kHz carrier suppression ratio.

(9) The RDS (Radio Data System) data signal and 1187.5Hz clock signal for synchronization may be output from the rear panel.
The 1187.5Hz clock signal can be inverted.

o Operation

(1) Data can be set or modified easily on the LCD by use of numeric keys and rotary knob.

o Memory fanction

(1) All data displayed on the panel and RDS (Radio Data System) data may be stores in memory. Up to 100 points of data can be stored and recalled.

o External control

(1) Standard GP-IB and RS-232C interfaces.

(2) All front operations may be controlled in the remote mode.

2. SPECIFICATIONS

o RDS (Radio Data System) signal

Frequency/Accuracy:	57kHz ±3Hz
Modulation range:	0 to 10%
Resolution:	0.01%
Frequency phase:	0° or 90° (for the third harmonic of the 19kHz pilot signal)
Adjustable range:	±10°
Resolution:	1°
Sub-carrier suppression ratio:	50dB or more
Switching function:	ON/OFF of TP, TA, and M/S ON/OFF of RDS (Radio Data System) signal
Data sets :	PI, PS, PTY, TP, TA, M/S, DI, AF, PIN, ON, RT, CT
Group type:	0A-FB (15B) and user-defined group("UD1","UD2")
Data source:	all 0, all 1
Data output:	TTL level (rear panel)
1187.5Hz clock output:	TTL level (rear panel)
Drop-out input:	TTL level (rear panel)

o TRI (= ARI) signal (Traffic Radio Infomation)

SK (Trasmitter Identification Signal)

Frequency/Accuracy:	57kHz ±3Hz
Modulation range:	0 to 10% prescribed level 4.7% RDS at 100% 5.3% TRI at 100%
Resolution:	0.1%
Accuracy:	(indicated value ±2)%

DK (Announcer Identification Signal)

Modulation frequency:	125Hz(1/456 of 57KHz)
Modulation level:	0 to 40% (prescribed level 30%)
Resolution:	1%
Accuracy:	(indicated value ±5)%
Distortion factor:	At demodulation bandwidth 15Hz to 15kHz ≦0.8%

BK (Area Identification Signal)

Modulation frequency:	A	23.75Hz (1/2400 of 57kHz)
	B	28.27Hz (1/2016 of 57kHz)
	C	34.93Hz (1/1632 of 57kHz)
	D	39.58Hz (1/1440 of 57kHz)
	E	45.67Hz (1/1248 of 57kHz)
	F	53.98Hz (1/1056 of 57kHz)

Modulation level:	0 to 80% (prescribed level 60%)
Resolution:	1%
Accuracy:	(indicated value ±5)%
Distortion factor:	At demodulation bandwidth 15Hz to 15kHz ≦0.8%
Area selection:	numeric key and rotary knob

Area/Scan function

Scan interval:	0.1s-12.0s (10.5s)
Resolution:	0.1s (0.0875s)
Skip function:	Each area possible (set to pass)
DK,BK signal output:	Output when SK is OFF
	DK approx. 0.3Vrms at 30% modulation
	BK approx. 0.6Vrms at 60% modulation

o Stereo/Monophonic signal

Frequency characteristics

Stereo:	30Hz to 15kHz	±0.3dB (1kHz reference)
Monophonic:	30Hz to 80kHz	±0.5dB (1kHz reference)

Modulation range

Stereo:	0-100%
Monophonic:	0-100%
Resolution:	0.5%
Accuracy:	(indicated value ±5)%
Distortion factor:	At demodulation bandwidth 30Hz to 15kHz
	200Hz to 10kHz ≦0.01%
	30Hz to 15kHz ≦0.05%
S/N Ratio:	At demodulation bandwidth 30Hz to 15kHz ≧86dB
Separation:	30Hz to 15kHz ≧66dB
Composit output range:	1.5Vp-p to 10Vp-p open-circuit voltage

Resolution: 10mVp-p
Accuracy: (indicated value ±5)%
Impedance: approx. 75Ω unbalanced

Pilot signal
Frequency/Accuracy: 19kHz/±1Hz
Modulation range: 0 to 15% 10% prescribed level
Resolution: 1%
Accuracy: (indicaded value ±2)%
Pre-emphasis: off, 25μs, 50μs, 75μs

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

Extarnal modulation input
a) AF/L
Frequency range
Stereo: 30Hz to 15kHz
Monophonic: 30Hz to 80kHz
Input voltage: 3Vp-p (with HI-LO monitor for ±2% of input voltage)
Input impedance: approx. 10kΩ unbalanced

b) R
Frequency range
Stereo: 30Hz to 15kHz
Input voltage: 3Vp-p (with HI-LO monitor for ±2% of input voltage)
(Check the input voltage by connecting R signal to AF/L input terminal.)
Input impedance: approx. 10kΩ unbalanced

Internal modulation generator output
Frequency: According internal modulation generator frequency
Output voltage: approx. 1Vrms open-circuit
Impedance: approx. 600Ω unbalanced
Distortion factor: At demodulation bandwidth 30Hz to 15kHz
≦0.01%

Pilot output

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

SCA input

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

Display function: Menu screens are switched from one to another by MENU key and F1-F5, and the generated/edited data and specified modulation level, output level, and functions are displayed.

Setting modes

Monophonic/Sterec signal: MONO, MAIN, LEFT, RIGHT, SUB
Modulation: MOD, ON/OFF
Pilot signal: PILOT ON/OFF
RDS signal: TP, TA, M/S, RDS ON/OFF
TRI signal: SK, DK, BK

Setting functions:

1) Setting of monophonic/stereo modulation level, pilot level, output level, RDS modulation level, data, TRI modulation level, memory, etc. using the ten key and rotary knob.
2) Preset keys
   Monophonic 100% (output level set)
   Stereo 100%, 30%
   RDS 100%
   TRI 100%

Memory function:

1) 100 points can be used (10 points x 10, or 100 points x 1). Monophonic/stereo modulation level, pilot level, RDS modulation level, data, TRI modulation level, specified modes, etc. can be memorized.
2) Store (with indicator)
3) Recall
4) Increment/decrement of memory address
5) Returning of memory address

Remote control: Same controls as the front pannel

GP-IB Interface: Interface function

Function	Code	Comments
Transmission Handshake	SH1	Has functions
Reception Handshake	AH1	Has all functions
Talker	T6	Has functions
Listener	L3	Basic listener func. only
Service Request	SR1	Has functions
Remote/Local	RL1	Has all functions
Parallel Pole	PP0	Has no functions
Device Clear	DC1	Has all functions
Device Trigger	DT0	Has no functions
Controller	C0	Has no functions

SIO interface (conforming to RS-232C)

Baud rate: 300, 600, 1200, 2400, 4800, 9600

Data length: 7 bits or 8 bits

Stop bit: 1 bit or 2 bits

Parity check: Even parity, odd parity, or none

Others: Asynchronous

Backup Battery Provided

Power Source: AC 100, 115, 215, 230V ±10% (Max. 250V)
(selected by a switch on rear panel)

Frequency: 50Hz/60Hz

Power dissipation: Approx. 33VA

Size and Weight

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

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

Weight: Approx. 7kg (15.4 lbs)

Environmental Conditions (temperature and humidity)

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

Accessories:	Output cable (SA570)	1
	Power supply cord	1
	Fuse (1.0A)	1
	Fuse (0.5A)	1
	Operation manual	1

Option: Supporting software for PC9801

3. PREPARATION FOR USE

3.1 Unpacking and Inspection

Before being shipped from the factory, the KSG3400A goes through thorough mechanical and electrical examinations and inspections, and its correct operation is confirmed and guaranteed.

On receiving the instrument, inspect it for any damage that may have been caused during transportation. Should a damage be found, notify the Sales Office immediately.

3.2 Line Voltage and Fuse Selection

Select a voltage range from the table below by the voltage selection pulg on the rear panel of KSG3400A, and the instrument can be used in the selected voltage range.

Before connecting the power supply cord to the instrument, verify that the voltage selection is matched to the power source. When the voltage range is changed, change the fuse also according to the table below. Application of a voltage beyond the selected range will cause in complete operation or failure.

Setting Position	Center Voltage	Line Voltage Range	Fuse
A	100V	90 - 110V	1.0A
B	115V	104 - 125V	
C	215V	194 - 236V	0.5A
D	230V	207 - 250V	

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

The KSG3400A operates correctly in temperatures from 0 to 40°C (32 to 104°F). If the instrument is used or placed under high temperature and humidity for a long time, failures will occur and the life of the instrument will be shortened.
The instrument requires the warm-up time of 30 minutes. Do not use the instrument near a strong magnetic field or electromagnetic waves.

3.4 Cautions on Rack Mounting

It is recommended to use supporting angles for rack mounting.

Secure a space of at least 50 mm above and below the instrument for the cooling air ventilation.

4. OPERATION

The front panel and rear panel are illustrated in Sections 4.3 and 4.4. The numbers ① to ㉖ given in these illustrations correspond to the encircled numbers used for the explanation in the entire Section 4.

4.1 Front Panel Features

① "POWER"

When the power switch is pressed, the KSG3400A is powered on; when it is pressed again, the KSG3400A is powered off.

When the KSG3400A is powered on, all the indicators on the front panel lights up first. Then, the indicators return to their respective states found when the KSG3400A was powered off previously.

Note, however, that the ④ "19kHz LOCK" indicator does not return to the previous state.

② "MEMORY" display

The column address and row address of the memory are displayed.

The left value is the column address, and the right value is the row address.

The memory can be used either as a continuous area of 100 points (00-99) or as an area divided into ten blocks (each block consisting of 10 points). The monophonic/stereo modulation level, pilot level, modulation mode, RDS (Radio Data System) data, TRI modulation level, and area identification signal that are displayed on LCD can be stored in the memory.

③ MEMORY keys

③-a Recall method

(1) Press SINGLE STEP △, and data is recalled from the row address incremented by one step.
Press SINGLE STEP ▽, and data is recalled from the row address decremented by one step.

(2) Press RCL and a numeric key, and data is recalled from the specified column.

(3) Press ⑭ RCL and . , and the column and row addresses are cleared from the display. Then, enter a 2-digit number by numeric keys, and data can be recalled from the column and row specified by the number.

(4) Press ⑭ RCL and - , and the row address is cleared from the display. Then, enter a 1-digit number by a numeric key, and data can be recalled from the row specified by the number.

③-b Store method

(1) Press ⑭ YE and STO (RCL), and the ② STO indicator lights up in green color. Then, enter a 1-digit number by numeric key, and the STO indicator goes off and the data such as modulation level, pilot level, RSD (Radio Data Systen) data, and TRI modulation level is stored in the first column of a block.

(2) Press ⑭ YE , STO (RCL), and NEXT (△), and the data such as modulation level, pilot level, RDS (Radio Data system) data, and TRI Modulation level is stored in the row address next to the displayed row address.

(3) Press ⑭ YE , STO (RCL), and . , and the column and row addresses are cleared from the display.
Then, enter a 2-digit number by numeric keys, and the data such as modulation level, pilot level, RDS (Radio Data system) data, TRI Modulation level is stored in the column and row specified by the number.

(4) Press ⑭ YE , STO (RCL), and - , and the row address is cleared from the display. Then, enter a 1-digit number by numeric key, and the data such as modulation level, pilot level, RDS (Radio Data system) data, and TRI Modulation level is stored in the row specified by the number.

(5) Press ⑭ YE , STO (RCL), and RTN (▽), and a RTN command is stored in the displayed row address and the data in the memory block can be recalled endlessly.

④ LEVEL HI-LO indicator

Use the LEVEL HI-LO indicator for checking the proper input level of the external modulation signal connected to ⑤ AF/L input connector, which is approximately 3Vp-p.

If no signal is connected to ⑤ AF/L input connector in the external modulation mode, "LO" of the LEVEL HI-LO indicator is turned on.

⑤ AF/L input, INT OSC OUTPUT 1V rms/600

This is a BNC connector, and it can be used in the following three ways:

(1) When EXT is selected, this connector is used as AF input terminal to which a monophonic external signal is supplied.

(2) When EXT L/R is selected, this connector is used as the L (left) side input terminal for external stereo modulation signal.

(3) When 30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10kHz, or 15kHz of SOURCE is selected, this connector functions as internal oscillator output terminal, so that the KSG3400A can be used as a low distortion spot oscillator of synchronization signal generator.

⑥ R input, PILOT OUTPUT 1V rms/600Ω

This is a BNC connector, and it can be used in the following two ways:

(1) When EXT L/R is selected, this connector is used as the R (right) side input terminal for external stereo modulation signal. To check the level of the signal to be input to ⑥ R, connect the signal to ⑤ AF/L and use ④ LEVEL HI-LO.

(2) When other than EXT L/R is selected, a stereo phase monitoring pilot signal is output from this connector. The output level is 1V rms and the output impedance is approximately 600Ω.

⑦ LCD

The LCD displays such information as the monopfonic stereo modulation level of RDS (Radio Data System) signal, pilot level, RDS (Radio Data System) data, modulation level and area of TRI signal. and output level. By using numeric keys and rotary knob, monophonic stereo modulation level, pilot level, modulation level of RDS signal, output level, and modulation level of TRI signal can be specified and the RDS data can be generated and edited.

⑧ Function keys F1-F5

The function keys move the cursor on ⑦ LCD and switch screens.

⑨ CONTRAST

The CONTRAST volume dial changes the contrast of the ⑦ LCD.
Adjust this dial to the position that makes the displayed data easiest to read.

⑩ Stereo

(1) MONO , MAIN , LEFT , RIGHT , and SUB keys

Use these keys for selecting monophonic modulation mode or stereo modulation modes.
When a mode is selected, the corresponding key lights up.

(2) PILOT ON key

ON/OFF key for pilot signal

(3) MOD ON key

ON/OFF key for monophonic and stereo modulation

(4) ⑭ YE and ⑩ SET (MONO) keys

When these keys are pressed, the following conditions are set: Monophonic modulation 100%, pilot level off, RDS modulation off, TRI modulation off, internal modulation 1 kHz, and output level 3Vp-p.

(5) ⑭ YE and ⑩ 100% (MAIN) keys

When these keys are pressed, the following conditions are set: Stereo modulation 90%, pilot 10%, RDS modulation off, and TRI modulation off.

(6) ⑭ YE and ⑩ 30% (LEFT) keys

When these keys are pressed, the following conditions are set: Setereo modulation 27%, pilot 10%, RDS modulation off, and TRI modulation off.

⑪ RADIO DATA

(1) TP , TA , and M/S keys

Realtime modificatin switches for "TP","TA", and "M/S" bits in RDS (Radio Data System) signal group data.

(2) ON key

ON/OFF key for RDS signal (DSB signal of 57kHz sub-carrier suppression). When the key lights up, the ON state is selected.

(3) ⑭ YE and ⑪ 100% (TP) keys

When these keys are pressed, the following conditions are set: Stereo modulation 85%, pilot 10%, RDS modulation 1.6%, SK modulation 4.7%, DK modulation 30%, BK modulation 60%, and area A.

⑫ TRI=TRAFFIC RADIO INFORMATION

(1) SK , DK , and BK keys

ON/OFF keys for the SK, DK, and BK traffic information signals. The signals are ON when the corresponding key indicators are on.

(2) ⑭ YE and ⑫ 100% (SK) keys

When these keys are pressed, the following conditions are set: Stereo modulation 85%, pilot 10%, RDS modulation 1.6%, SK modulation 5.3%, DK modulation 30%, BK modulation 60%, and area A.

⑬ LOCAL key

(1) LOCAL key

When the KSG3400A is controlled by an external instrument, the REMOTE indicator lights up in red color, but the KSG3400A can be returned to the local control state by pressing the LOCAL key on the front panel.

Note, however, that this key is disabled when the KSG3400A is in local lock out state.

(2) REMOTE indicator

The REMOTE indicator lights up when the KSG3400A is in remote control state and goes off when it is in local control state.

(3) ADDRESS key (⑭ YE + LOCAL)

Press ⑭ YE key and LOCAL key successively, and the GP-IB device address "11" is displayed on ⑦ <GP-IB address> screen.
If an address other than "11" is set, the set address is displayed.
To return to the preceding screen, press a MENU key.

⑭ DATA ENTRY

(1) YE key

To execute the function indicated in yellow color on the front panel, press the YE key (shift function key) and the key for that function successively.

(2) STREO RADIO DATA, TRI, EON (YE RADIO DATA), and SYSTEM (YE TRI) keys

These keys switch the current screen to <Stereo=STEREO>, <Radio Data System main=RADIO DATA>, <Traffic Radio Information=TRI>, <Other Net.n=ON>, and <Radio Data System SYS=SYSTEM> screens respectively.

(3) Numeric keys

Use these keys for entering numeric values (0-9) and the symbols "." and "-".

(4) YE + A (1) to F (6) keys

Use these keys for entering the letters "A" to "F".

(5) ENTER key

Press this key to indicate termination of data entry. However, it need not be pressed after specifying a ② memory address or setting data by rotary knob.

(6) MHz and kHz keys

Press one of these keys to indicate termination of AF (alternative frequencies) entry.

(7) ⇐ key

BS (back space) key.
Use this key for correcting the entered numeric values or rewriting screens.

(8) △ ▽ ◁ , and ▷ keys

Use these keys for moving the cursor on ⑦ LCD.

(9) Rotary knob

Use the rotary knob for modifying data at the cursor position.

⑮ SCOPE PHASE

Minor adjustment volume for adjusting the phase of the oscilloscope to monitor the phase of 38kHz subcarrier and pilot signal.

⑯ COMPOSITE OUTPUT (Z=75Ω)

BNC output connector for the composite signal composed of stereo signal, RDS (Radio Data System) signal, and TRI signal.

Since the output impedance is approximately 75Ω, the composite signal can be supplied to the FM standard signal generator or transmitter whose input impedance is either high or low.

The output level is within the range from 1.5Vp-p to 10Vp-p.

4.2 Rear Panel Features

⑰ SIO

Use this connector for controlling the KSG3400A through a serial interface (RS-232C).

⑱ SCA INPUT

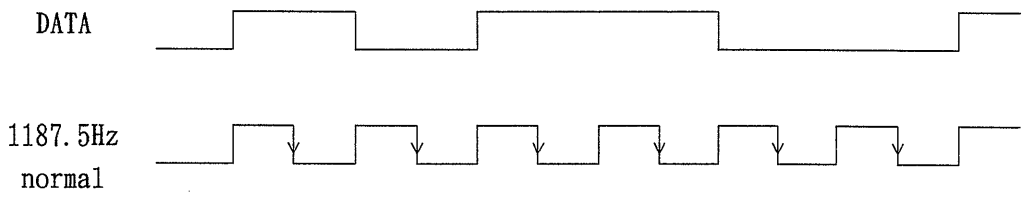
BNC connector used as SCA signal input terminal.
The input impedance is approximately 10kΩ, and the input level required for 10% modulation is approximately 1V rms.
When the SCA signal input is unnecessary, do not connect anything to this connector.
See Section 4.16 for details.

⑲ DROP CONTROL INPUT (TTL)

When a signal of TTL low level is input, the output level (RDS signal + TRI signal) becomes the drop out level specified on the front panel.

⑳ OUTPUT (TTL) DATA

The RDS (Radio Data System) data is output through this BNC connector on TTL level. The data timing is as follows:



Whether the data is to be sampled by the rising portion or the falling portion of clock signal can be specified on the 〈Hard set Information〉 screen (Section 4.8.17).

㉑ OUTPUT (TTL) 1187.5Hz

Through this BNC connector, the clock signal of RDS (Radio Data System) data is output on TTL level.

㉒ FUSE

Fuse for AC power source. The fuse must match the AC line voltage.
The applicable fuse is indicated on the rear panel.

㉓ AC connector

AC power inlet.

㉔ REMOTE

This connector can be used for the following two purposes:

(1) To control the functions on front panel by an external instrument

(2) To dump the contents of memory to another instrument of the same type

㉕ GP-IB

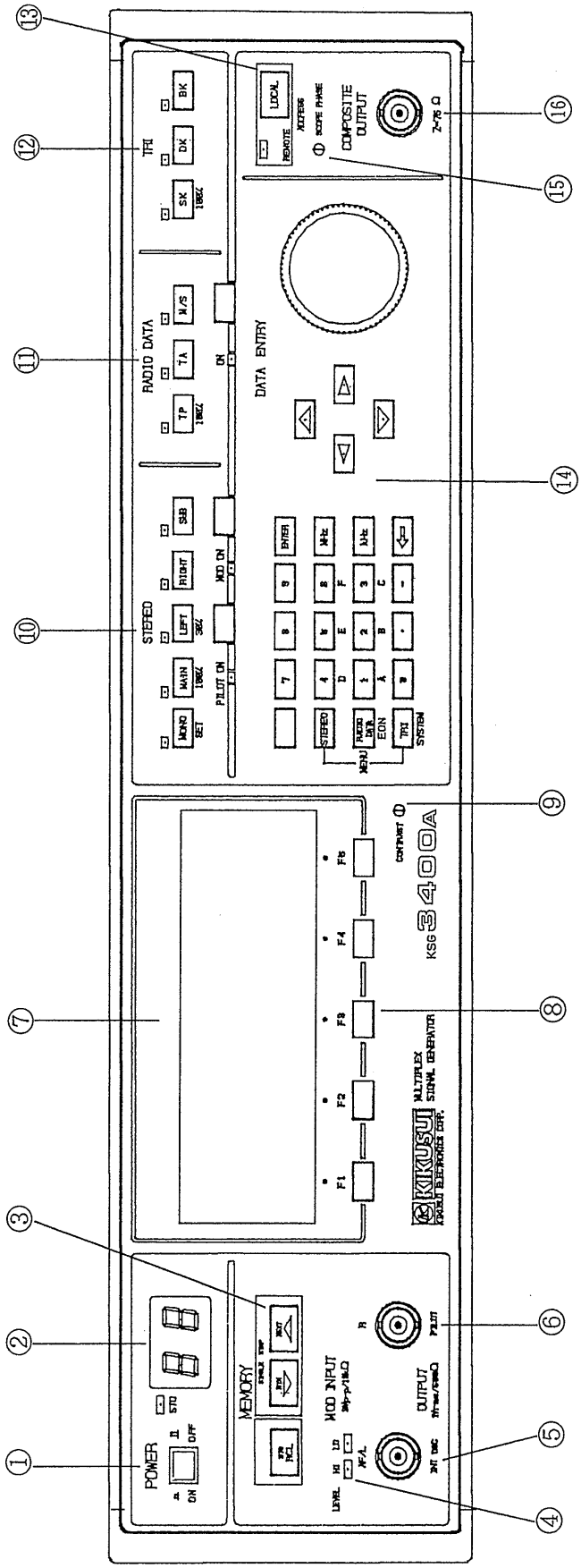
Use this connector for controlling the KSG3400A through GP-IB.

㉖ VOLTAGE SELECTOR

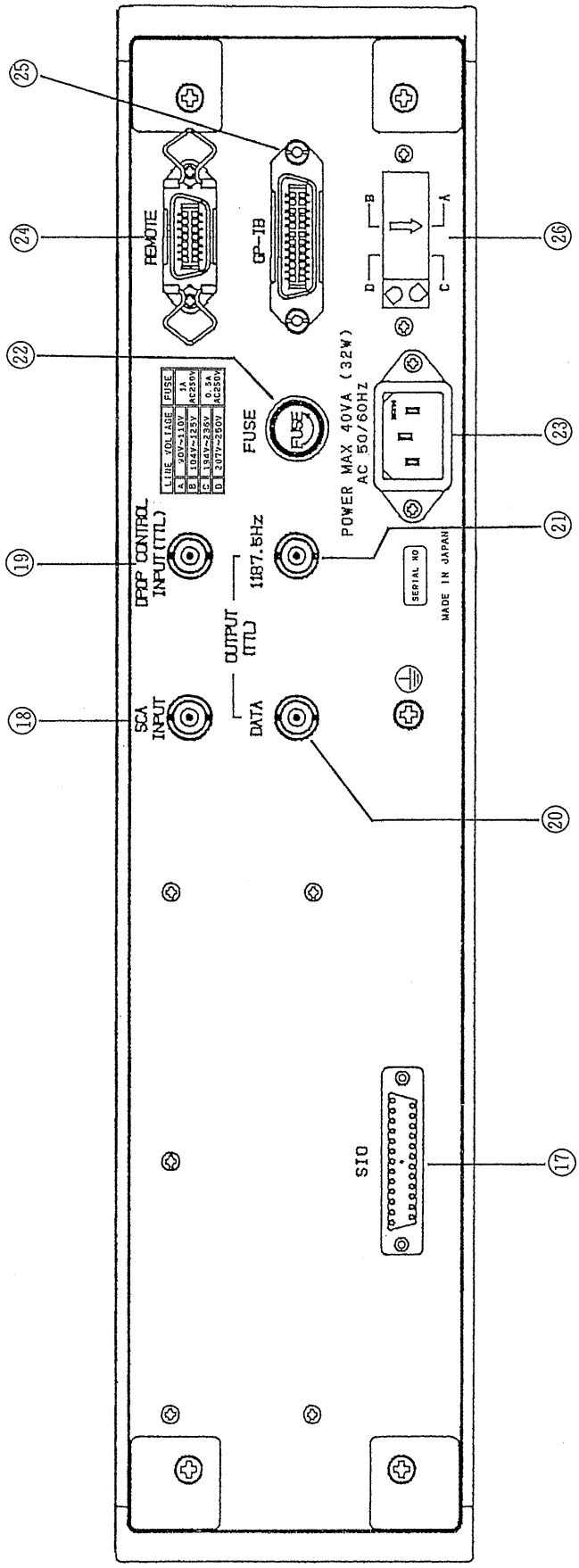
AC power source voltage selector.

Insert the plug according to the AC line voltage (the arrow on the plug indicates the correct position). See Section 3.2.

4.3 Front Panel



4.4 Rear Panel



4.5 Power-On Procedure

Connect the power supply cord to the power source of proper voltage, and press the ① POWER switch.

All the indicators on the front panel light up and then return to their respective states found immediately before the power was turned off previously. The ④ "19kHz LOCK" indicator, however, may not return to its previous state.

Note 1: When the supporting software is to be used, connect the KSG3400A to a personal computer by RS232C and power on the personal computer first. The KSG3400A should be powered on after the personal computer.

Note 2: If the KSG3400A stops its operation because of a shock to a connector during control by the supporting software, press the ① POWER switch while pressing the ⑬ YES key in order to reset the KSG3400A (see Section 8.2 (2) "Software Reset"). Then, confirm operation of the KSG3400A by pressing any key on the front panel and restart the supporting software. At this time, the KSG3400A is initialized as explained in Note 3.

Note 3: When the instrument is shipped from the factory, the memory of 100 points (00-99) contains the following initial values; "Mod = 85%, pilot level = 10%, internal modulation oscillator frequency = 1kHz, and pre-emphasis = off" as stereo modulation parameters, "all 0" as RDS (Radio Data System) data, "SK = 4.7%, DK = 30%, BK = 60%, area = A, Scan = off, and Time = 1.0S" as traffic information (TRI), and "Tone = off". With these initial values, the data of "group type 15B, PI 0000, TP 0, TA 0, PTY 0, M/S 0, DI 0" is output from the KSG3400A.

4.6 Simplified Operation Method

(1) Press ⑭ YE and ⑩ SET (MONO) keys, and the monophonic modulation level is set to 100%, MOD ON key indicator lights up, the internal modulation frequency oscillator is set to 1kHz, the output level is set to 3.00Vp-p, and the external modulation input level of the FM standard signal geneator (hereafter abbreviated as SG) can be set. Adjust the external modulation input level of SG to the proper level by changing the output level of 3.00Vp-p by ⑭ rotary knob and using the HI-LO indicator of SG.
Also, adjust the 100% modulation level to 75kHz deviation.
See Section 4.9 for the detailed method of setting each level.

(2) Press ⑭ YE and ⑩ 100% (MAIN) keys, and the stereo modulation level is set to 90%, MAIN , PILOT ON , and MOD ON key indicators light up, and the sum of stereo modulation level and pilot level is output.
Each time ⑩ MAIN , LEFT , RIGHT , and SUB keys are switched from one to another in this state of 100% composite output, the HI and LO indicators of the SG connected to ⑯ "COMPOSITE OUTPUT" may light up alternately, but it can be ignored because it is not a serious error.
When ⑩ MONO is selected, however, the LO indicator lights up because the output signal becomes a monophonic modulation signal of 90%.

(3) Press ⑭ YE and ⑩ 30% (LEFT) keys, and the stereo modulation level is set to 30% and MAIN , PILOT ON , and MOD ON key indicators light up. The total modulation level is 37%, which is the sum of the stereo modulation level of 27% (=90% x 0.3) and the pilot level of 10%. In this case, if the KSG3400A is used with SG, the LO indicator of the SG lights up.

(4) Press ⑭ YE and ⑪ 100% (TP) keys, and MAIN , PILOT ON , MOD ON RDS ON , SK , DK , and BK key indicators light up, the stereo modulation level is set to 85%, pilot level is set to 10%, RDS modulation level is set to 1.6%, SK modulation level is set to 4.7%, DK modulation level is set to 30%, BK modulation level is set to 60%, and the composite signal whose level is 99.7% in total is output from ⑯ "COMPOSITE OUTPUT".

(5) Press ⑭ YE and ⑫ 100% (SK) keys, and MAIN, PILOT ON, MOD ON SK, DK, and BK key indicators light up, the stereo modulation level is set to 85%, pilot level is set to 10%, SK modulation level is set to 5.3%, DK modulation level is set to 30%, BK modulation level is set to 60%, and the composite signal whose level is 100.3% in total is output. When the BK key indicator is turned off, only the DK modulation signal is output, and when only the BK key indicator is turned on, only the BK modulation signal output.

4.7 Screen (LCD) Operation Flow

Sections 4.7.1, 4.7.2, 4.7.3, 4.7.4, and 4.7.5, explain the screen flows selected by the ⑭ MENU STEREO, RADIO DATA, EON (YE RADIO DATA), TRI, and SYSTEM (YE TRI) keys respectively.
Choose the desired screen by referring to the flowcharts.
In the flowcharts, the mark "#" indicates the function enabled after the YE key is pressed.

Explanation common to all screens

(1) The screen information enclosed in brackets 〈 〉 means that Pressing of the specified function key switches the current screen to the corresponding screen.
The screen information not enclosed in brackets 〈 〉 means that pressing of the specified function key moves cursor to the position of the corresponding code or executes ON/OFF toggle operation.

(2) When the YE key is pressed, the mark "*" which indicates the shift function state appears in the lower right-hand corner of the screen. In this state, if the key pressed after the YE key is a function key, the corresponding shift function is selected, and if the key pressed after the YE key is not a function key, the function indicated in yellow letters is selected.
When the YE key is pressed again, the KSG3400A is released from the shift function state.
See Section 4.8 for the explanation of each screen.

(3) Any screens can be directly switched to the screens selected the MENU STEREO, RADIO DATA, TRI, EON (YE RADIO DATA), and SYSTEM (YE TRI) keys.
To switch a screen in the shift function state to the screen selected by STEREO, RADIO DATA or TRI, release the KSG3400A from the shift function state by pressing the YE key or press the STEREO, RADIO DATA or TRI key twice.

(4) If the rotary knob is turned quickly, the liquid crystal display screen may be disturbed.
In this case, rewrite the screen by pressing the ⇐ key.

4.7.1 Flow selected by MENU STEREO key.

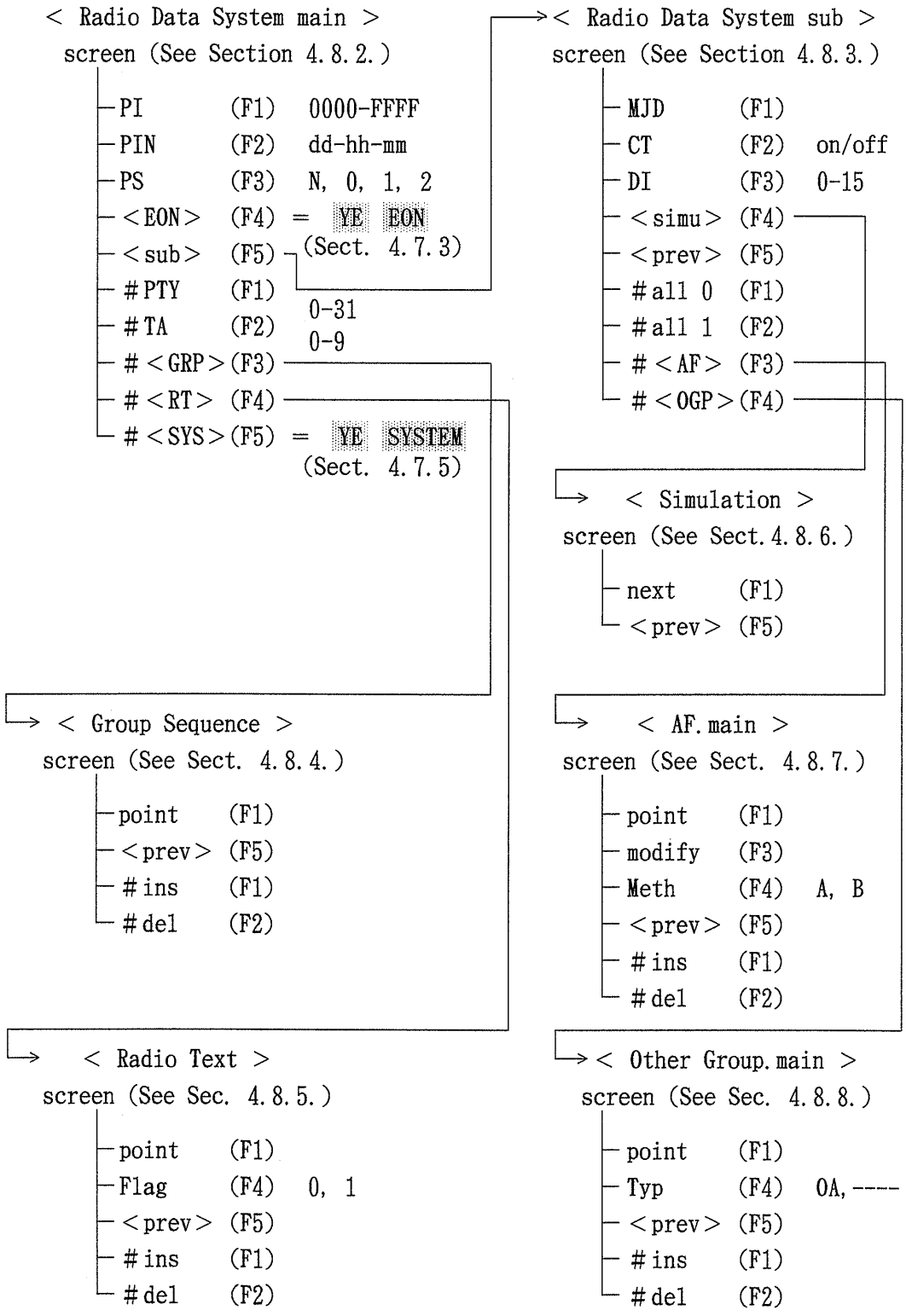
When the MENU STEREO key is pressed, the <Stereo> screen is displayed.

<Stereo>
Screen (See Section 4.8.1)

├	Mod	(F1) Modulation level	0-100%
├	Pilot	(F2) Pilot level	0-15%
├	Sourec	(F3) EXT, 30Hz-15kHz	
├	Pre-em	(F4) off, 25μS, 50μS, 75μS	
├	L/R	(F5) EXT L/R	
├	# Tone	(F1) on/off	
├	# Scan	(F2) on/off	
├	# AREA	(F3) Area A-F	
└	# Time	(F4) pass, 0.1-120S	

4.7.2 Flow selected by MENU RADIO DATA key

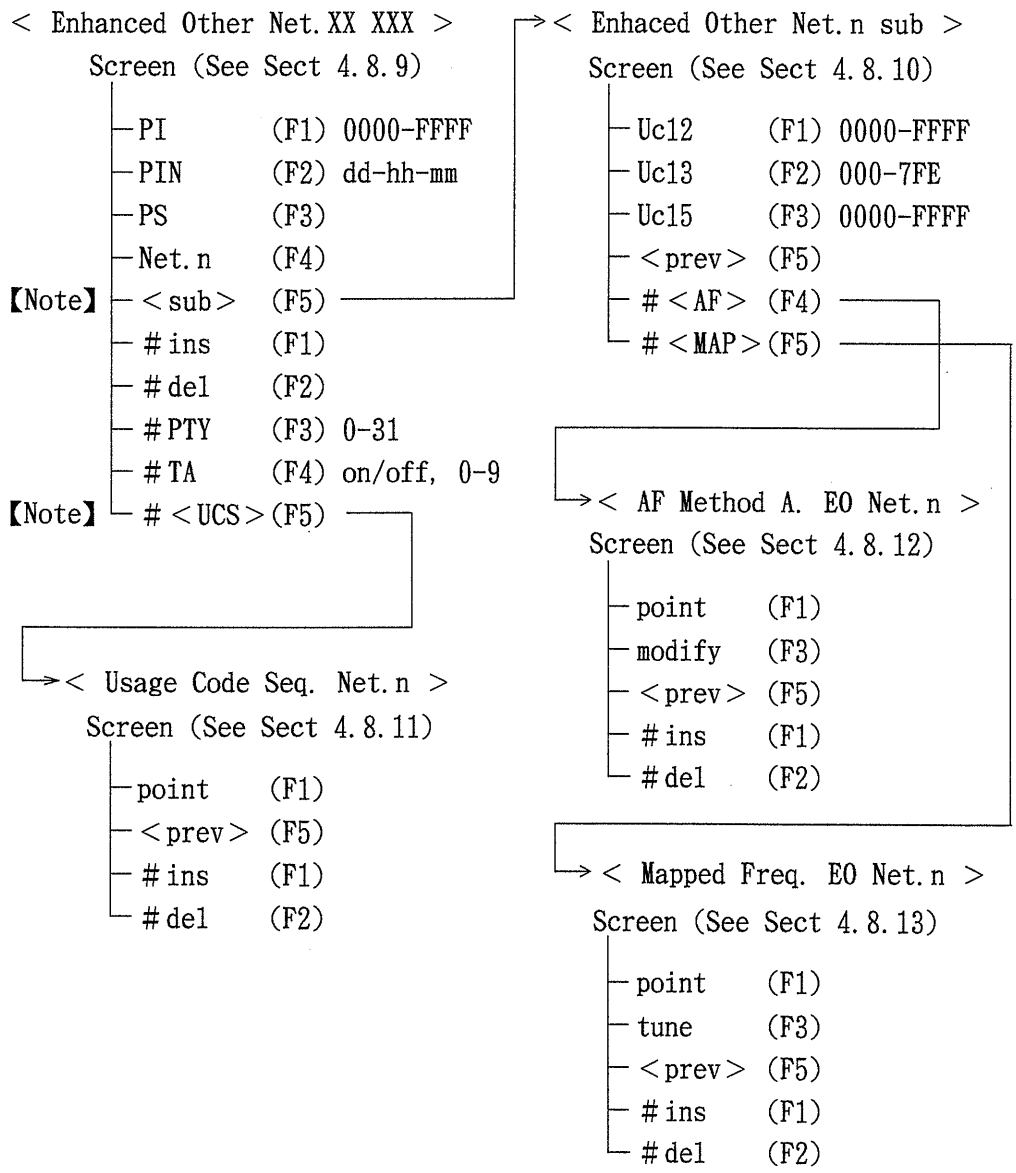
When the MENU RADIO DATA key is pressed, the 〈Radio Data System main〉 screen is displayed.



4.7.3 Flow selected by MENU YE , EON key

When the <EON> key or the MENU YE EON (YE RADIO DATA) key is pressed on the <Radio Data System main> screen, the <Enhanced Other Net ......> or <Enhanced Other Net.01 on/ off> screen is displayed.

In the flowchart, the mark "#" indicates the function enabled after the YE key is pressed.



Note: When the data area is not secured, "...." is displayed in the place of "<sub>" or "<UCS>". "<sub>" or "<UCS>" is displayed when the ins key is pressed after YE key. See Section 4.8.9 for details.

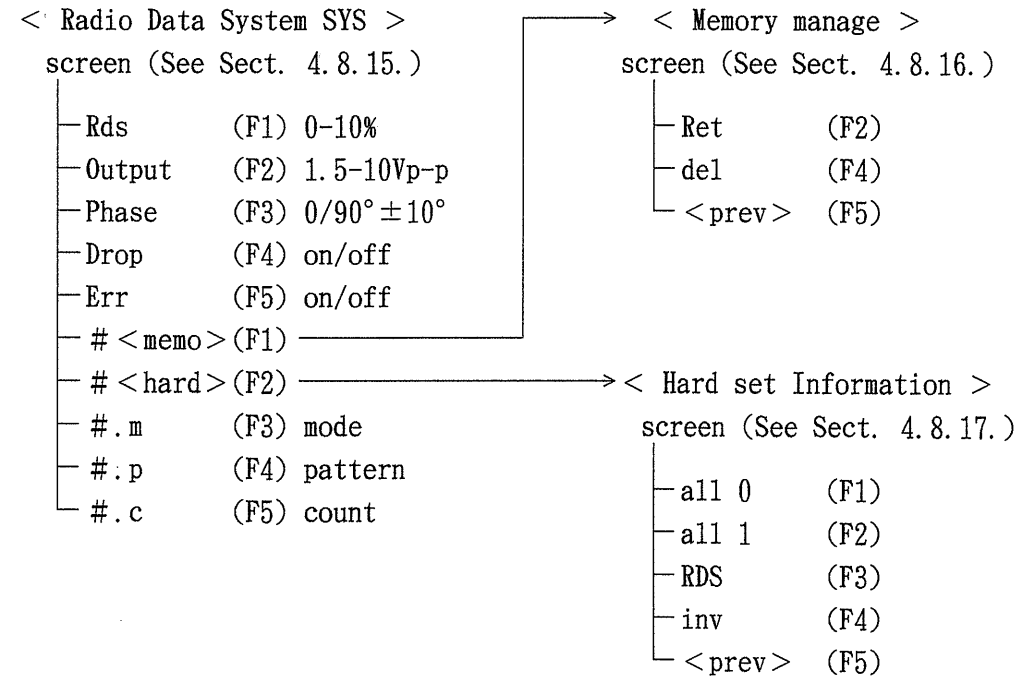
4.7.4 Flow selected by MENU TRI key

When the MENU TRI key is pressed, the 〈Traffic Radio Information〉 screen is displayed.

```
< Traffic Radio Information >
    screen (See Sect. 4.8.14.)
    ├─SK   (F1) modulation factor 0-10%
    ├─DK   (F2) modulation factor 0-40%
    ├─BK   (F3) modulation factor 0-80%
    └─AREA (F4) area  A-F
```

4.7.5 Flow selected by MENU YE , SYSTEM keys

When the MENU YE and SYSTEM (YE TRI) keys are pressed, the 〈Radio Data System SYS〉 screen is displayed.



4.8 Screen Explanation and Operation

4.8.1 <Stereo> screen

Mod: Monophonic/stereo modulation level

The monophonic/stereo modulation level can be set within the range from 0% to 100% by the step of 0.5%.
Use ⑭ numeric keys or rotary knob for setting the modulation level.
When the pre-emphasis is on, however, the allowable range of the modulation level is from 0% to 10%.
See Section 4.9.2 for details.

Pilot: Pilot level

The pilot level can be set within the range from 0% to 15% by the step of 1%.
Use ⑭ numeric keys or rotary knob for setting the pilot level.
See Section 4.9.3 for details.

Source: Selecting external modulation or internal modulation frequency

Select external modulation or an internal modulation oscillator frequency by ⑭ rotary knob. The external modulation and the internal madulation oscillator frequencies become effective in the following order: EXT, 30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10kHz, and 15kHz.

Press ⑧ L/R (F5) key, and ⑩ both LEFT and RIGHT key indicators light up at the same time and stereo modulation is done by using the two external modulation signals connected to ⑤ AF/L and ⑥ R input connectors.
Check the proper input level, which is approximately 3Vp-p, by ④ LEVEL HI-LO indicator.
When no signals are connected to ⑤ AF/L and ⑥ R input connectors, "LO" of ④ LEVEL HI-LO is on.
See Section 4.10 for details.

Pre-em: Setting pre-emphasis

Set the pre-emphasis by using ⑭ rotary knob. The pre-emphasis items become effective in the following order: OFF, 25μS, 50μS, and 75μS.
When the pre-emphasis function is used, the monophonic/stereo modulation level decreases by 20dB. Therefore, the modulation level displayed for MOD is reduced to 1/10.
See Section 4.11 for details.

L/R: The modulation is switched to the stereo modulation of the two external modulation signals connected to ⑤ AF/L and ⑥ R input connectors. See the explanation of Source.

Press YE key, and the following functions are displayed:

Tone: Turns on/off the output of TRI announce signal and area signal. When the output is on, the modulation level can be set but the functions of stereo modulator are disabled.
See Section 4.15 for details.

Scan: Turns on/off the scanning of area signal.
See Section 4.14 for details.

AREA: Area display

Select A, B, C, D, E or F by ⑭ YE and A - F key or rotary knob, and the selected area identification signal (frequency) can be obtained.

Time: Setting area signal scan time

The time can be set within the range from 0.1S to 12.0S by the step of 0.1S, and also, skip can be selected. Use ⑭ numeric keys or rotary knob.

Note: 0.1S is approximately 87.5msec. Therefore, 12.0S is approximately 10.5sec (87.5msec x 120 = 10500msec).
Thus, the unit of S does not represent the actual time of second.

4.8.2 〈Radio Data System main〉 screen

PI: Program identification code

Enter a 4-digit hexadecimal number (0000-FFFF) consisting of 16 bits because four bits are used to identify the country, another four bits are used to identify the region, and the remaining eight bits are used to identify the program service. Enter all the necessary digits of the hexadecimal number. If less than four digits are entered, the remaining digits are considered to be "0".

PIN: Program item number

The broadcast starting time code is sent. This code is used for the receive reservation.

Day: Expressed by five bits. Enter a 2-digit decimal number within the range from 0 to 31.

Hour: Expressed by five bits. Enter a 2-digit decimal number within the range from 0 to 31.
The actual hour is up to 23, but the hour can be set within the range from 0 to 31 for the purpose of program verification, etc.

Minute: Expressed by six bits. Enter a 2-digit decimal number within the range from 0 to 63.
The actual minute is up to 59, but the minute can be set within the range from 0 to 63 for the purpose of program verification, etc.
The values of the day, hour, and minute should be connected by hyphens (example: 20-10-15). The hyphens can be entered by the [-] key.
The day, hour, and minute can be specified by the rotary knob, also.

PS N: Program service name

The abbreviated name of the broadcasting station, program name, etc., are sent.

N specifies the code table as follows:

"0" means the code table in Figure 21 of EBU Tech. 3244-E.
"1" means the code table in Figure 22 of EBU Tech. 3244-E.
"2" means the code table in Figure 23 of EBU Tech. 3244-E.
"n" means that no code table is specified.

To enter the data for PS, move the cursor to the hex display section by the ▷ key. Then, enter the data by the rotary knob or numeric keys. The range of the data that can be entered is from 20 to FF, but the mark "." is displayed for 7F or greater value.
Enter eight ASCII characters as PS, and they are addressed and output in units of two characters starting from the left most character.

〈EON〉: Selecting 〈EON〉 on this screen is equivalent to the pressing of EON (YE RADIO DATA) key explained in Section 4.7.3; That is, the current screen is switched to the 〈Enhanced Other Net.XX XXX〉 screen explained in Section 4.8.9.

〈sub〉: The 〈Radio Data System sub〉 screen explained in Section 4.8.3 is displayed.

When the YE key is pressed, the following functions are displayed:

PTY: Program type. Identifies the contents of program.
The PTY is expressed by five bits; enter a 2-digit decimal number within the range from 0 to 31.

TA n: Traffic information announcement identifier
One bit is used as the signal to indicate that traffic information is being broadcasted.
For TA, enter "1" or "0" by the TA ON/OFF key on the front panel. When "1" is entered, the indicator is turned on.
For n, specify the number of the groups of type 15B to be inserted when TA is changed. The number can be specified within the range from 0 to 9. When 0 is specified, the automatic insertion is not done.

〈GRP〉: The 〈Group Sequence〉 screen explained in Section 4.8.4 is displayed.

〈RT〉: The 〈Radio Text〉 screen explained in Section 4.8.5 is displayed.

〈SYS〉: Selecting 〈SYS〉 on this screen is equivalent to the pressing of SYSTEM (YE TRI) key explained in Section 4.7.5; that is, the current screen is switched to the 〈Radio Data System SYS〉 screen explained in Section 4.8.15.

4.8.3 〈Radio Data System sub〉 screen

The 〈Radio Data System sub〉 screen is displayed when the 〈sub〉 key is pressed on the 〈Radio Data System main〉 screen explained in Section 4.8.2.

MJD: Enter the initial value. When the initial value of MJD is set, the initial value of CT is set also.
"hh:mm ±nn.n" indicates the hour, minute, and local offset time, and it is represented by MJD on the screen.
When the rotary knob is turned, the year, month, and day (eight digits) change in linkage.
The date, expressed by 17 bits, can be specified within the range from March 1, 1900, to February 28, 2100.
Enter a value within the range from 0 to 31 for the hour (hh) expressed by five bits, and a value within the range from 0 to 63 for the minute (mm) expressed by six bits.
Although the actual hour is up to 23 and the actual minute is up to 59, the allowable ranges are 0-31 and 0-63 respectively.
The local offset time (±nn.n) can be specified within the range from ±0 to ±15.5.
The data values should be entered by numeric keys and connected by hyphens (example: 1989-1-20-12-30--15.5). Use the - key for entering the hyphens and minus sign.
The data values can be changed by the rotary knob also.

CT on/off: Clock information in units of minutes. Enables/disables the automatic increment of minute and the 4A interrupt output function.
Each time the CT key is pressed, the state of CT is switched over (from ON to OFF or OFF to ON). The state of CT can be changed by the rotary knob also. When CT is ON, the value of the minute for CT is incremented by 1 at every one minute on the basis of the initial value of MJD and the output group sequence is interrupted by 4A.
Also, when the state of CT is changed from OFF to ON, the value of the minute is incremented by 1 and the output group sequence is interrupted by 4A.
When CT is OFF, the above automatic increment and interrupt functions are disabled. When the KSG3400A is controlled through GP-IB or RS232C, the automatic increment is stopped also. The automatic increment of minute changes the values of hour and date in linkage.

DI: Decoder identifier
Identifies the send state, that is, turns on/off the monophonic/ stereo state, decoder, etc.
For the DI, expressed by four bits, enter a 2-digit decimal value within the range from 0 to 15.

〈Simu〉: The current screen is switched to the 〈Simulation〉 screen explained in Section 4.8.6.

〈Prev〉: The current screen is switched to the previous screen, that is, to the 〈Radio Data System main〉 screen.

When the YE key is pressed, the following functions are displayed:

all 0: All 0 data is output as RDS (Radio Data System) data, and the following message is displayed in the second line of the screen:

..... Output data is all 0 .....

To terminate this state, press the "all 0" key again.

all 1: All 1 data is output as RDS (Radio Data System) data, and the following message is displayed in the second line of the screen:

..... Output data is all 1 .....

To terminate this state, press the "all 1" key again.

〈AF〉: The 〈AF.main〉 screen explained in Section 4.8.7 is displayed.

〈OGP〉: The 〈Other Group.main〉 screen explained in Section 4.8.8 is displayed.

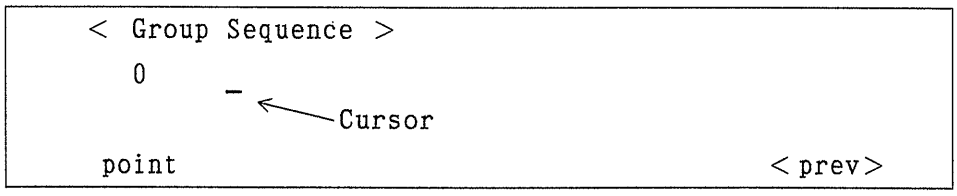
4.8.4 〈Group Sequence〉 screen

4.8.4.1 Screen explanation and operation

The 〈Group Sequence〉 screen is displayed when the YE key and 〈GRP〉 key are pressed successively on the 〈Radio Data System main〉 screen explained in Section 4.8.2.
The group sequence (group type sequence for the data to be output from KSG3400A) can be edited on the 〈Group Sequence〉 screen.
Use the numeric keys or rotary knob for changing group types.
To input the user-defined group types UD1 and UD2, enter "D1" and "D2" by the numeric keys respectively.

point: This function indicates how the group type displayed at the beginning of the first line of the data edit area of the screen is locted in the entire group types.

When no group types are displayed on the screen, "0" is displayed at the point position as follows:



To input the group type 1A on the above screen by numeric keys, press 1 , YE , 1 (A), and ENTER in this order. As a result of this operation, the cursor moves to the next data input position and the screen becomes as follows:

```
< Group Sequence >
   1      1A  _


 point                                    <prev>
```

If the YE and F1 (ins) keys are pressed successively, "15B" is entered and the cursor does not move.
The entered group types can be modified by the rotary knob.
When the cursor is not found in the data edit area, move it to the right by the ▷ key.
Assume that the screen appears as follows as a result of entering group types successively:

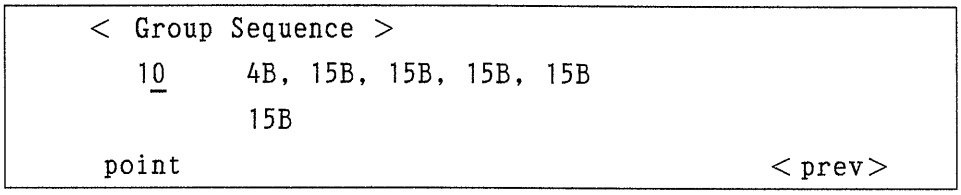
```
< Group Sequence >
   1      0A,  0B,  1A,  1B,  2A,
          2B,  3A,  3B,  4A,  4B,
          15B, 15B, 15B, 15B, 15B
 point                                    <prev>
```

If the F1 (point) key is pressed for the above screen, the cursor moves to the point position, and if the rotary knob is turned clockwise to the utmost, the screen becomes as follows:

```
< Group Sequence >
   15    15B


 point                                    <prev>
```

The value at the cursor position (point position) means that 15 group types have been entered and that the 15th group type is 15B.
If the rotary knob is turned counterclockwise by five steps, five more group types appear on the screen, which indicates that the 10th group type is 4B as follows:



〈prev〉: The current screen is switched to the preceding screen, that is, to the 〈Radio Data System main〉 screen.

When the YE key is pressed, the mark "＊" appears in the lower right-hand corner of the screen and the following functions are displayed:

ins: Data insertion

To insert a group type into the displayed group types, move the cursor to the desired position and press the ins key. Then, "15B" is inserted at that position and the screen returns to the preceding state. Replace "15B" with the desired group type name.

To add a group type to the displayed group types, move the cursor to the position next to the last group type name and enter the desired group type name by using numeric keys.

A group type cannot be inserted by the rotary knob.

Note: "15B" is inserted to secure a data area. The ins function sets "15B" forcibly for the safety of data.

del: Data deletion

Move the cursor to the desired position and press the del key, and the data at the cursor position is deleted and the screen returns to the preceding state.

Note: When deletion of variable length data such as GRP is to be executed on the edit screen, the data is considered to be divided into some pages for the convenience of processing. Each page is deleted except for one data item.

4.8.4.2 User-defined groups UD1 and UD2

UD1: UD1 is the group type in which any one of the offset words (A, B, C, C′, D, E, and F) can be applied to any one of the blocks (1 to 4) and no regulations are imposed on the information word.
For each one of the blocks 1 to 4, enter a 4-digit hexadecimal number as information word and a 3-digit hexadecimal number as offset word.
The 3-digit hexadecimal numbers to be entered as offset words are listed in the table below.
When the data of UD1 is output from the KSG3400A, a check word is calculated for the information word and the specified offset word is added.

Offset word	HEX code
A	0FC
B	198
C	168
C'	350
D	1B4
E	000
F	194

UD2: Enter a 7-digit hexadecimal number as UD2. No regulations are imposed on the information word and check word plus offset word. The data of UD2 is output from the KSG3400A without being processed.

See Section 4.8.8 for the method of editing UD1 and UD2.

4.8.5 〈Radio Text〉 screen

The 〈Radio Text〉 screen is displayed when the YE key and 〈RT〉 key are pressed successively on the 〈Radio Data System main〉 screen explained in Section 4.8.2.
The radio text of up to 64 characters can be edited on this screen.
The radio text characters can be entered in hexadecimal mode by the numeric keys or ins key and can be edited by the rotary knob.

Point: This function indicates how the text character displayed at the beginning of the first line of the data edit area of the screen is located in the entire text characters.

Flag: Turns on/off the Text A/Text B flag by toggle operation.

〈Prev〉: Switches the current screen back to the preceding screen, that is, to the 〈Radio Data System main〉 Screen.

Data entry: Enter data by the numeric keys or ins (YE F1) key in the same method that is explained in Section 4.8.4.
Up to 64 characters can be entered in units of two digits in hexadecimal mode.
The allowable range is from 00 to FF, but the mark "." is displayed for 1F or smaller value and 7F or greater value.

When the YE key is pressed, the following functions are displayed:

ins: The data insertion method is the same as that explained in Section 4.8.4. That is, Press the ins key at the desired cursor position, and a space is inserted at that position. Then, replace the space with the desired data. When the ins key is pressed, the current screen is switched back to the preceding screen.

Note: This ins function inserts a space as above in order to secure a data area.

del: The data deletion method is the same as that explained in Section 4.8.4.

4.8.6. 〈Simulation〉 Screen

Press the 〈sub〉 key on 〈Radio Data System main〉 screen and the 〈simu〉 key on 〈Radio Data System sub〉 screen, and then the 〈Simulation〉 screen is displayed. This screen displays the data to be output from the KSG3400A in hexadecimal mode according to the group type sequence specified in Section 4.8.4.

If 3A or 3B is specified in the group type sequence when other networks 0-7 are off, the data of 3A or 3B is not displayed on the simulation screen because such data is not output from the KSG3400A.

next: The data of the next group type is displayed.

〈Prev〉: The current screen is switched back to the preceding screen, that is, to the 〈Radio Data System sub〉 screen.

Explanation of screen titles

Group: The group type is indicated. The group type code and version code in the information word of the second block are displayed.

e: If an error bit is set, the mark "＊" is displayed.
See Section 4.8.15.

i: The content of the information word is displayed in the form of a 4-digit hexadecimal number. The subscript "1/3" means that the hexadecimal number in the first line is the information word of block 1 and that in the second line is the information word of block 3.
The subscript "2/4" means that the hexadecimal number in the first line is the information word of block 2 and that in the second line is the information word of block 4.

c+o: The content of the check word plus offset word is displayed in the form of a 3-digit hexadecimal number.

Note 1: After data is modified, the modified data is not displayed on the simulation screen immediately; the data of approximately eight groups is displayed before the modified data because there are eight output buffers.

Note 2: When the screen is rewritten by the ⇦ key, the data of only one group is displayed because the data of the next group is displayed.

4.8.7 〈AF.main〉 screen

Press the 〈sub〉 key on 〈Radio Data System main〉 screen and the 〈AF〉 key (YE F3) on 〈Radio Data System sub) screen, and the 〈AF.main〉 screen is displayed.
On this screen, a list of frequencies (alternative frequencies) for a particular program can be edited.
The filler code can be entered by pressing the numeric key "F".
The filler code is displayed as "FL" on the screen.
When Method A is selected, the FM band frequency expressed by "nn.n:" is used as the main transmitter frequency output with the "Number of freq" code.
When Method B is selected, the FM band frequency expressed by "nn.n:" is used as the header frequency.

point: This function indicates how the frequency displayed at the beginning of the first line of the data edit area of the screen is located among the entire frequencies.

modify: The FM band frequency of adjacent region (displayed with the mark "*"), main transmitter frequency of Method A (displayed with the mark ":"), header frequency of Method B (displayed with the mark ":"), alternative frequency, and FM band frequency with offset (+25k, +50k, +75k) are switched over from one to another.

Meth: Method A and Method B are switched over from one to the other.

〈prev〉: The current screen is switched back to the preceding screen, that is, to the 〈Radio Data System sub〉 screen.

Data entry: See Section 4.8.4.
The allowable ranges of frequencies are as follows:
FM: 87.5 - 107.9MHz, by the step of 0.1MHz
MF: 531 - 1602kHz, by the step of 9kHz
LF: 155 - 281kHz, by the step of 9kHz

The MF and LF band frequencies can be modified by the rotary knob after they are entered by numeric keys.

The ENTER or MHz key is used as the terminator of the FM band frequency entry, and the kHz key is used as the terminator of the MF and LF band frequency entry.

When the YE key is pressed, the following functions are displayed:

ins: The data insertion method is the same as that explained in Section 4.8.4. That is, press the ins key at the desired cursor position, and "FL" is inserted at that position.
Then, replace "FL" with the desired data.
When the ins key is pressed, the current screen is switched back to the preceding screen.
Note: The ins function inserts "FL" as above in order to secure a data area.

del: The data deletion method is the same as that explained in Section 4.8.4.

4.8.8 〈Other Group.main〉 screen

Press the <sub> key on the <Radio Data System main> screen explained in Section 4.8.2 and press the YE and <OGP> keys on the <Radio Data System sub> screen; then, the <Other Group.main> screen is displayed. On this screen, the spare bits of Other Groups (group types other than 0A, 0B, 2A, 2B, 14A, 14B, and 15B and user-defined group types UD1 and UD2) can be edited. This instrument treats the spare bits of 1A, 1B, and 4A as those of Other Groups.

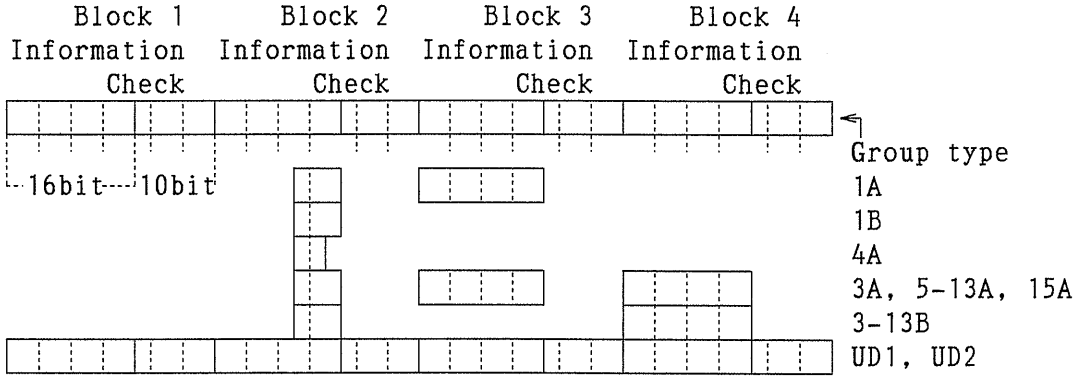
Note: The lowest three bits (unused bits) of information block 2 of group type 14B are not treated as spare bits. "000" is output for those three bits, and no desired value can be entered for them.

point: This function indicates how the Other Group displayed at the beginning of the first line of the data edit area on the screen is located among the entire Other Groups.

Typ: Move the cursor to the position of Other Group type and enter a group type by numeric keys in hexadecimal mode, or select an Other Group type by the rotary knob.

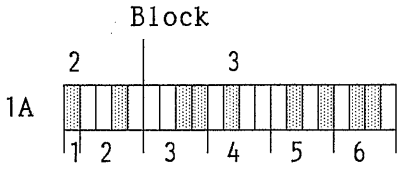
<prev>: The current screen is switched back to the previous screen.

Data entry: The number of the digits of the data to be entered is determined automatically for each group type. The following figure shows the spare bit insertion positions for the respective group types:



Note: The data of each Other Group type is considered to be continuous.

Example: For group type 1A, enter the data in hexadecimal mode considering that the lowest five bits of the information word in block 2 are linked to the 16 bits of the information word in block 3 as follows:



If ▯ is considered as 0 and ▮ as 1, the value in the left figure can be expressed as [123456]HEX.

On the screen below, "0" is displayed at the point position because the data of Other Group 1A is not entered yet.
For example, the data "hh-hhhh-xxxx" should be entered as "12-3456". The part "xxxx" is set by this instrument automatically.

```
< Other  Group.main  >    Typ   1A


   0 hh-hhhh-XXXX


point                      Type <prey>
```

When the YE Key is pressed, the following functions are displayed:

ins: The data insertion method is the same as that explained in Section 4.8.4.
That is, press the ins key at the desired cursor position, and "0" is inserted at that position.
Then, replace "0" with the desired data.

Note: The ins function inserts "0" as above in order to secure a data area.

del: The data deletion method is the same as that explained in Section 4.8.4.

4.8.9 <Enhanced Other Net.XX XXX> Screen

When the <EON> key or the MENU YE EON (YE RADIO DATA) key is pressed on the <Radio Data System main> screen, (1) <Enhanced Other Net.01 on/off> or (2) <Enhanced Other Net .....> is displayed.

(1) <Enhanced Other Net.01 on/off> indicates that the displayed data is entered for Other Network 01.

(2) <Enhanced Other Net... ...> indicates that no data area is secured for Other Networks.

Therefore, data cannot be entered.

```
< Enhanced Other Net .._ .... >
PI  ....          PTY  ..
PIN ........      TA   ...  .
PS   . . . . . .  TP   ...
hex ................

  PI   PIN   PS    Net.n    ....
```

Press the YE key and ins key, and a data area is secured for an Other Network. The repetition of this operation increases the number of networks.

In other words, when the YE and ins keys are pressed, the data area is secured for Other Network .01 as follows:

```
< Enhanced Other Net .01 off  >
PI   0000          PTY    0
PIN  00-00-00      TA   off  0
PS                      TP   off
hex  2020202020202020

  PI    PIN    PS    Net.n   <sub>
```

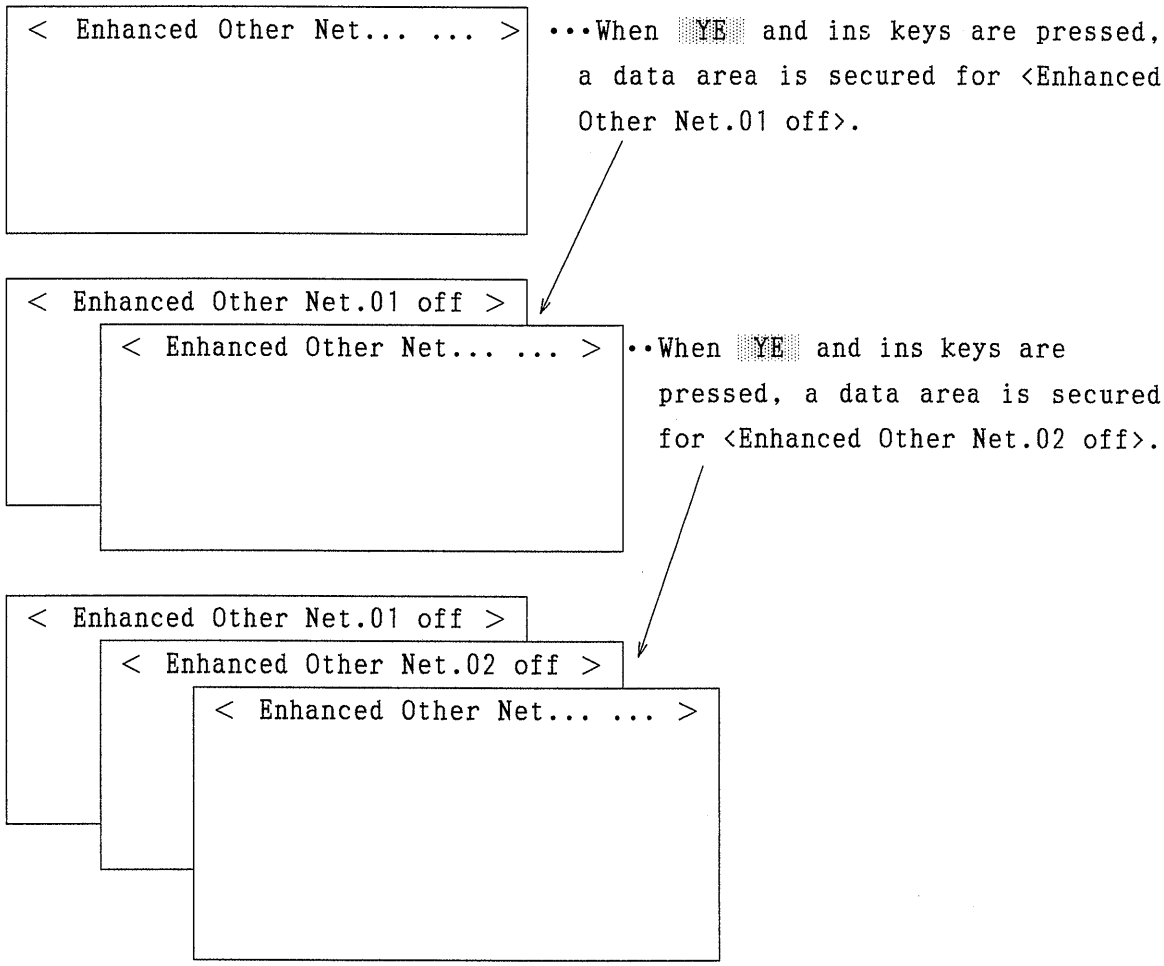
To add the data area of Other Network .02, move the cursor to "Net .01" by pressing the Net.n key and turn the rotary knob clockwise until the <Enhanced Other Net... ...> screen appears.

Press the YE and ins keys, and the data area is secured for Other Network .02 as follows:

```
< Enhanced Other Net .02  off  >
PI   0000          PTY    0
PIN  00-00-00      TA  off  0
PS                     TP   off
hex  2020202020202020

 PI     PIN    PS   Net.n   <sub>
```

To increase the number of Other Networks, repeat the above operation. If the ins key is pressed on the <Enhanced Other Net .01 off> screen, data areas are inserted one at a time.
The following figure illustrates how the data areas of Other Networks are added:



Note: The maximum number of Other Networks is 99 (01 to 99).

PI: EON program identification code

Enter a 4-digit hexadecimal number (0000-FFFF) consisting of 16 bits, of which four bits are used to identify the country, another four bits are used to identify the region, and the remaining eight bits are used to identify the program service. Enter all the necessary digits of the hexadecimal number. If less than four digits are entered, the remaining digits are considered to be "0".

PIN: EON program item number

The broadcast starting time code is sent. This code is used for the receive reservation.

Day: Expressed by five bits. Enter a 2-digit decimal number within the range from 0 to 31.

Hour: Expressed by five bits.

Enter a 2-digit decimal number within the range from 0 to 31.

The actual hour is up to 23, but the hour can be set within the range from 0 to 31 for the purpose of program verification, etc.

Minute: Expressed by six bits.

Enter a 2-digit decimal number within the range from 0 to 63.

The actual minute is up to 59, but the minute can be set within the range from 0 to 63 for the purpose of program verification, etc.

The values of the day, hour, and minute should be connected by hyphens (example: 20-10-15).

The hyphens can be entered by the ⊣ key. The day, hour, and minute can be specified by the rotary knob also.

PS: EON program service name

The abbreviated name of the broadcasting station, program name, etc. are sent. Enter the PS data by the rotary knob or numeric keys.

The range of the data that can be entered is from 20 to FF, but the mark "." is displayed for 7F or greater value. Enter eight ASCII characters.

Net.n: Move the cursor to the position of EON network number. Enter the desired network number by numeric keys or rotary knob.

on/off: Other Network can be turned on/off by the rotary knob.

Information is output only about the Other Network that is in the "on" state.

<sub>: The <Enhanced Other Net.n sub> screen explained in Section 4.8.10 is displayed.

When the YE key is pressed, the following functions are displayed:

ins: Press the ins key when the cursor is at the position of EON network number, and a data area is inserted for the Other Network.

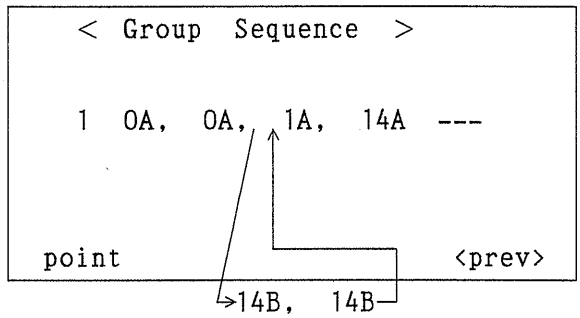
del: Press the del key when the cursor is at the position of EON network number, and a data area is deleted from Other Network.

PTY: EON program type
The PTY is expressed by five bits; enter a 2-digit decimal number within the range from 0 to 31.

TA: Turns on/off the TA of EON. When the TA is turned on, "1" is set, and when it is turned off, "0" is set. The TA can be turned on/off by the rotary knob also.

TA n: "n" specifies the number of the groups of type 14B to be inserted into the normal group sequence when the TA status changes(from "on" to "off" or from "off" to "on") while the TP of EON is on.
The number of inserted groups "n" can be specified within the range from 0 to 9. When 0 is specified, the automatic insertion is not done.

Example:Assume that "TA n = 2" is specified for the following group sequence:



In this example, when TA is turned on or off, two groups of type 14B are automatically inserted as above.

TP on/off: Turn on/off the TP of EON by the rotary knob.
When it is turned on, "1" is set, and when it is turned off, "0" is set.

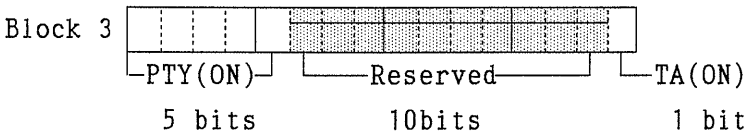
<UCS>: The <Usage Code Seq. Net.n> screen explained in Section 4.8.11 is displayed.

4.8.10 <Enhanced Other Net.n sub> Screen

The <Enhanced Other Net.n sub> screen is displayed when the <sub> key is pressed on the <Enhanced Other Net.n on/off> screen explained in Section 4.8.9.

Uc12: Enter a 4-digit hexadecimal number (16-bit data) for the information block 3 which corresponds to the usage code 12 of type 14A. The allowable range of the hexadecimal number is 0000 to FFFF.

Uc13: Enter a 3-digit hexadecimal number representing 10 bits ("Reserved" bits in the figure below) out of the 16 bits of the information block 3 which corresponds to the usage code 13 of type 14A.
The allowable range of the hexadecimal number is 000 to 7FE.



Uc15: Enter a 4-digit hexadecimal number (16-bit data) for the information block 3 which corresponds to the usage code 15 of type 14A. The allowable range of the hexadecimal number is 0000 to FFFF.

When the YE key is pressed, the following functions are enabled:

<AF>: Displays the <AF Method A. EO Net.n> screen explained in Section 4.8.12.

<MAP>: Displays the <Mapped Freq. EO Net.n> screen explained in Section 4.8.13.

4.8.11 <Usage Code Seq. Net.n> Screen

This screen is displayed when the YE and <UCS> keys are pressed successively on the <Enhanced Other Net.n on/off> screen explained in Section 4.8.9.

4.8.11.1 Usage code and usage code sequence

The data of the block 3 of type 14A is output according to usage code sequence (UCS). Therefore,when EON information is to be sent by setting type 14A in a group sequence, the UCS need be entered for each Other Network. A value within the range from 0 to 15 may be entered as the usage code (UC).
Table 1 lists the usage codes and the EON data items that correspond to them.

Table 1

Usage Code	EON data	
0-3	PS(ON) 8 characters	[Note1]
4	AF(ON) - Method A	[Note2]
5	Turning freq. (TN) and Mapped FM freq.1 (ON)	
6	Turning freq. (TN) and Mapped FM freq.2 (ON)	
7	Turning freq. (TN) and Mapped FM freq.3 (ON)	
8	Turning freq. (TN) and Mapped FM freq.4 (ON)	
9	Turning freq. (TN) and Mapped LF/MF freq. (ON)	
*10	unallocated	[Note3]
*11	unallocated	[Note4]
12	Linking information	
13	PTY (ON), TA (ON), etc.	
14	PIN (ON)	[Note5]
15	Reserved for broadcasters use	

"TN" and "ON" designate "This Network" and "Other Network" respectively.

Note 1: To output the eight characters of PS (ON), all the four usage codes (0, 1, 2, and 3) must be entered.

Note 2: Since, in principle, the AF frequency of EON is set either by Method A or by the mapped frequency method, usage code 4 and usage codes 5-9 should not be mixed. However, when they are mixed intentionally for the purpose of receiver's program verification, etc., the data of both Method A and mapped frequency are output.

*Note 3: Usage code 10 corresponds to unallocated data. Since this data is different from normal data and it should not be out put originally, usage code 10 is displayed as "*10" to draw the operator's attention. When *10 is set, the instrument outputs the fixed hexadecimal data "0000" for convenience.*

*Note 4: In the same way as usage code 10, usage code 11 corresponds to unallocated data. Since this data is different from normal data and it should not be output originally, usage code 11 is displayed as "*11" to draw the operator's attention.*
*When *11 is set, the instrument outputs the fixed hexadecimal data "0000" for convenience.*

Note 5: When no usage codes are set in usage code sequence, the instrument assumes that usage code 0 is set and it outputs two characters of PS (ON).

(1) Output of PS (ON), PTY (ON), TA (ON), and PIN (ON)

To output the eight characters of PS (ON), enter usage codes 0, 1, 2,and 3 successively in the UCS.

To output PTY (ON) and TA (ON), enter usage code 13 in the UCS.

To output PIN (ON), enter usage code 14 in the UCS.

(2) Output of AF list by Method A

To output the AF list by Method A, enter usage code 4 in the UCS. Note, however, that the number of the times to enter the usage code 4 is determined by the number of AFs in the list and the attribute of AF frequency (FM band frequency without offset, FM band frequency with offset, or LF/MF frequency).

If the usage code 4 is entered once, two FM band frequencies without offset, one FM band frequency with offset, or one LF/MF frequency is output as shown in the table below.

The first frequency in the AF list must be an FM band frequency without offset or a filler code because it is paired with the code that indicates the total number of AFs.

Usage code	AF list (Contents of block 3 of type 14A)	
4	Total number of AFs	FM band frequency without offset
4	FM band frequency without offset	FM band frequency without offset
4	FM band frequency with offset	
4	LF/MF frequency	

Example: Assume that 90MHz, 91MHz, 92MHz, 93MHz, and 153kHz are set in the AF list.

Usage code	AF list	
4	5 (total number of AFs)	90MHz
4	91MHz	92MHz
4	93MHz	Filler Code
4	153kHz	

To output the data as listed in the above table, usage code 4 must be entered four times successively in the UCS.
(See Section 4.8.11.3 for the method of entering the code.)

```
< Usage  Code  Seq. Net.01  >
    1     4,   4,   4,   4  ---

point                        <prev>
```

Note: The support software provides the function to expand usage code 4 in the UCS by referencing the AF list which was set in the Ins mode of the UCS.

(3) Output of AF frequencies by mapped frequency method
To output AF frequencies by the mapped frequency method, enter usage code 5 in the UCS. The number of the times to enter the usage code is determined by the number of the mapped frequencies in AF list.

Example:

Usage code		Mapped data group 1		
5	Tuning Freq.1	95MHz	89MHz	Mapped Freq.1
6	〃	95MHz	91MHz	Mapped Freq.2
7	〃	95MHz	92MHz	Mapped Freq.3
8	〃	95Mhz	101MHz	Mapped Freq.4
9	〃	95MHz	153kHz	Mapped LF Freq.
		Mapped data group 2		
5	Tuning Freq.2	88MHz	96MHz	Mapped Freq.1
		Mapped data group 3		
5	Tuning Freq.3	102MHz	90MHz	Mapped Freq.1
6	〃	102MHz	100MHz	Mapped Freq.2
9	〃	102MHz	531kHz	Mapped MF Freq.

(a) If the above data groups 1-3 are already entered in this instrument, only the corresponding UCS need be entered. Since the total number of the mapped frequencies that correspond to the specified tuning frequencies is nine, usage code 5 should be entered in the UCS nine times. (See Section 4.8.11.3 for the method of entering the usage code.)

Note 1: In this example, usage code 5 is used to represent all the mapped data groups (usage codes 5-9).

```
< Usage Code  Seq. Net.01   >
    1    5,   5,   5,   5,   5,
         5,   5,   5,   5,

point                      <prev>
```

If the actual usage codes that correspond to the specified mapped frequencies are entered as shown below, the same result is obtained. (Each time any one of the usage codes 5-9 appears in the UCS, this instrument switches frequencies in the order they are specified as mapped data.)

```
< Usage Code  Seq. Net.01   >
    1    5,   6,   7,   8,   9,
         5,   5,   6,   9,

point                      <prev>
```

Note 2: The support software provides the function to expand usage codes 5-9 in the UCS by referencing the mapped data which was set in the Ins mode of the UCS.

4.8.11.2 Synchronized output of usage code sequence and AF data

Normally, the usage code sequence is not synchronized with AF data, but the AF data can be output starting from its beginning if it is stored in the memory of this instrument and recalled from it.
Assuming that the following PS (ON) data and mapped data are set, Example 1 shows the output data out of synchronization and Example 2 shows the synchronized output data.

PS (ON) data: KIKUSUI

Mapped data :

Mapped data group 1

Tuning Freq.1	88MHz	90MHz	Mapped Freq.1
〃	88MHz	91MHz	Mapped Freq.2

Mapped data group 2

Tuning Freq.2	92MHz	89MHz	Mapped Freq.1
〃	92MHz	95MHz	Mapped Freq.2
〃	92MHz	162kHz	Mapped Freq.

Mapped data group 3

Tuning Freq.3	103MHz	97MHz	Mapped Freq.1

Example 1: Output data out of synchronization

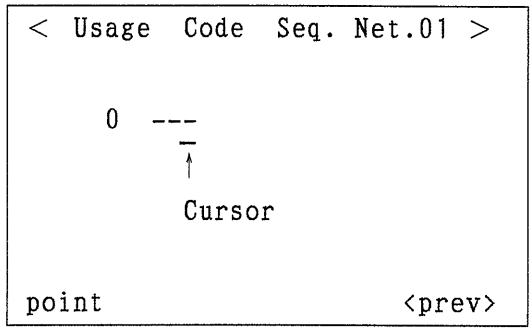
Usage code	Output data		
0	K I		
1	K U		
2	S U		
3	I		
9	92MHz	162kHz	Mapped data group 2
5	103MHz	97MHz	Mapped data group 3
5	88MHz	90MHz	Mapped data group 1
6	88MHz	91MHz	Mapped data group 1
5	92MHz	89MHz	Mapped data group 2
6	92MHz	95MHz	Mapped data group 2

Example 2: Synchronized output data

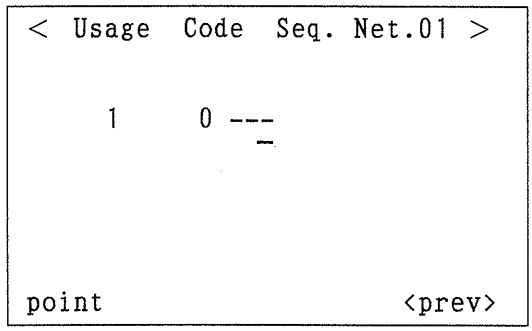
Usage code	Output data		
0	K I		
1	K U		
2	S U		
3	I		
5	88MHz	90MHz	Mapped data group 1
6	88MHz	91MHz	Mapped data group 1
5	92MHz	89MHz	Mapped data group 2
6	92MHz	95MHz	Mapped data group 2
9	92MHz	162kHz	Mapped data group 2
5	103MHz	97MHz	Mapped data group 3

4.8.11.3 Screen explanation and data entry

point: This function indicates how the usage code displayed at the beginning of the first line of the data edit area on the screen is located among the entire usage codes.
In the following example, "0" is displayed at the point position because the usage code sequence data is not entered for Other Network .01 yet.



When the cursor is not found in the data edit area, move it to there by the cursor positioning keys. To enter usage code 0, press the numeric key 0 and ENTER key in this order, or insert "14" by pressing YE and ins keys and modify it by the rotary knob. As the result of this operation, the cursor moves to the next data entry position, and the screen becomes as follows:



The entered usage code can be modified by the rotary knob. To add data, move the cursor to the data entry position (designated by the mark "--- ") and enter the data directly by numeric keys.

<prev>: The current screen is switched to the previous screen, that is, to the <Enhanced Other Net.n on/off> screen.
Functions enabled after YE key is pressed

ins: Data insertion

Press the ins key, and "14" is inserted at the cursor position.

Change "14" to other usage code by using numeric keys or rotary knob. No usage codes can be inserted by the rotary knob.

Note: The ins function sets "14" forcibly for securing a data area and for the safety of data.

del: Data deletion

Press the del key, and the data at the cursor position is deleted.

Example: To set the usage code sequence of eight PS characters, AF (Method A: 88 MHz, 90 MHz, and 103 MHz), PTY, TA, and PIN for Other Network .01 and to output the sequence, enter the usage codes as follows:

```
< Usage  Code  Seq. Net.01 >

   1     0,   1,   2,   3,   4,
         4,  13,  14,  ---

point                      <prev>
```

Example: To set the usage code sequence of eight PS characters, AF (Tuning Freq = 88 MHz, Mapped Freq.1 = 90 MHz, and Mapped Freq.2 = 103 MHz), PTY, TA, and PIN for Other Network .02 and to output the sequence, return to the <Enhanced Other Net.01 off> screen and secure a data area for Other Network .02 first.

```
< Usage  Code  Seq. Net.02 >

   1     0    1,   2,   3,   5,
         5,  13,  14,  ---

point                      <prev>
```

4.8.12 <AF Method A. EO Net.n> Screen

Use this screen for entering the AF frequencies of EON for Method A. Press the <sub> key on the <Enhanced Other Net.n on/off> screen explained in Section 4.8.9, and press the YE and <AF> keys on the <Enhanced Other Net.n sub> screen; then, this screen is displayed.

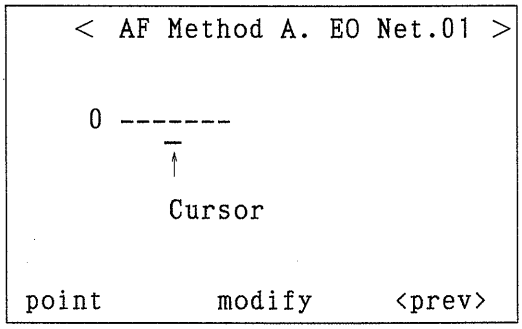
4.8.12.1 AF list data entry for Method A

The frequencies within the following ranges can be entered:
FM: 87.5 to 107.9 MHz, by the step of 0.1 MHz
MF: 531 to 1602 kHz, by the step of 9 kHz
LF: 153 to 279 kHz, by the step of 9 kHz
The ENTER or MHz key is used as the terminator of the FM-band frequency entry, and the kHz key is used as the terminator of the MF/LFband frequency entry.

Note: According to the specifications of EBU EN 50067, the FM-band carrier frequency of 87.5 MHz defined by EBU Tech.3244-E is not used, but this instrument allows the entry of this carrier frequency for the purpose of receiver's program verification,etc.

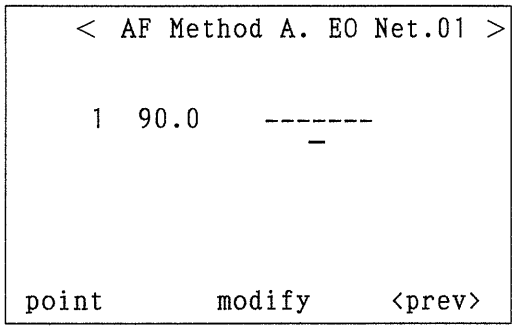
point: This function indicates how the AF frequency displayed at the beginning of the first line of the data edit area on the screen is located among the entire AF frequencies that are specified.

In the following example, "0" is displayed at the point position because the AF frequency data is not entered for Other Network .01 yet.



When the cursor is not found in the data edit area, move it to there by the cursor positioning keys. To enter the AF frequency of 90 MHz, press the numeric keys 9 , 0 , and ENTER (or MHz) in this order.

As the result of this operation, the cursor moves to the next data entry position, and the screen becomes as follows:



The entered AF frequency can be changed by the rotary knob.
To add data, move the cursor to the data entry position (designated by the mark "---") and enter the data directly by numeric keys.

modify: This function switches between the FM-band AF frequency without offset and that with offset (+25k, +50k, or +75k) by toggle operation.

Note: According to the specifications of EBU EN 50067, the frequency offset defined by EBU Tech.3244-E is deleted, but this instrument allows the frequency offset to be specified by using the modify function. However, because of the restriction on the AF data transmission method, the offset can be specified only for the second and subsequent FM-band AF frequencies.

Functions enabled after YE key is pressed

ins: Data insertion

Press the ins key, and "FL" is inserted at the cursor position.

Replace "FL" with a desired frequency by using numeric keys or rotary knob. The frequency cannot be inserted by the rotary knob.

Note: The ins function sets "FL" forcibly for securing a data area and for the safety of data.

del: Data deletion

Press the del key, and the data at the cursor position is deleted.

4.8.13 <Mapped Freq. EO Net.n> Screen

Use this screen for entering the AF frequencies of EON for the mapped frequency method. Press the <sub> key on the <Enhanced Other Net.n on/off> screen explained in Section 4.8.9, and press the YE and <MAP> keys on the <Enhanced Other Net.n sub> screen; then, this screen is displayed.

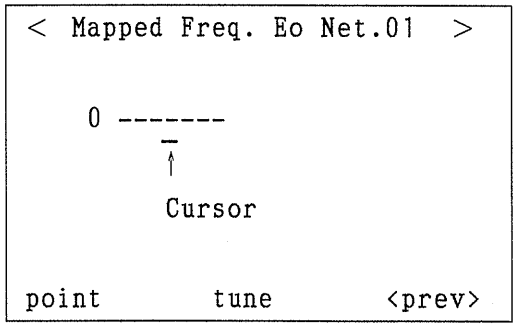
4.8.13.1 AF frequency data entry for mapped frequency method

The frequencies within the following ranges can be entered:
FM: 87.5 to 107.9 MHz, by the step of 0.1 MHz
MF: 531 to 1602 kHz, by the step of 9 kHz
LF: 153 to 279 kHz, by the step of 9 kHz
The ENTER or MHz key is used as the terminator of the FM-band frequency entry, and the kHz key is used as the terminator of the MF/LF-band frequency entry.

Note: According to the specifications of EBU EN 50067, the FM-band carrier frequency of 87.5 MHz defined by EBU Tech.3244-E is not used, but this instrument allows the entry of this carrier frequency for the purpose of receiver's program verification, etc.

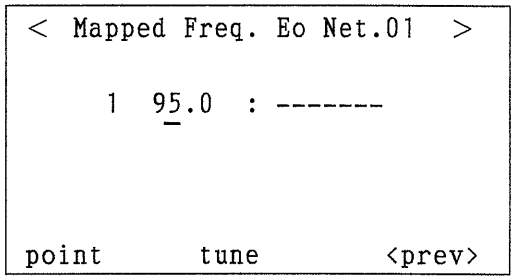
point: This function indicates how the AF frequency displayed at the beginning of the first line of the data edit area on the screen is located among the entire AF frequencies that are specified.

In the following example, "0" is displayed at the point position because the mapped data is not entered for Other Network .01 yet.



When the cursor is not found in the data edit area, move it to there by the cursor positioning keys.

Enter the tuning frequency first. To enter the tuning frequency of 95 MHz, for example, press the numeric keys 9 , 5 , and ENTER (or MHz), and move back the cursor to the position of 95.0. Then press the tune key so that the entered frequency is considered as the tuning frequency.



The entered frequency can be changed by the rotary knob.
To add data, move the cursor to the data entry position (designated by the mark "---") and enter the data directly by numeric keys.

tune: This function specifies the tuning frequency (with the mark ":") and releases it alternately by toggle operation.

Functions enabled after YE key is pressed

ins: Data insertion
Press the ins key, and "FL" is inserted at the cursor position. Replace "FL" with a desired frequency by using numeric keys or rotary knob. The frequency cannot be inserted by the rotary knob.
Note: The ins function sets "FL" forcibly for securing a data area and for the safety of data.

del: Data deletion
Press the del key, and the data at the cursor position is deleted.

Example: Mapped data

	Mapped data group 1		
Tuning Freq.1	95MHz	89MHz	Mapped Freq.1
〃	95MHz	91MHz	Mapped Freq.2
〃	95MHz	92MHz	Mapped Freq.3
〃	95MHz	101MHz	Mapped Freq.4
〃	95MHz	153kHz	Mapped LF Freq.

Mapped data group 2

Tuning Freq.2	88MHz	96MHz	Mapped Freq.1

Mapped data group 3

Tuning Freq.3	102MHz	90MHz	Mapped Freq.1
〃	102MHz	100MHz	Mapped Freq.2
〃	102MHz	531kHz	Mapped LF Freq.

The above mapped data groups are set in this instrument as below. The tuning frequency for each mapped data group must be specified by the tune key.

```
< Mapped Freq. Eo Net.01  >

    1  95.0  :  89.0  ,  91.0  ,
       92.0  , 101.0  ,   153k ,
       88.0  :  96.0  , 102.0  :
       90.0  , 100.0  ,   531k

point          tune          <prev>
```

4.8.14 〈Traffic Radio Information〉 screen

This screen is displayed when the MENU TRI key is pressed.

SK: Specify the ratio of the SK modulation level to the 100% composite signal. The ratio can be specified within the range from 0% to 10%. Since the output level or TRI signal is the output level of the SK signal obtained when DK and BK are turned off on the panel surface, the output level increases when DK and BK are turned on. When the modulation level is set to 10%, one-tenth (1/10) of the sepcified output level is output.
For example, if 5% is specified as the modulation level and the predetermined output level is 3Vp-p, the data of 1.5Vp-p is output (5% × 3Vp-p/10% = 1.5Vp-p).

DK: Specify the AM depth of DK signal within the range from 0% to 35%. The standard AM depth is 30%.

BK: Specify the AM depth for areas A to F within the range from 0% to 64%. The standard AM depth is 60%.

AREA: Specify the areas of A to F.

4.8.15 〈Radio Data System SYS〉 screen

This screen is displayed when the 〈SYS〉 key (YE F5) is pressed on the 〈Radio Data System main〉 screen or when the YE and TRI keys are pressed successively.

Rds: Sepcify the ratio of the RDS (Radio Data System) modulation level to the 100% composite signal. Signal within the range from 0% to 10%.
The output level of RDS (Radio Data System) signal is the output level for all-zero data.
When 10% is specified, data is output at the predetermined 1/10 of output level.
For example, if 3% is specified as the modulation level and the predetermined output level is 3Vp-p, the data of 0.9Vp-p is output (3% × 3Vp-p/100% = 0.09Vp-p).

Output: This function displays the output level (peak to peak) obtained when the monophonic/stereo modulation level is set to 100%. Set the voltage that corresponds to the input voltage sensitivity required by the external modulation input of the SG used with the KSG3400A. See Section 4.9.1.
When the Stereo, RDS and TRI signals are modulated simultaneously, the output level increases because the vector sum of the Stereo modulation level, RDS modulation level and TRI (=SK) modulation level is considered to be the output level.
Also, the output level by simultaneous modulation varies with the phase difference (0°, 90°, ±10°, etc.) between the RDS signal and TRI signal.

Phase: See Section 4.12 "57 kHz sub-carrier Phase Changing Method".

Drop on/off: Turns on/off the drop out function by the drop key toggle operation. The drop out function can be turned on/off by the rotary knob also.
See Section 4.13 "Drop Out Function".

Err on/off: Turns on/off the error function by the toggle operation of the error key. The error function can be turned on/off by the rotary knob also.
The bit error in the RDS (Radio Data System) data caused by the multi path, etc. influences the operation of the receiver, and the error function is used to simulate the influence.

Specify an error pattern of one block (.p) and the error mode (.m) which is the type of the logical operation between the error pattern and normal RDS data. Then, the result of the logical operation is output as RDS data when the error function is on (in the Err on state).

When the error function is off (in the Err off state), the specified error pattern and error mode are invalid and they are not reflected in the output RDS data.

The following is an example of the RDS data bit string of one block output by the specification of error mode and error pattern:

Example:		
	Normal RDS data	FE00 3CD
	Error mode (.m)	AND
	Error pattern (.p)	1234 167
	output RDS data (Err on)	1200 145
	output RDS data (Err off)	FE00 3CD

When the YE key is pressed, the following functions are displayed:

〈memo〉: Switches the current screen to the 〈Memory manage〉 screen explained in Section 4.8.16.

〈hard〉: Switches the current screen to the 〈Hard set Information〉 screen explained in Section 4.8.17.

.m: Select the error mode from "XOR", "OR", and "AND" by the rotary knob.

.p: Specify the error pattern in hexadecimal mode by numeric keys or by the rotary knob.

The specified error pattern is effective when the error function (Err) is on.

.c: Since the error blocks are generated at regular intervals in the output data, specify the number of blocks in each interval.

If "0" is specified, the error blocks are generated for all the output blocks.

The generated error blocks can be checked on the 〈Simulation〉 screen explained in Section 4.8.6.

The number of blocks should be specified within the range from 0 to 255 by the numeric keys or rotary knob.

4.8.16 〈Memory manage〉 screen

To display the 〈Memory manage〉 screen, press the 〈SYS〉 key (YE F5) on the 〈Radio Data System main〉 screen or the YE and TRI keys successively and then press the 〈memo〉 key (YE F1) on the 〈Radio Data System SYS〉 screen.
This screen shows how the memory is used and deletes unnecessary data from the memory. This screen cannot be used for recall or store operation (excluding that by RTN command).

Ret: RTN can be set in any memory address. To clear the RTN from that address, set RTN in another memory address. However, the RTN can be cleared only within a block of 10 points.

del: Deletes data from the memory area of the displayed address.

〈prev〉: Switches the current screen to the preceding screen, that is, to the 〈Radio Data System SYS〉 screen.

Explanation of screen titles

Memory: A memory address is displayed to indicate how the memory is used, but when the screen is changed, "00" is displayed. See Section 4.18 for the memory manipulation.

Return: The mark "＊＊" is displayed at the position where RTN has been input.

data: Amount of the data occupying the memory area of the displayed address

max 5000: Maximum memory capacity

free: Usable free memory capacity

active: Active memory capacity

4.8.17 〈Hard set Information〉 screen

To display the 〈Hard set Information〉 screen, press the 〈SYS〉 key (YE F5) on the 〈Radio Data System main〉 screen or the YE and TRI keys successively and then press the 〈hard〉 key (YE F2) on the 〈Radio Data System SYS〉 screen.
The keys on this screen have the following functions:

all 0: The data of continuous 0 is output as RDS (Radio Data System) data, and the message "....Output data is all 0...." is displayed in the upper part of each screen.
To terminate the all 0 data output, press the all 0 key (F1) again or press the RDS key (F3).

all 1: The data of continuous 1 is output as RDS (Radio Data System) data, and the message "....Output data is all 1...." is displayed in the upper part of each screen.
To terminate the all 1 data output, press the all 1 key (F2) again or press the RDS key (F3).

RDS (Radio Data System):
The content of the active memory, that is, the generated and edited data, is output from the KSG3400A.

inv: See the explanation of OUT (TTL) 1187.5Hz below.

〈prev〉: Switches the current screen to the preceding screen, that is, to the 〈Radio Data System SYS〉 screen.

Explanation of screen titles

OUT (TTL) 1187.5Hz: Whether the data output from the "OUTPUT DATA" terminal on the rear panel is to be sampled at the positive edge or negative edge of the signal output from the "1187.5Hz" terminal is specified by the inv key.
If "normal" is specifed, the data is sampled at the negative edge; if "inverse" is specified, it is sampled at the positive edge.

Output data: Select the RDS data source from the all 0, all 1, and RDS keys.

4.9 Level Setting Method

4.9.1 Setting output level (connection with SG)

(1) The output level can be set by simply pressing ⑭ YE and ⑩ SET (MONO) keys. When these keys are pressed, the monophonic modulation level is set to 100%, internal modulation oscillator frequency is set to 1 kHz, and output level is set to 3.00Vp-p.

Connect ⑯ COMPOSITE OUPUT to the external modulation input terminal of SG, and adjust the input level of the SG by using its EXT LEVEL HI-LO indicator and ⑭ rotary knob.

The modulation input level for the SGs of KSG4100-4300 Series is approximately 3Vp-p, but there is a slight difference among models. Therefore, the input level need be adjusted.

(2) To switch from the monophonic/stereo modulation level display to the output level display, press ⑭ YE and SYSTEM (TRI) keys successively. When the output level is displayed, adjust the modulation input level of SG to the proper level.

If the monophonic modulation level of other than 100% is set, however, the modulation input level of SG cannot be set correctly.

(3) To switch from the output level display to the monophonic/stereo modulation level display, press ⑭ STEREO key.

4.9.2 Setting monophonic/stereo modulation level

(1) Setting by rotary knob

Press ⑭ STEREO key to get the <stereo> screen. If the cursor is not placed at the monophonic/stereo modulation level setting position, move it to the position by using ⑧ MOD (F1) key or ⑭ ◁, ▷, △, or ▽ key. The modulation level can be increased or decreased at the digit of the cursor position.

(2) Setting by numeric keys

Move the cursor to the monophonic/stereo modulation level setting position, and set the modulation level by using ⑭ numeric keys and ENTER key.

To set the modulation level to 80%, for example, press ⑭ 8, 0, and ENTER in this order.

The monophonic/stereo modulation level can be set within the range from 0% to 100%.

(3) Switching between monophonic and stereo modulation modes

Select the modulation made by pressing ⑩ MONO or MAIN SUB key. When the modulation mode is changed, ⑩ MOD ON key indicator lights up. When ⑩ MONO key indicator is on, PILOT ON cannot be turned on.

4.9.3 Setting pilot level

In the stereo modulation mode, the pilot signal can be turned on/off independently by pressing ⑩ PILOT ON.

If the cursor is placed at the pilot level setting position, the pilot level can be set by ⑭ rotary knob or numeric keys even when ⑩ PILOT ON is off.

The pilot level can be set within the range from 0% to 15%.

(1) Setting by rotary knob

Press ⑭ STEREO key to get the <Stereo> screen. If the cursor is not placed at the pilot level setting position, bring it to the position by using ⑧ Pilot (F2) key or ⑭ ◁, ▷, △, or ▽ key. The pilot level can be increased or decreased at the digit of the cursor position.

(2) Setting by numeric keys

Bring the cursor to the pilot level setting position, and set the pilot level by using ⑭ numeric keys and ENTER key.

4.9.4 Setting RDS (Radio Data System) modulation level

See the explanation of Rds in Section 4.8.15 "<Radio Data System> screen".

4.9.5 Setting TRI (Traffic Radio Information) modulation level

See Section 4.8.14 "<Traffic Radio Information> screen".

4.10 Modulation Setting Method

4.10.1 Modulation source

Press ⑭ STEREO key to get the <Stereo> screen. Bring the cursor to the modulation source setting position by pressing ⑧ Source (F3) key.

(1) Setting internal modulation oscillator frequency

Select 30Hz, 100Hz, 400Hz, 1kHz, 6.3kHz, 10kHz, or 15kHz by ⑭ rotary knob.

(2) Setting external modulation

(a) External modulation by one signal

Select EXT by ⑭ rotary knob. Supply a signal of proper level to ⑤ AF/L input connector, and adjust the external signal input level to the level that turns off both "HI" and "LO" of ④ LEVEL HI-LO indicator.

(b) External modulation by two signals

Press ⑧ L/R (F5) key, and both LEFT and RIGHT key indicator (⑩) light up. In this state, ⑤ AF/L connector functions as the left-side (L-side) stereo modulation signal input terminal and ⑥ R connector functions as the right-side (R-side) stereo modulation signal input terminal.

Adjust the left-side external signal input level to the level that turns off both "HI" and "LO" of ④ LEVEL HI-LO indicator in the same way as explained in (a) above.

As to the external signal input level of ⑥ R side, connect the signal to ⑤ AF/L connector and adjust the level to the proper level by using ④ LEVEL HI-LO indicator.

4.10.2 Connecting external modulation signal source

(1) Connecting and setting method

For the external modulation by one signal, connect the signal to ⑤ AF/L input terminal on the panel.

The input impedance is approximately 10kΩ, and the proper input level is approximately 3Vp-p.

Adjust the external modulation signal level in the range that turns off both "HI" and "LO" of ④ LEVEL HI-LO indicator.

In this state, the required modulation level can be set only by specifying the level on ⑦ LCD. The external modulation signal level need not be readjusted even if the modulation level or modulation mode is changed.

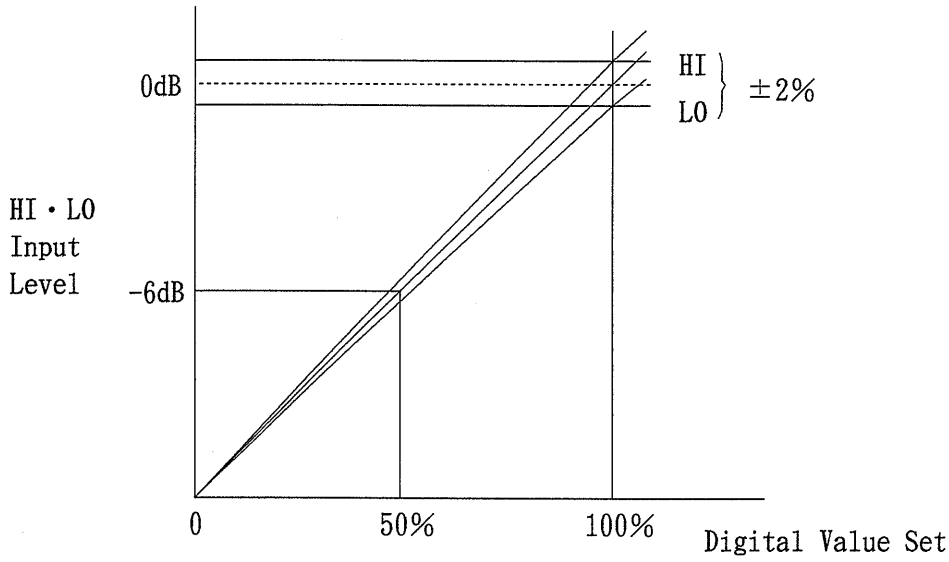
If the external modulation signal level is too low, "LO" lights up; if it is too high, "HI" lights up.
The above explanation applies to the signal input to ⑥ R in the case of stereo external modulation by two signals also.

(2) Setting range

When the external modulation input level is set in the range that turns off both "HI" and "LO", the error of the set value does not exceed the range of ±2%. Based on these HI and LO levels, the modulation level is converted into a digital set value internally. In other words, once the input level of the external modulation signal is set, it need not be changed and the digital set value is used for setting the necessary modulation level.

The figure below shows the relationship between the input level and digital set value.

As the figure shows, the range of input level is proportional to the input level.



For example, after setting the input level in the HI-LO range and setting the modulation level to 100% on LCD, reduce the input level by 6dB. Then, the actual modulation level is reduced to 50% although the modulation level is displayed to be 100%. At this time, the "LO" indicator lights up, but the correct modulation level of 50% is obtained. The above relationship can be applied to the external modulation input level of SG, and when setting the level of the signal output from the KSG3400A, determine the HI-LO range by using using the peak of the signal whether the signal is composite or monophonic.

When the signal level is set in the proper HI-LO range, the "HI" and "LO" indicators are off, but they may light up alternately each time ⑩ MAIN LEFT, RIGHT, and SUB keys are switced form one to another.
The "HI" and "LO" indicators may light up alternately because the HI-LO range is very narrow, but it does not mean a great error and does not affect the operation of the instrument.

Note: The peak level of the composite signal of MAIN, SUB, and pilot signals is obtained by adding two cycles of 38kHz and one cycle of 19kHz. Therefore, the ratio of the peak level of the signal composed of LEFT, RIGHT, or SUB signal and pilot signal to the peak level of the signal composed of MAIN signal and pilot signal is 97%. Accordingly, the amplitude level of the former signal is lower than that of the latter signal by 0.26dB.
Therefore, the "LO" indicator may light up easily when LEFT, RIGHT, or SUB key is pressed.

4.11 Pre-emphasis Function

The pre-emphasis function can be used for either monophonic modulation, stereo modulation, internal modulation, or external modulation.

Press ⑭ STEREO key to get the <Stereo> screen. Press ⑧ Pre-em (F4) key, bring the cursor to the pre-emphasis setting position, and select off, 25μS, 50μS, or 75μS for the pre-emphasis by turning ⑭ rotary knob.
Figure 4-1 shows the standard pre-emphasis characteristics.
The straight line of 20dB in the figure represents the off state of the pre-emphasis function. When the pre-emphasis function is on, the level is reduced by 20dB in the band lower than 400Hz.
For example, if the monophonic modulation level is set to 100% when the pre-emphasis is off, it becomes 10% in the band lower than 400Hz when the pre-emphasis is turned on. If the stereo modulation level and pilot level are set to 90% and 10% respectively when the pre-emphasis is off, the total modulation level becomes 19% when the pre-emphasis is turned on (9% stereo modulation level + 10% pilot level = 19%).

The RDS (Radio Data System) modulation level and TRI modulation level are added to the stereo modulation level without being changed, like the pilot level.

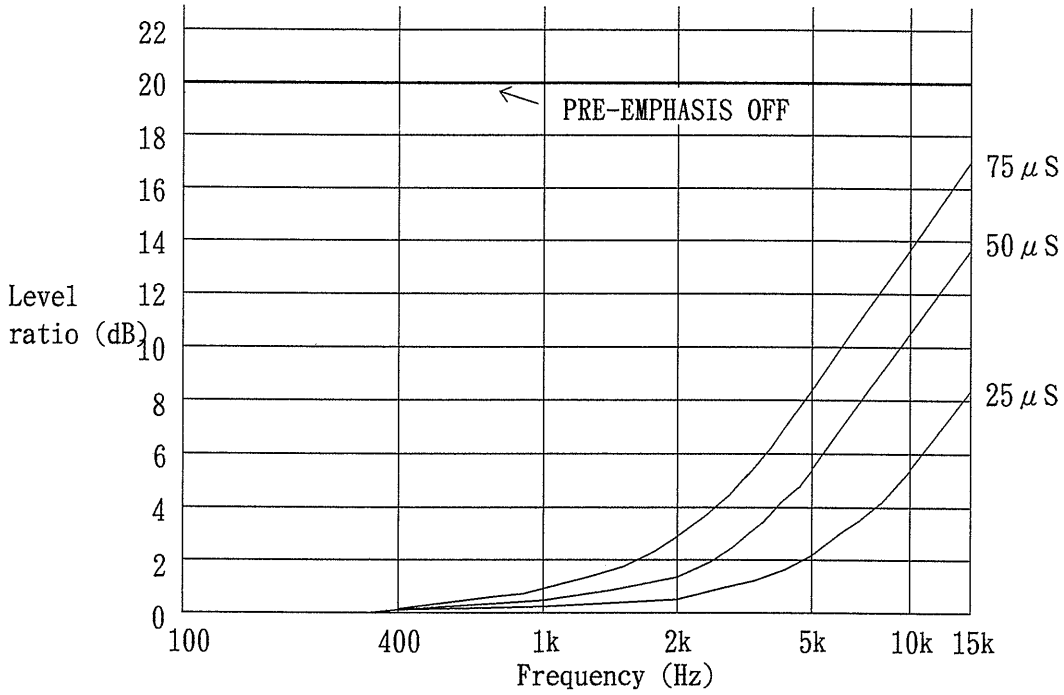


Figure 4-1

4.12 57kHz Sub-carrier Phase Changing Method

The RDS (Radio Data System) 57kHz sub-carrier phase changing function is used to evaluate the margin of the receiver operation for the 57kHz sub-carrier phase shift caused by multi path.

The phase difference between the 57kHz sub-carrier and the 57kHz sub-carrier can be made 0° or 90° by the toggle operation of the Phase key on the ⑦ 〈Radio Data System SYS〉 screen
To modify the phase difference, move the cursor to the right side of "S" (Shift) by the ▷ key. The phase difference can be modified within the range of ±10° by the step of 1°; that is, 0° and 90° can be changed to 0°±10° and 90°±10° respectively.

Note: Normally, the phase of the 57kHz sub-carrier should be set to 90°±0°

4.13 Drop Out Function

The drop out function is used to evaluate the operation of the RDS (Radio Data System) receiver against the fluctuation of the level of the RDS signal input to the receiver. Connect a signal of TTL level provided by the user to the ⑲ DROP CONTROL INPUT (TTL) terminal on the rear panel.

When the TTL signal is low, the combination of the RDS signal and TRI signal is output from the ⑯ OUTPUT terminal at the drop out level specified on ⑦ LCD.

The drop out function is turned on/off by the toggle operation of the Drop key on the <Radio Data System SYS> screen displayed on ⑦ LCD.
It can be turned on/off by the rotary knob also.

If the drop out level is set to 100%, the RDS and TRI signals are output at 100% of the predetermined modulation levels.
The drop out level can be specified within the range from 0% to 100% by the step of 1%.

Note: When the drop out function is not used, disconnect the signal from the ⑲ DROP CONTROL INPUT (TTL) terminal on the rear panel and turn off the drop out function.

4.14 Setting Scan Time and Starting and Stopping Scan for TRI BK Area

(1) Setting scan time

(a) Press ⑭ STEREO key to get the <Stereo> screen.
Press ⑭ YE and ⑧ Time (F4) keys and bring the cursor to the scan time setting position.
Set the necessary time by ⑭ rotary knob or numeric keys.
Set the scan time between the currently displayed area and next area. The scan time can be set within the range from 0.1S to 12.0S by the step of 0.1s.
0.1s is determined by the internal clock, and it is equivalent approximately to 87.5msec. Therefore, 12.0S is about 10.5 sec by actual time.

(b) To skip an area, select "pass". To terminate skipping the area, select the area and set the scan time to other that "pass" by ⑭ rotary knob.

(2) Starting scan

(a) Press ⑭ YE and ⑧ SCAN (F2) keys, and the scan is started. The scan can be started by ⑭ rotary knob also.
During the scan, letters A-F that represent areas are displayed in inverse mode on the <Stereo> screen and <Traffic Radio Information> screen.

(b) The relationship between area indication and scan mode is as follows: Scan mode

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

Note: If "pass" is selected as the scan time for all the areas from A to F, the scan operation cannot be performed.

(3) Stopping scan

Press ⑭ YE and ⑧ Scan (F2) keys during scan operation, and the scan operation stops. It can be stopped by ⑭ rotary knob also.

4.15 Output of Only DK or BK Signal (Tone Output)

(a) Press ⑭ Stereo key to get the <Stereo> screen.
Press ⑭ YE and ⑧ Tone (F1) keys, and all the indicators on the panel go off except the DK and BK key indicators and the instrument is set in the tone output mode.
In this mode, SK signal is not output and only DK and BK signals are output.

(b) Either ⑫ DK or BK key or both of them can be selected.
The tone output level is proportional to the DK/BK modulation level that has been set. For example, the tone output level for 30% modulation level is approximately 0.3V rms.

(c) Press ⑭ YE and ⑧ Tone (F1) keys, and the instrument is released from the tone output mode and enters the normal output mode for stereo modulation, etc.
This can be done by ⑭ rotary knob also.

4.16 Setting SCA Level

The maximum modulation level of SCA is determined to be 10%.

The KSG3400A has ⑱ SCA INPUT connector on its rear panel.

The signal supplied to this connector is output from ⑯ COMPOSITE OUTPUT connector regardless of the operation status of the KSG3400A (internal oscillator or external signal input).
Therefore, do not connect any signals to the ⑱ SCA INPUT connector on the rear panel unless the SCA signal need be supplied.

For setting the level of the SCA signal, turn off the monophonic/ stereo modulation level, RDS (Radio Data System) modulation level, SK modulation level, and pilot level. When the level of the signal input to ⑱ SCA INPUT is approximately 1V rms, the SCA modulation level is approximately 10%. Since the modulation level displayed on ⑦ LCD does not include the SCA modulation level, the modulation level of the main and sub channels must be limited to 80% when the 10% SCA modulation level is added. Also, the FM deviation must not exceed 75 kHz for the modulation in SG.

When using traffic infomation signal, do not connect anything to ⑱ SCA INPUT. (SCA = Subsidiary Communication Authorization)

4.17 Monitoring Pilot Phase

(1) Connect an X-Y oscilloscope to the KSG3400A as follows:

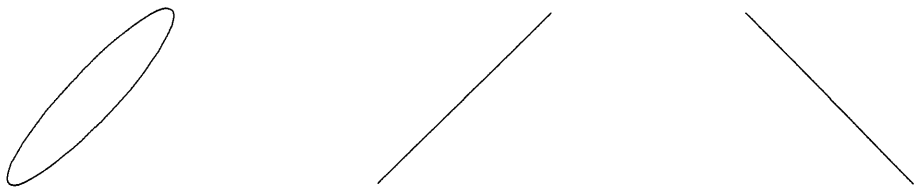
KSG3400A side	X-Y oscilloscope side
⑥ PILOT OUTPUT connector	X INPUT connector (200mV/DIV)
⑯ COMPOSITE OUTPUT connector ...	Y INPUT connector (100mV/DIV)

(2) Press ⑭ YE and ⑩ SET (MONO) keys, and the output level is set to 3.00Vp-p (Monophonic modulation level is set to 100% and internal modulation oscillator frequency is set to 1kHz).

(3) Press ⑭ YE and ⑩ 100% (MAIN) keys, and the stereo modulation level and pilot level are set to 90% and 10% respectively.

(4) Press ⑭ STEREO key to get the <Stereo> screen.

(5) Press ⑩ STEREO MOD ON key to turn off its indicator, and turn off the stereo modulation ("0" is not displayed).
Set the input sensitivity of the oscilloscope to X-INPUT=200mV/DIV and Y-INPUT=100mV/DIV, and a waveform is displayed on the oscilloscope as shown in Figure 4-2. Turn ⑮ SCOPE PHASE half-fixed adjuster till the waveform (b) in Figure 4-2 is obtained.



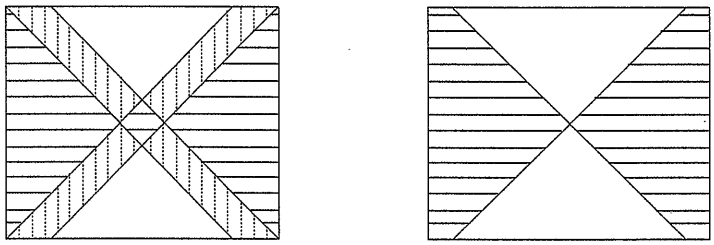
(a) Out of phase

(b) In phase

(c) 180° out of phase

Figure 4-2

(6) Keep the input sensitivity adjustment dial of the oscilloscope unchanged, and manipulate the keys of the KSG3400A as follows:
Turn off ⑩ PILOT ON key.
Select ⑩ STEREO SUB key.
Confirm that the waveform (b) in Figure 4-3, which indicates the correct adjustment of phase, is displayed on the oscilloscope.
Calibration is not necessary because the pilot phase is highly stable, but if a waveform such as (a) is displayed, which means that the phase is not adjusted correctly, tha adjustment in Figure 4-2 is shifted from the correct position by some degrees.



(a) (b)

Figure 4-3

4.18 Memory

4.18.1 Memory recall method

Memory addresses are allocated in a matrix of 10 rows and 10 columns (100 points in total).

The following is the memory address allocation diagram:

MEMORY address 2-digit 7-segment display

00	01	02	03	04	05	06	07	08	09
10									•
20									•
30									•
40									•
50									•
60									•
70									•
80									•
90	•	•	•	•	•	•	•	•	99

[Basic operation of recall]

(a) A column number is called by pressing the ③ RCL key and a ⑭ numeric key 0 to 9, and a row number is called by pressing the ③ △ key in MEMORY section.

(b) To call a memory address directly, erase the old address from the ② MEMORY display by pressing the ③ RCL key and ⑭ • key and enter a 2-digit number (one digit for column and the other digit for row) by numeric keys.

(c) To call a memory address directly, erase the old row number from the ② MEMORY display by pressing the ③ RCL key and ⑭ - key and enter a 1-digit number (for the new row number) by a numeric key. (In this case, the column number remains the same.)

Example 1 : To call memory address "43"

Press ③ RCL key and ⑭ numeric key 4 , and press △ key in ③ MEMORY section three times, and the value "43" appears on the MEMORY display.

Example 2 : To call memory address "10"

Press ③ RCL key and ⑭ numeric key 1 , and the value "10" appears on the display.

The rows in block 1 can be called consecutively by pressing △ or ▽ key in ③ MEMORY section.

Example 3: To call memory address "56" directly

Press the ③ RCL key and ⑭ . key, and the ② MEMORY display is cleared.

Press the ⑭ numeric keys 5 and 6 , and "56" is displayed.

Example 4: To call memory address "58" directly

Press the ③ RCL key and ⑭ - key, and the row of ② MEMORY display is cleared.

Press the ⑭ numeric key 8 and "58" is displayed.

4.18.2 Memory store method

As explained in Section 4.18.1, the memory addresses are allocated in the form of a matrix, and the values of the items specified by the front panel functions except for the following items can be stored in the memory:

Note : Memory store

1. *Do not execute the memory store operation when the following screens are displayed:*
   1) *<Memory manage> screen*
   2) *<Hard set Information> screen*
   3) *<Simulation> screen*
   4) *<GP-IB Address> screen*

2. *To store data in the first address of each block (00, 10, 20,...90), press keys in the following order:*

   YE → *STO* → *0* ... *9*

Pressing of the YE , STO , and RTN keys in this order for the first address of a block is considered to be the specification of "Return" operation, and if the NEXT key is pressed after these keys, only the first address is displayed.

Items that cannot be stored in memory

1) Error pattern
2) Error count
3) Drop out level
4) Whether the data output from RDS DATA is to be sampled at the rising portion (inverse) or falling portion (normal) of the signal output from 1187.5Hz terminal
5) Scan time
6) Output level (Vp-p)

[Preparation for store]

(1) To store all 0 or all 1
Select "all 0" or "all 1" on the 〈Hard set Information〉 screen or on the screen which appears when the YE key is pressed on the 〈Radio Data System sub〉 screen. Then, execute the basic operation of store explained below.

(2) To store the edited RDS data
Select "RDS (Radio Data System)" on the 〈Hard set Information〉 screen, and execute the basic operation of store explained below.

Note: Before storing the edited RDS data in the memory address containing the all 0 or all 1 data, be sure to select "RDS (Radio Data System)" on the 〈Hard set Information〉 screen.

[Basic operation of store]

(a) To store data in the beginning of a block, press ⑭ YE , ③ STO (RCL), and ⑭ numeric key 0 ～ 9 .

(b) To store data in the next row, press ⑭ YE , ③ STO (RCL), and △ key in ③ MEMORY section.

(c) To store data directly in the address of desired column and row, clear the ② MEMORY display by pressing ⑭ YE , ③ STO (RCL), and ⑬ . and enter the desired 2-digit number by numeric keys.

Example 1: To store data in memory address "10"

a) Specify the value of stereo modulation level 85%, pilot 10%, SK modulation level 5.3%, DK modulation level 30%, BK modulation level 60%, area A, RDS (Radio Data System) modulation level, TRI modulation level, or other item on the front panel.

b) Press ⑭ YE , ③ STO (RCL), and the ⑭ numeric key 1 , and the above value is stored in memory address "10".

Example 2: To store data in memory address "13"

a) After pressing ③ RCL and ⑭ 1 , press ③ △ twice. Then, the value "12" appears on the ② MEMORY display.

b) Specify the value of stereo modulation level 85%, pilot level 10%, SK modulation level 5.3%, DK modulation level 30%, BK modulation level 60%, area A, RDS (Radio Data System) modulation level, TRI modulation level, or other item on the front panel.

c) Press ⑭ YE , ③ STO (RCL), and △ , and the value "13" appears on the MEMORY display and the value specified in b) is stored in the memory address "13".

Example 3: To store data directly in memory address "45"

a) Specify the value of stereo modulation level 85%, pilot level 10%, SK modulation level 5.3%, DK modulation level 30%, BK modulation level 60%, area A, RDS (Radio Data System) modulation level, TRI modulation level, or other item.

b) Clear the ② MEMORY display by pressing ⑭ YE , ③ STO (RCL), and ⑬ . .

c) Press the ⑭ numeric keys 4 and 5 , and the value specified in a) is stored in the memory address "45".

Note 1: In the direct store method explained in Example 3, the pressing of YE , STO , and • cannot be omitted even if the next data is to be stored in the next memory address.

Note 2: The REM (▽) key explained in Section 4.18.3 cannot be used in the direct store method.

4.18.3 Storing data into a part of memory row (Setting RTN key)

(1) Example: To shift memory addresses as "10" → "11" → "12" → "13" → "10" → "11"

Key operation	MEMORY display	
③ RCL , ⑭ 1 , △ Press three times	"13"	
⑭ YE , ③ STO (RCL), RTN (▽)	"13"	RTN command is stored

[How to use the function]

③ RCL , ⑭ 1	"10"	(First memory address)
③ △	"11"	(Second memory address)
③ △	"12"	(Third memory address)
③ △	"13"	(Fourth memory address)
③ △	"10"	(Returns to first memory address)

4.18.4 How to release RTN key

The following two methods are available:

(1) Display "19" by ③ RCL , • , ⑭ 1 , ③ 9 keys

Press ⑭ YE , ③ STO (RCL), ▽ keys "19"
By the above operation, all the ten columns become available as they were before the RTN key was pressed.

(2) Display "13" by ③ RCL , ⑭ 1 , and ③ △ keys (Press three times)

Press ⑭ YE , ③ STO , △ keys "14" RTN command is
.. stored at "14"
..
⑭ YE , ③ STO (RCL), △ keys "19"
(Press five times)

Each time the △ key is pressed, the RTN command is sent to the next column, and finally, all the ten columns become available as they were before the RTN key was pressed.

4.18.5 Recalling more than ten columns continuously

(Setting NEXT key)

Normally, up to ten memory columns (00 - 09, 10 - 19, ..., 90 - 99) can be recalled at a time, but more than ten columns can be recalled continuously by the following operation:
Display column number "9" in ② [MEMORY] section and press ⑭ YE , ③ STO (RCL), and NEXT (△) keys; then, another ten columns can be recal-led without specifying the next row number.

(1) Example: To recall memory addresses "10" - "29" continuously

Key operation	MEMORY display	
③ RCL , 1 , △	"19"	Previous value
⑭ YE , ③ STO (RCL)	"19"	STO LED comes on
③ NEXT (△)	"20"	STO LED comes off

The memory addresses are recalled as follows:

→ "10" → "11" → • • • → "19" → "20" → "21" → • • • → "29" ┐
└──┘

4.18.6 How to release NEXT key

Display the memory address ("09", "19", ..., or "89") at which the function is to be released, and press the ⑭ YE, ③ STO (RCL), and RTN (▽) keys in this order.

(1) Example: To reset the continous recall of memory addresses "10" - "29" (to recall "10" - "19" and "20" - "29" separately)

Key operation	MEMORY display	
③ RCL, 1, △	"19"	Previous value
⑭ YE, ③ STO (RCL)	"19"	STO LED comes on
③ RTN (▽)	"19"	STO LED comes off

5. REMOTE CONTROL

5.1 General Description

5.1.1 Outline

The KSG3400A provides a remote connector so that the key operation can be done by a remote box in the same way as it is done on the front panel.

Figure 5-1 shows the timing chart for reading the Key code data sent from the remote box.

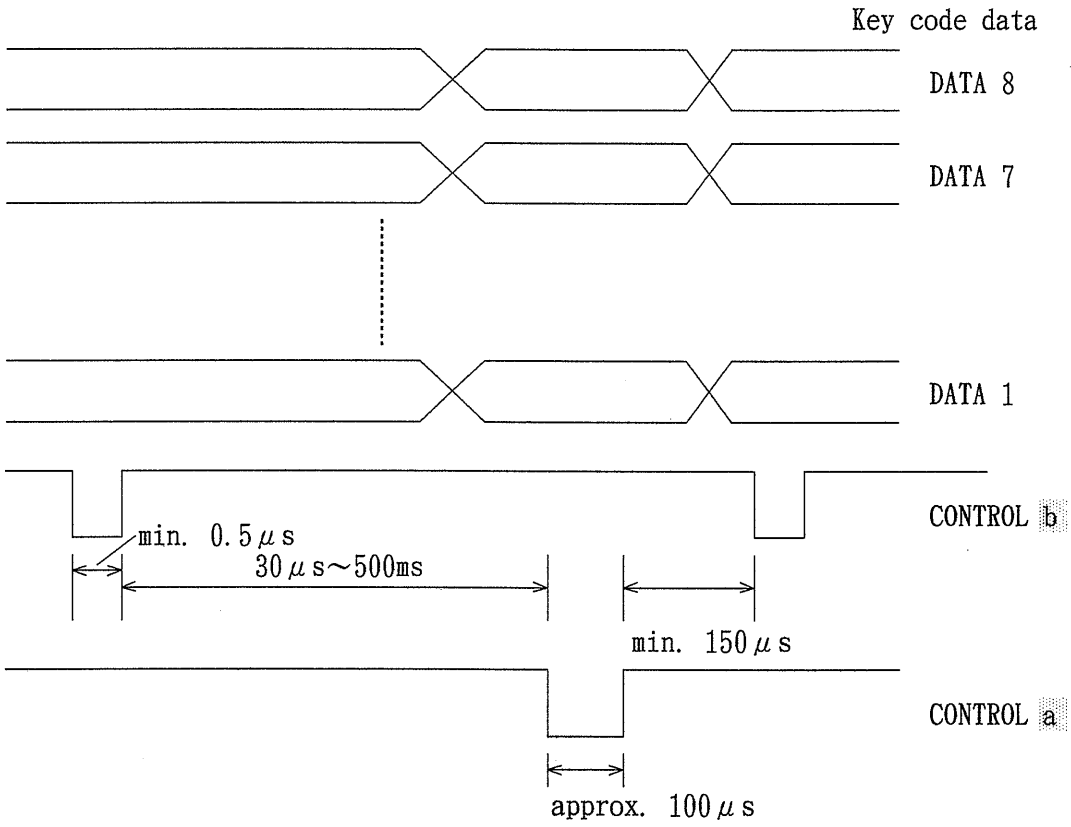


Figure 5-1

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

CONTROL b : Signal to request data read. This signal should be set to "0" for more than 0.5μs.

CONTROL a : This signal is set to "0" 30µs to 500ms after CONTROL b is accepted. It is set to "0" for approximately 100µs, and data is read during this period.
CONTROL b cannot be accepted for 150µs after CONTROL a returns to "1".

DATA 1 - 8 : Key code data. These signals must be kept unchanged while CONTROL a is set to "0 ".

5.2 Operation procedure

5.2.1 Explanation of Remote Control Connector

Figure 5-2 shows the connector pin allocation on the rear panel.

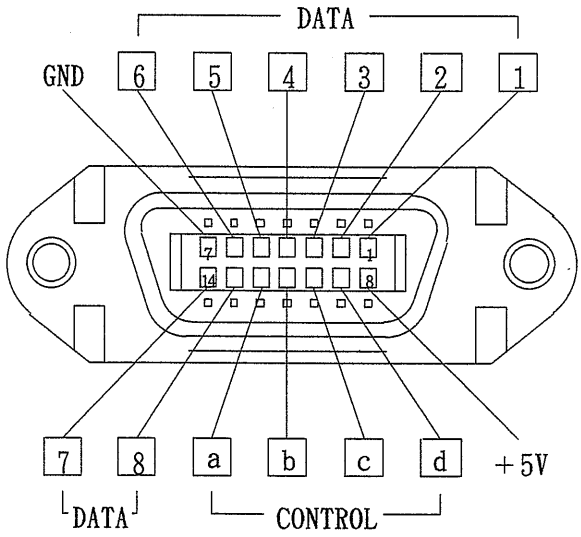


Figure 5-2

[Explanation of terminals]

(1) DATA terminals 1 - 8 (Pins 1 - 6, 13, and 14)

The DATA terminals are used for connecting a bus to the rear panel of the KSG3400A. Since the bus is bidirectional, it can be used for both input and output.

Note: Since the DATA terminals are bidirectional, the signal generator does not function if data "0" or "1" is applied to the lines of DATA 1 - 8 directly.

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

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

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

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

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

Note : A signal of rectangular waveform is output from d continuously. The width of the wave is approximately 13ms, and its cycle is about 87.6ms.

(4) +5V (Pin 8)

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

(5) GND (Pin 7)

5.2.2 Panel key code table

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

Note : Set the fixed data "1" for DATA input pins 13 (DATA 8) and 14 (DATA 7).

Table 5-1

	DATA input pin number					
	6	5	4	3	2	1
Key name	MSB	←	Key Code		→	LSB
MEMORY RCL / STO	0	0	0	1	0	0
MEMORY ▽ / RTN	0	0	0	1	1	1
MEMORY △ / NEXT	0	0	0	1	1	0
F1	0	0	1	0	0	1
F2	0	0	1	0	1	1
F3	0	0	1	1	0	0
F4	0	1	0	0	0	0
F5	0	1	0	0	0	1
MONO (SET)	1	0	1	0	1	0
MAIN (100%)	0	1	1	1	0	0
LEFT (30%)	0	1	1	1	0	1
RIGHT	0	1	1	1	1	0
SUB	0	1	1	1	1	1
MOD ON	0	0	1	1	1	1
PILOT ON	0	0	1	1	1	0
RADIO DATA TP (100%)	1	0	0	1	1	0
RADIO DATA TA	1	0	0	1	1	1
RADIO DATA M/S	1	0	1	0	0	0
RADIO DATA ON	1	0	0	1	0	0
TRI SK (100%)	1	0	0	0	0	1
TRI DK	1	0	0	0	1	0
TRI BK	1	0	0	0	1	1
YE (Yellow Key)	0	1	1	0	1	1

(Cont'd)

Table 5-1

Key name	MSB	←	Key Code	→	LSB
MENU STEREO	0	1	0	0	1	0
MENU RADIO DATA (EON)	0	1	0	0	1	1
〃 TRI (SYSTEM)	0	1	0	1	0	0
DATA ENTRY ENTER	0	0	1	0	1	0
DATA ENTRY MHz	0	1	0	1	1	0
DATA ENTRY kHz	1	0	0	1	0	1
DATA ENTRY 0	1	1	0	0	0	0
DATA ENTRY 1 (A)	1	1	0	0	0	1
DATA ENTRY 2 (B)	1	1	0	0	1	0
DATA ENTRY 3 (C)	1	1	0	0	1	1
DATA ENTRY 4 (D)	1	1	0	1	0	0
DATA ENTRY 5 (E)	1	1	0	1	0	1
DATA ENTRY 6 (F)	1	1	0	1	1	0
DATA ENTRY 7	1	1	0	1	1	1
DATA ENTRY 8	1	1	1	0	0	0
DATA ENTRY 9	1	1	1	0	0	1
DATA ENTRY •	1	0	1	1	1	0
DATA ENTRY –	1	0	1	1	0	1
DATA ENTRY ⇦	0	0	1	0	0	0
DATA ENTRY △	0	1	0	1	1	1
DATA ENTRY ▽	0	1	1	0	0	0
DATA ENTRY ◁	1	1	1	1	0	0
DATA ENTRY ▷	1	1	1	1	0	1
DATA ENTRY Rotary knob UP	0	0	0	0	0	0
DATA ENTRY Rotary knob DOWN	0	0	0	0	0	1
LOCAL (REMOTE, ADDRESS)	1	0	1	1	1	1

5.2.3 Example of recalling data by external control

In this example, data is to be recalled from address "57".

(1) Set the RCL code "000100" according to the front panel key code table (Table 5-1).

(2) Set CONTROL b to "0". Data is read while CONTROL a is set to "0".

(3) Set "101110" as the data of ·, and set CONTROL b to "0".

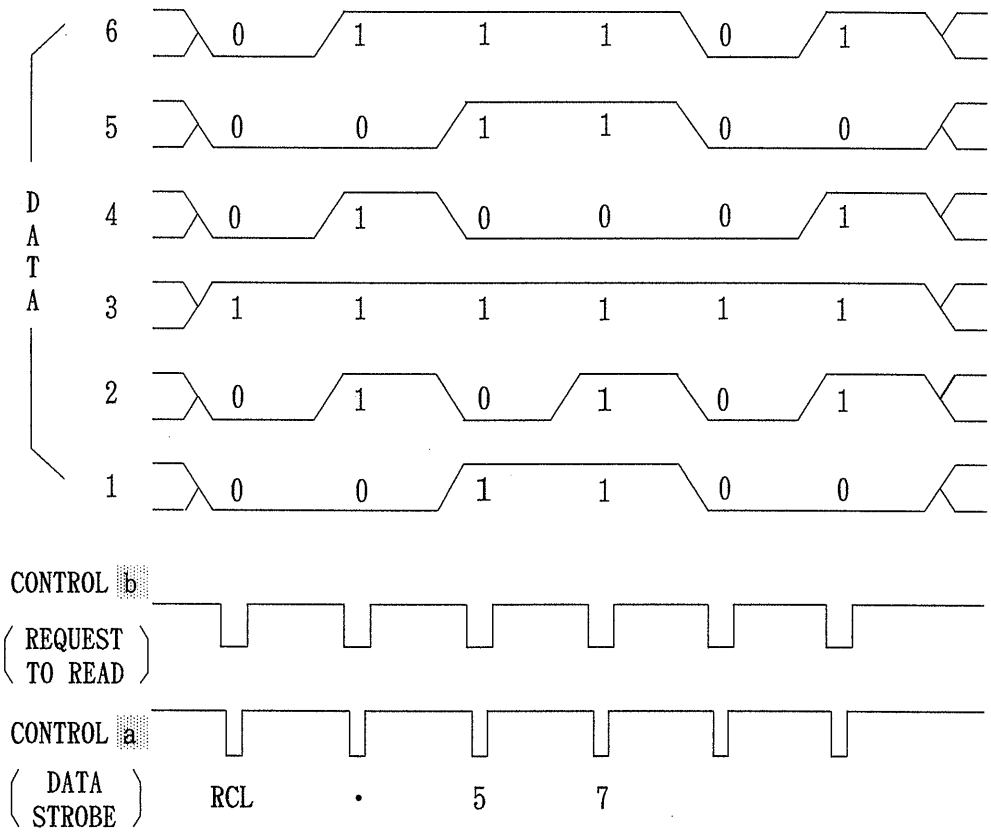


Figure 5-3

(4) In the same way, set "110101" as the data of "5" and send CONTROL b.

(5) Finally, set "110111" as the data of "7" and send CONTROL b. When CONTROL a is set to "0", the recall processing is started in the KSG3400A.

5.2.4 Remote control circuit diagram example and operation

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

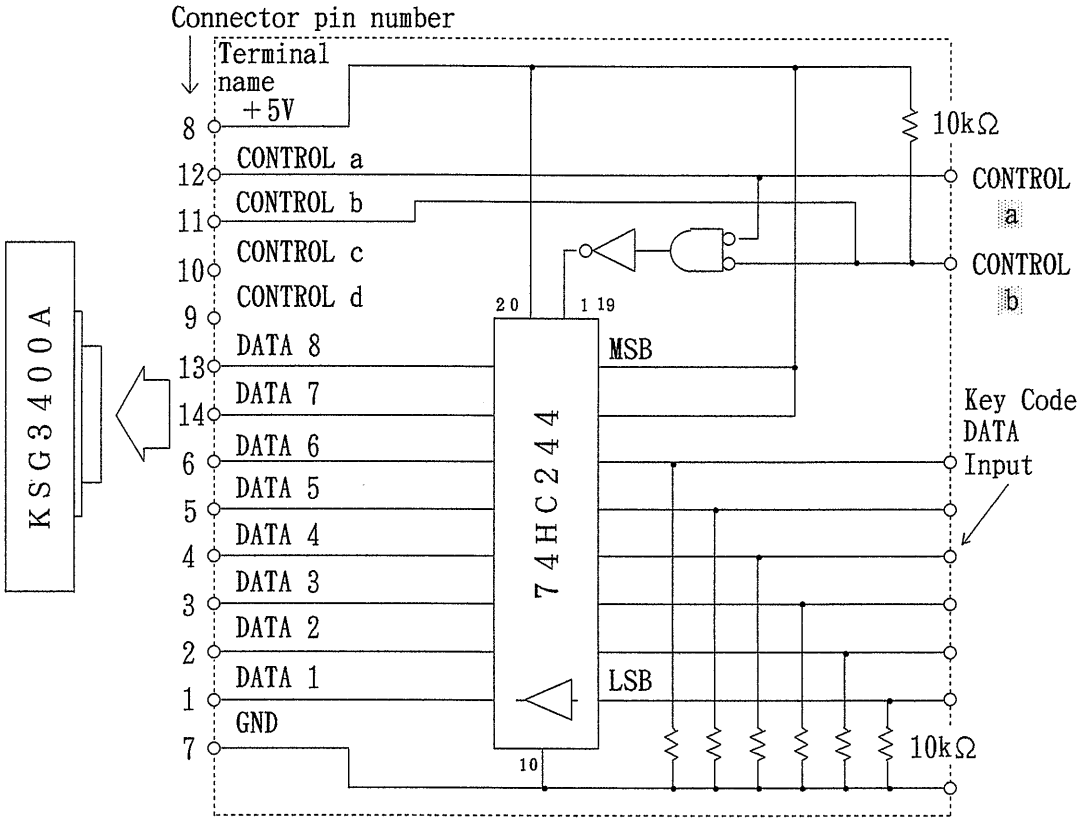


Figure 5-4

Figure 5-4 shows the circuit for controlling the KSG3400A in remote mode. When CONTROL b is "1", set the key code data (DATA 1-6) based on key code table (Table 5-1) to the key code data input terminal, and more than 10μs after the last data is stabilized, set CONTROL b to "0".

CONTROL a is set to "0" 30μs to 500ms after CONTROL a is set to "0". When CONTROL a is set to "0", Enable A and B (pins 1 and 19) of 74HC244 are set to "0", and during the period of about 100μs when CONTROL a is "0", the set key code data is read and processed by the KSG3400A. When the processing has finished, CONTROL a is set to "1".

After confirming that this signal has risen, the next key code data is set.
By repeating the above operation, key code data is input one by one.

Note 1 : If CONTROL b is set to "0" before the processing of the previous key code data is completed, about 500ms at maximum (memory call key code data processing time) is required till CONTROL a is set to "0".

Note 2 : Since the connector has eight DATA terminals, always set bits 7 and 8 (pins 14 and 13) to "1" by using 74HC244.

Figure 5-5 shows the timing chart for the example remote control circuit.

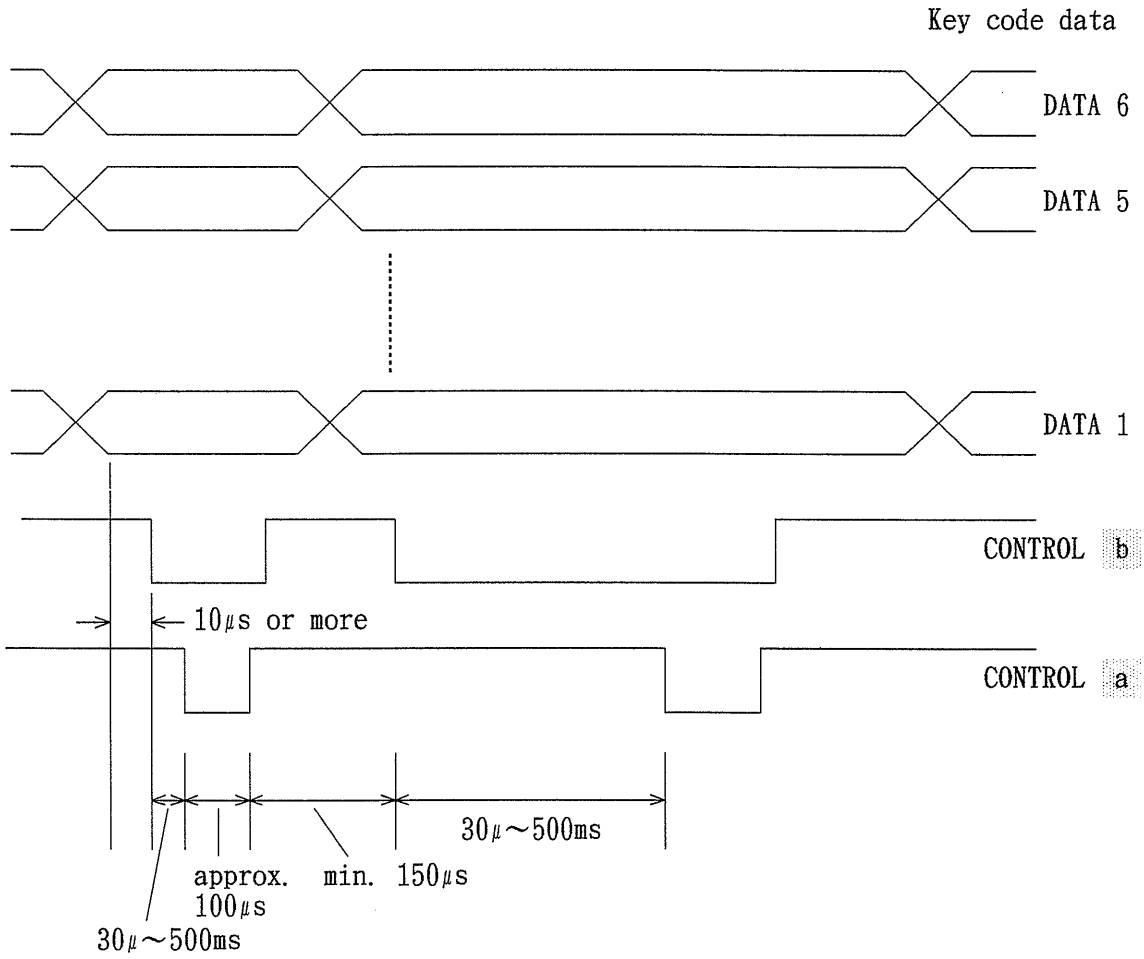


Figure 5-5

5.2.5 Memory display output circuit example

Figure 5-6 shows example circuit.

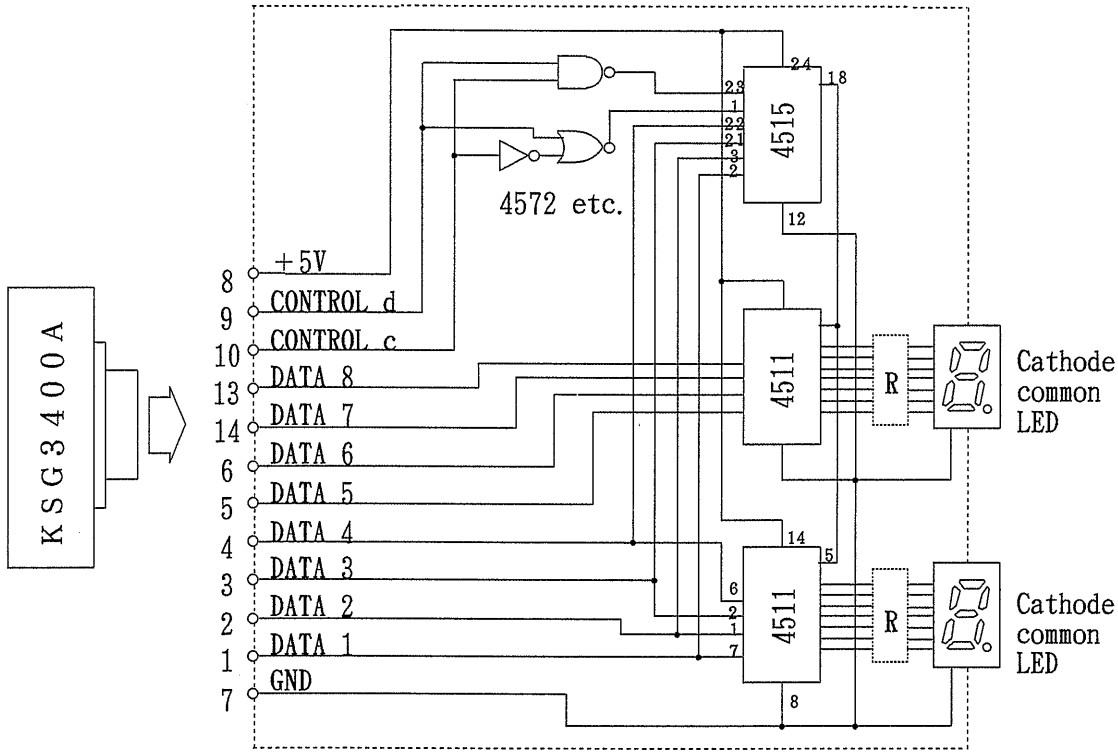


Figure 5-6

Since the remote control terminal has a bidirectional bus structure, it can output the same data displayed in the ② MEMORY section of the signal generator through the circuit shown in Figure 5-6. Additionally, the data in the ② MEMORY section can be used for a process if the CMOS 4511 is replaced by a latch circuit.

If the circuit in Figure 5-4 is connected to that in Figure 5-6 by the connector section in parallel, the user can control the signal generator by a remote unit, display the data in ② MEMORY section, and check the data on the signal generator.

6. GP-IB

(General Purpose Interface Bus)

6.1 Introduction

6.1.1 General description

The KSG3400A has a GP-IB interface, and it can be controlled by the IEEE 488 standard interface bus.

6.1.2 Features

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

(2) The remote mode can be verified by the ⑬ REMOTE indicator.

(3) The signal generator can be set in local mode at any time by the pressing of ⑬ LOCAL key. In the local mode, manual operation on the front panel is allowed. (In local lockout mode, however, the manual operation is not allowed.)

(4) The device address assigned to the signal generator can be displayed in the ⑦ LCD section.

6.2 Performance

6.2.1 Electrical specifications related to interface system

Conforms to IEEE Std 488-1975.

6.3 Operation Procedure

6.3.1 Preparation for use

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

(1) Press the ⑬ LOCAL (ADDRESS) key after the ⑭ YE key, and device address is displayed in the ⑦ LCD section.

(2) To change the device address, set a new address according to the address setting method explained in Section 6.3.2.

(3) After the hardware/software reset of CPU, the specified value "11" is displayed.

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

6.3.2 Address setting method

(1) Address Setting method by software

The old address is displayed while the ⑭ YE and ⑬ LOCAL keys are pressed.
Input new address by numeric keys or rotary knob.

(2) Address Setting method by hardware

The address of the KSG3400A is set at "11" when the instrument is delivered from the factory.
The address switch is mounted on the CPU board in the radio data signal generator. To set a new address, remove the top panel and shield board, and manipulate the address switch S1 on the PC board 90-SIG-9004* found in the left aluminum sash case viewed from the front panel. The address "11" can be changed to a desired address.

To remove the top panel, lift it up after removing two screws each from the top surface, right side, and left side (six screws in total).
The screws on the left side are fastened with rubber feet.

Remove the two screws on the left side of the aluminum sash case.
The aluminum sash case can be taken out. Lift the case, and pull out the case.
After setting the address, put the board back to its original position. Then, execute the software or hardware reset of CPU (see Section 8.2).

a) Table 6-1 lists the values of S1 and the corresponding addresses.

b) When a switch of S1 is set to ON, the corresponding bit is set to the level of "0".

c) Figure 6-1 shows how S1 is set for address "11".

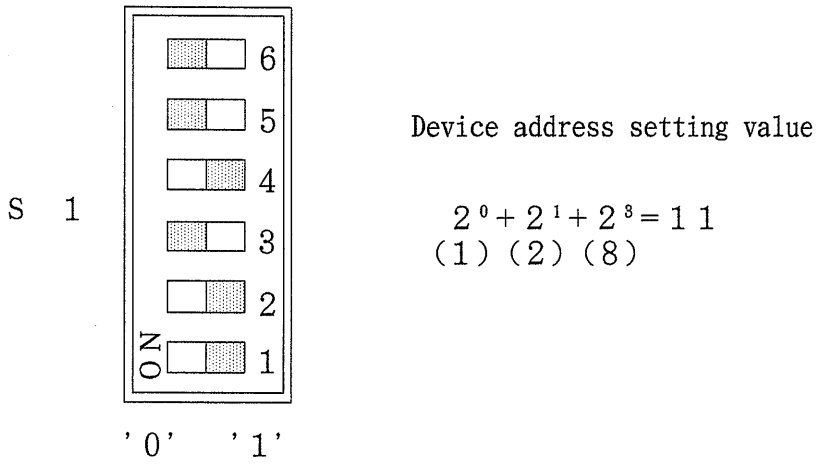


Figure 6-1

Table 6-1

Listener address	Address switch
Device number	1 2 3 4 5 6
00	0 0 0 0 0 0
01	1 0 0 0 0 0
02	0 1 0 0 0 0
03	1 1 0 0 0 0
04	0 0 1 0 0 0
05	1 0 1 0 0 0
06	0 1 1 0 0 0
07	1 1 1 0 0 0
08	0 0 0 1 0 0
09	1 0 0 1 0 0
10	0 1 0 1 0 0
11	1 1 0 1 0 0
12	0 0 1 1 0 0
13	1 0 1 1 0 0
14	0 1 1 1 0 0
15	1 1 1 1 0 0
16	0 0 0 0 1 0
17	1 0 0 0 1 0
18	0 1 0 0 1 0
19	1 1 0 0 1 0
20	0 0 1 0 1 0
21	1 0 1 0 1 0
22	0 1 1 0 1 0
23	1 1 1 0 1 0
24	0 0 0 1 1 0
25	1 0 0 1 1 0
26	0 1 0 1 1 0
27	1 1 0 1 1 0
28	0 0 1 1 1 0
29	1 0 1 1 1 0
30	0 1 1 1 1 0
Listen only	* * * * * 1

DIP SW

1 = OFF, 0 = ON

The DIP-SW is set to "11" at the factory.

6.3.3 Available control command and bus line commands

Table 6-2

Control comand and Bus line command for hP BASIC (for NEC)	Explanation
OUTPUT (PRINT@)	Specifies the listener address and sends program data.
ENTER (INPUT@)	Specifies the talker address and inputs data via interfase.
REMOTE (ISET REN)	Turns on the ⑬ REMOTE indicator (red) and prepares for receiving data when the listener adrress is specified. If the ⑬ LOCAL key on the front panel is pressed in this state, the ⑬ REMOTE indicator is turned off and the radio data signal generator is set in local mode to enable manual operation on the front panel.
LOCAL LOCKOUT	Disables manual operation on all the devices on GP-IB. The LOCAL LOCKOUT command is a universal command.
LOCAL (IRESET REN)	Turns off the ⑬ REMOTE indicator and sets the multiplex signal generator in local mode to allow manual operation on the front panel.
CLEAR (ISET IFC)	Sets the multiplex signal generator in the same state as the initial power-on state.

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

6.3.4 Program code table

Set the program codes for KSG3400A according to the function setting methods listed in Table 6-3.
See Table 6-4 for the codes for listener in alphabetical order.
See Table 6-5 for the codes for talker.
The sequence of the program codes (commands) on control program should be the same as the sequence of the operations on front panel.

Table 6-3 GP-IB Function Setting Method

Function	Program code	Data	Unit
Modulation level	MOD	○○○	PC (%)
Modulation level	MOD	○○.○	(%) PC
Modulation on/off	MODOF•ON	− − −	− − −
Modulation fanction	M1-7 (MO)	− − −	− − −
Modulation source	S1-8	− − −	− − −
Pilot level	PL	○○	PC (%)
Pilot on/off	PLOF•ON	− − −	− − −
Pre-emphasis	PRE0-3	− − −	− − −
Output level	AP	○○.○○	V
RDS modulation level	AF	○○.○○	PC (%)
RDS modulation on/off	OTOF•ON	− − −	− − −
RDS source	RDSN, 0, 1	○	− − −
Phase 0°/90°	PHO•90	○○	− − −
Phase shift	PHS	±○○	− − −
Error	ER	○○○	− − −
Error on/off	EROF•ON	− − −	− − −
Error pattern	ERP	○○○○	− − −
		○○○	
Error pattern XOR	ERXOR	− − −	− − −
Error pattern OR	EROR	− − −	− − −
Error pattern AND	ERAND	− − −	− − −
Drop level	DROP	○○○	PC (%)
Drop on/off	DROPOF•ON	− − −	− − −
Traffic radio information			
SK modulation level	SK	○○.○	PC (%)
SK modulation level on/off	SKOF•ON	− − −	− − −
DK modulation level	DK	○○	PC (%)
DK modulation level	TDK	○○	PC (%)
DK modulation level on/off	DKOF•ON	− − −	− − −
DK modulation level on/off	TDKOF•ON	− − −	− − −
BK modulation level	BK	○○	PC (%)
BK modulation level	TBK	○○	PC (%)
BK modulation level on/off	BKOF•ON	− − −	− − −
BK modulation level on/off	TBKOF•ON	− − −	− − −

(Cont'd)

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

Table 6-3 GP-IB Function Setting Method

Function	Program code	Data	Unit
BK area identification signal	AREAA-		
	AREAF	○	– – –
BK area identification signal	TAREAA-		
	TAREAF	○	– – –
Tone output on/off	TOF・ON	– – –	– – –
Memory			
Memory recall	RC	○○	– – –
Memory store	ST	○○	– – –

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

Note 1: Only capital letters can be used for the header.

2: The mark "○○" means that the data may be specified with one digit up to the maximum number of digits.

3: Data must be expressed in integers or real numbers; it must not be expressed in E format.

4: The make "---" means an optional item.

Table 6-4 GP-IB Program Codes

Classified by function

function	Program code
Modulation level	MOD
Modulation off	MODOF
Modulation on	MODON
Modulation function	
MAIN	M1
LEFT	M2
RIGHT	M3
SUB	M4
EXT L/R	M5
MONO	M6
Modulation off	M7 (M0)
Modulation source	
EXT	S1
30Hz	S2
100Hz	S3
400Hz	S4
1kHz	S5
6.3kHz	S6
10kHz	S7
15kHz	S8
Pilot level	PL
Pilot off	PLOF
Pilot on	PLON
Pre-emphasis	
OFF	PRE0
25μs	PRE1
50μs	PRE2
75μs	PRE3
Output level	AP
RDS modulation level	AF
RDS modulation off	OTOF
RDS modulation on	OTON
RDS data output	RDSN
RDS data a110	RDS0
RDS data a111	RDS1

(cont'd)

Table 6-4 GP-IB Program Codes

Classified by function

function	Program code
Phase 0°	PH0
Phase 90°	PH90
Phase shift	PHS
Error	ER
Error off	EROF
Error on	ERON
Error pattern set	ERP
Error pattern XOR	ERXOR
Error pattern OR	EROR
Error pattern AND	ERAND
Drop level	DROP
Drop level off	DROPOF
Drop level on	DROPON
SK signal	
Modulation level	SK
Modulation level off	SKOF
Modulation level on	SKON
DK signal	
Modulation level	DK
Modulation level	TDK
Modulation level off	DKOF
Modulation level off	TDKOF
Modulation level on	DKON
Modulation level on	TDKON
BK area signal	
Modulation level	BK
Modulation level	TBK
Modulation level off	BKOF
Modulation level off	TBKOF
Modulation level on	BKON
Modulation level on	TBKON

(cont'd)

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

Table 6-4 GP-IB Program Codes

Classified by function

function	Program code
BK area A	AREAA
BK area A	TAREAA
BK area B	AREAB
BK area B	TAREAB
BK area C	AREAC
BK area C	TAREAC
BK area D	AREAD
BK area D	TAREAD
BK area E	AREAE
BK area E	TAREAE
BK area F	AREAF
BK area F	TAREAF
Tone output off	TOF
Tone output on	TON
Data	
Numeric value	0-9
Minus signal	−
Decimal point	.
Unit	
%	PC or %
Vp-p	V
Memory	
Memory/recall	RC
Memory/store	ST

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

Table 6-5 GP-IB Program Codes

Alphabetical order

Program code	Explanation	Remarks
AF	RDS (Radio Data System) modulation level	Data set
AP	Output level	Data set
AREAA	BK area A	Function mode
AREAB	BK area B	Function mode
AREAC	BK area C	Function mode
AREAD	BK area D	Function mode
AREAE	BK area E	Function mode
AREAF	BK area F	Function mode
BK	BK modulation level	Data set
BKOF	BK modulation level OFF	Function mode
BKON	BK modulation level ON	Function mode
DK	DK modulation level	Data set
DKOF	DK modulation level OFF	Function mode
DKON	DK modulation level ON	Function mode
DROP	Drop level	Data set
DROPOF	Drop OFF	Function mode
DROPON	Drop ON	Function mode
ER	The error pattern is added at regular intervals, and the number of the group in each interval is specified.	Data set
ERAND	Error pattern AND	Function mode
EROF	Error OFF	Function mode
ERON	Error ON	Function mode
ERP	Error pattern setting	Function mode
EROR	Error pattern OR	Function mode
ERXOR	Error pattern XOR	Function mode
M1	MAIN signal	Modulation source
M2	LEFT signal	Modulation source
M3	RIGHT signal	Modulation source
M4	SUB signal	Modulation source
M5	EXT L/R signal	Modulation source
M6	MONO signal	Modulation source
M7(MO)	Modulation off	Modulation source

(cont'd)

Table 6-5 GP-IB Program Codes

Alphabetical order

Program code	Explanation	Remarks
MOD	Modulation level	Data set
MODOF	Modulation off	Fanction mode
MODON	Modulation on	Fanction mode
OTOF	RDS (Radio Data System) modulation level OFF	Function mode
OTON	RDS (Radio Data System) modulation level ON	Function mode
PC(%)	Percent	Unit
PH0	Phase 0°	Function mode
PH90	Phase 90°	Function mode
PHS	Phase shift (-10° - +10°)	Data set
PL	Pilot level	Data set
PLOF	Pilot off	Function mode
PLON	Pilot on	Function mode
PRE0	Pre-emphasis off	Function mode
PRE1	Pre-emphasis 25μs	Function mode
PRE2	Pre-emphasis 50μs	Function mode
PRE3	Pre-emphasis 75μs	Function mode
RC	Memory recall	Data set
RDSN	Output of RDS (Radio Data System) data	Function mode
RDS0	Output of all 0	Function mode
RDS1	Output of all 1	Function mode
S1	External modulation EXT	Modulation source
S2	Internal modulation 30Hz	Modulation source
S3	Internal modulation 100Hz	Modulation source
S4	Internal modulation 400Hz	Modulation source
S5	Internal modulation 1kHz	Modulation source
S6	Internal modulation 6.3kHz	Modulation source
S7	Internal modulation 10kHz	Modulation source
S8	Internal modulation 15kHz	Modulation source
SK	SK modulation level	Data set
SKOF	SK modulation level OFF	Function mode
SKON	SK modulation level ON	Function mode
ST	Memory store	Data set

(cont'd)

Table 6-5 GP-IB Program Codes

Alphabetical order

Program code	Explanation	Remarks
BK	Area indentification signal mod. level	Data set
TBK	Area indentification signal mod. level	Data set
AREAA	Area indentification signal A	Function mode
TAREAA	Area indentification signal A	Function mode
AREAB	Area indentification signal B	Function mode
TAREAB	Area indentification signal B	Function mode
AREAC	Area indentification signal C	Function mode
TAREAC	Area indentification signal C	Function mode
AREAD	Area indentification signal D	Function mode
TAREAD	Area indentification signal D	Function mode
AREAE	Area indentification signal E	Function mode
TAREAE	Area indentification signal E	Function mode
AREAF	Area indentification signal F	Function mode
TAREAF	Area indentification signal F	Function mode
BKOF	BK Modulation level off	Function mode
TBKOF	BK Modulation level off	Function mode
BKON	BK Modulation level on	Function mode
TBKON	BK Modulation level on	Function mode
DK	DK Modulation level	Data set
TDK	DK Modulation level on	Data set
DKOF	DK Modulation level off	Function mode
TDKOF	DK Modulation level off	Function mode
DKON	DK Modulation level on	Function mode
TDKON	DK Modulation level on	Function mode
TOF	Tone output signal off	Function mode
TON	Tone output signal on	Function mode
V	Output level	Unit
0 - 9	Numeric value	Data
-	Minus sign	Data
.	Decimal point	Data
% (PC)	Modulation level in percent	Unit

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

Table 6-6 GP-IB Program Codes (Use talker)

Program code	Returned data	Comment
AF?	dd.dd%	"dd.dd" is the set value.
AP?	dd.ddV	"dd.dd" is the set value.
AREA?	c	"c" is a letter selected from "A" to "F".
BK?	s n%	"s" is replaced by "ON or "OFF". "n" is the set value of one or two digits.
DK?	s n%	"s" is replaced by "ON or "OFF". "n" is the set value of one or two digits.
DROP?	s n%	"s" is replaced by "ON or "OFF". "n" is the set value of one, two, or three digits.
ER?	s s1 Phhhhhhh n	"s" is replaced by "ON" or OFF". "s1" is replaced by "OR", "XOR", or "AND". "hhhhhhh" is replaced by the letter and a 7-digit hexadecimal number. "n" is a 3-digit number.
MOD?	s ddd.d% s dd.dd%	"s" is replaced by "ON" or "OFF". "ddd.d" is the set value. The first letter d is a blank when "ddd.d" is less than equal to 10% . In the case of ON pre-emphasis only.
OT?	s	"s" is replaced by "ON" or "OFF".
PH?	n Sn'	"n" is replaced by "0" or "90". "Sn'" is replaced by the letter "Sn'" and a value within the range of ±10.
RDS?	c	"c" is replaced by "N", "0", or "1".
SK?	s dd.d%	"s" is replaced by "ON" or "OFF". "dd.d" is the set value.

6.3.5 Basic method of setting data

In the following examples, HP9816 or PC9801 is used.

Example 1: To set the modulation level to 90%, pilot level to 10%, internal modulation frequency to 1kHz, output level to 3Vp-p, RDS (Radio Data Sysem) modulation level to 5%, and SK modulation level to 7%.

```
OUTPUT 711 ;"MOD90PC, PL10%, S5, ........
(PRINT@  11 ;"MOD90PC, PL10%, S5, ........
```

Output command — Modulation level data — Pilot data — 1kHz data

```
........AP3V, AF5PC, SK7PC"
........AP3V, AF5PC, SK7PC")
```

Output data — RDS Modulation level data — SK Modulation level data

Normally, CRLF OR EIO is sent.

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

```
OUTPUT 711 ;"MOD90PC",(PRINT@ 11;"MOD90PC")
OUTPUT 711 ;"PL10%",  (PRINT@ 11;"PL10%")
OUTPUT 711 ;"S5",     (PRINT@ 11;"S5")
OUTPUT 711 ;"AP3V",   (PRINT@ 11;"AP3V")
OUTPUT 711 ;"AF5PC",  (PRINT@ 11;"AF5PC")
OUTPUT 711 ;"SK7PC",  (PRINT@ 11;"SK7PC")
```

Example 3: The traffic information area of TRI is to be input to A$.

```
OUTPUT 711 ;"AREA?"   (PRINT@ 11 ;"AREA?")
ENTER  711 ;A$        (INPUT@ 11 ;A$)
```

Example 4: To set the stereo modulation level to 30% and pilot level to 8%.

Example 5: To set modulation function to LEFT signal, enter "M2".

Example 6: To set modulation source to 400 Hz, enter "S4".

Example 7: To turn off the modulation level, enter (1) "MODOF", (2) "M7", and (3) "MO".

Example 8: To turn off the pilot level, enter "PLOF".

Example 9: To set the output level to 2.83 Vp-p, enter "AP2.83V"

Example10: To set the RDS (Radio Data System) modulation level to 1.6%, enter "AF1.6pc".

Example11: To set the BK area to A, enter "AREAA".

Example12: To set the RDS (Radio Data System) output level to OFF, enter "OTOF".

Example13: Recall of memory
Recall of memory address ⌜36⌟, enter "RC36".

Example14: Store of memory
Same as recall.

6.3.6 Connector pin allocation diagram

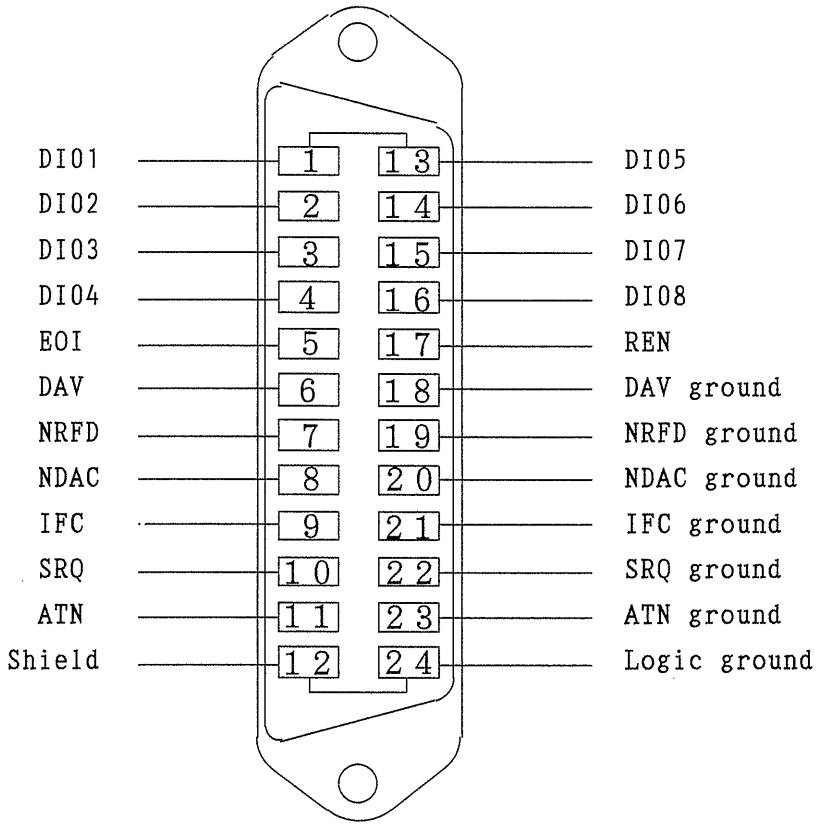


Figure 6-2

6.3.7 Sample program

For reference, this section gives a sample program to set the stereo modulation level, pilot level, and modulation source, to store the set data in the memory of KSG3400A, and to call them. HP9816 is to be used for the program.

This program may not be the best. Since the description method varies with the control system, select the control method that suits the system.

```
10  Dev=709                                  Interface select
                                             code*100 + device/address
20  Mod_level=10                             10%
30  Mod_level_step=10                        10%
40  Pilot_level=10                           10%
50  Pilot_step=-1                            -1%
60  CLEAR Dev                                Select device clear
70  WAIT 2
80   FOR N=0 TO 9
90    Mod=Mod_level + Mod_level_step*N
100   Pilot=Pilot_level + Pilot_step*N
110   OUTPUT Dev; "MOD"; Mod "PC"             Stereo Modulation level
                                             set
120   OUTPUT Dev; "PL"; Pilot "PC"            Pilot level set
130   OUTPUT Dev; "S5"                        Internal 1kHz set
140   OUTPUT Dev; "ST"; N                     Memory/store
150 NEXT N
160 FOR N=0 TO 9
170   OUTPUT Dev; "RC"; N                     Memory/recall
180   WAIT 2
190 NEXT N
200 END
```

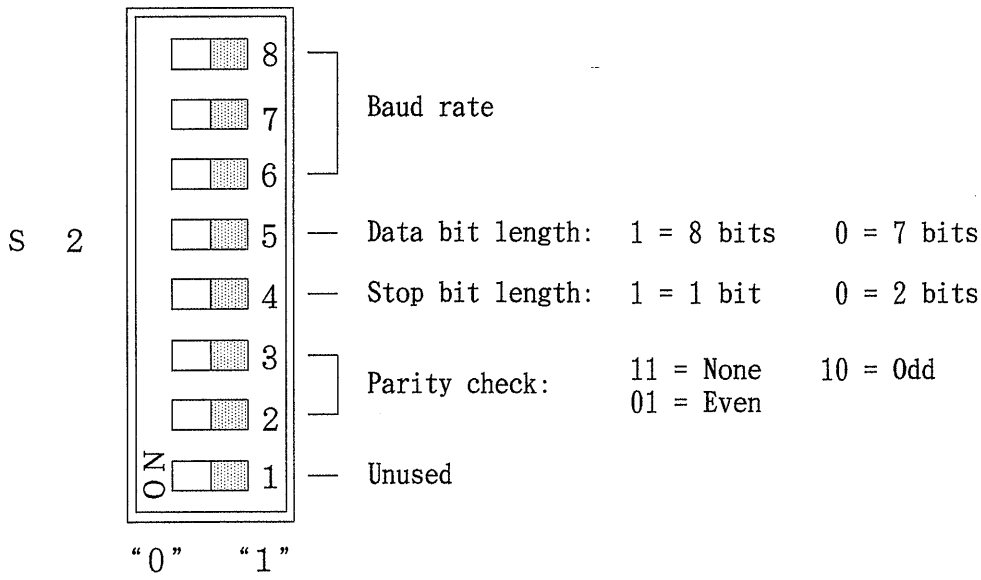
7. SIO INTERFACE

(conforming to RS-232C)

7.1 SIO Interface Function

Baud rate: 300, 600, 1200, 2400, 4800, 9600
Data bit length: 7 bits, 8 bits
Stop bit length: 1 bit, 2 bits
Parity check: Even, odd, none
Others: Asynchronous

To select the proper value for each one of the above items, use the switch "S2" on the Board 90-SIG-9004* as below.
See Section 6.3.2 for the method of removing the top panel and aluminum sash case.



(8)(7)(6)				(5)(4)(3)(2)				Data bit length	Stop bit length	Parity check
1	1	1	9600bps	1	1	1	1	8	1	None
1	1	0	4800 〃	1	1	1	0	8	1	Odd
1	0	1	2400 〃	1	1	0	1	8	1	Even
1	0	0	1200 〃	1	0	1	1	8	2	None
0	1	1	600 〃	0	1	1	0	7	1	Odd
0	1	0	300 〃	0	1	0	1	7	1	Even
				0	0	1	0	7	2	Odd
				0	0	0	1	7	2	Even

Setted values when the KSG3400A is shipped from factory.

When the instrument is shipped from the factory, all the bit switches on S2 are set to "1"; that is, the baud rate is 9600 bps, data bit length is 8 bits, stop bit length is 1 bit, and no parity check is specified.

7.2 Control through RS232C

By using the commands listed in the GP-IB program code tables 6-3 to 6-5, the KSG3400A can be controlled through the RS232C interface in the same way as it is controlled through the GP-IB interface.

7.2.1 Connector pin assignment

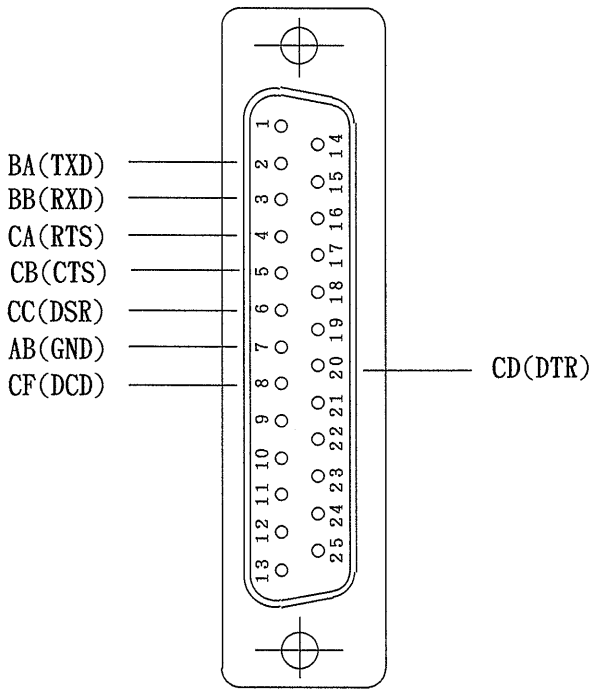


Figure 7-1

This connector is designed as the DCE (data circuit terminating equipment) of RS232C.

To send a program code by the RS232C, turn on CA first. After CA is turned on, CB is turned on. After CB is turned on, send the program code through BA.

CB is turned on/off for each character.

Each program code may consist of ASCII characters, carriage return (CR), and line feed (LF), and it must not exceed 80 characters. To receive the return data through the RS232C, CD must be turned on.

After sending the program code to request return data in the above method, send ACK (CTRL-F) in the same method. Then, the return data is received through BB.
The return data is terminated with CR and LF.
CC and CF are turned on when the KSG3400A is powered on and set in the active state.

8. BACKUP BATTERY AND INITIALIZING CPU

8.1 Backup Battery

The KSG3400A uses a memory backup battery, and the battery may discharge all its electricity when the signal generator is not used for a long time.

Turn on the power for the signal generator having a charging circuit, and fully charge the battery.

The memory backup battery is greatly affected by the surrounding temperature, humidity, and storage conditions. After about five years, the discharge capability of the battery is reduced to approximatly 90% of the initial capability. The battery is fully usable in this state, but when it becomes unusable, replace it with GB 50H-3X of Japan Storage Battery Co., Ltd.

[Battery position and replacement method]

Remove the top panel of the KSG3400A, and an aluminum sash case is found on the left-hand side viewed from the front panel.
The aluminum sash case contains the CPU printed circuit board, and the battery is mounted on this board.
See Section 6.3.2 for the method of removing the top panel and taking out the aluminum sash case.

Pull out the printed circuit board from the aluminum sash case, and replace the old battery with a new one.

After replacing the battery, insert the PC board into the aluminum sash case and fasten the screws.

Then, be sure to execute the CPU hardware reset.

8.2 Initializing CPU

(1) Hardware reset

Turn on the power, and initialize the CPU by pushing the initial setting button switch S1 by an isolation screwdriver or something inserted from the hole on the side of the aluminum sash case containing the CPU board. At this time, all the data in memory, values for steps, and GP-IB address are set to their initial values.

(2) Software reset

Turn on the power switch while pressing the YE key on the panel;
then, the CPU is reset. At this time, all the data in memory, values for steps, and GP-IB address are set to their initial values.

9. MESSAGES

The messages for the operation of the KSG3400A are displayed in the second line of the screen on ⑦ LCD.

Message	Explanation
-- Output data is all 0 --	The data of continuous 0 is set as RDS (Radio Data System) data. When this message is displayed, changing the RDS data on the screen by numeric keys or rotary knob does not affect the output data. To terminate the output of all 0 data, select "RDS (Radio Data System)" on the 〈Hard set Information〉 screen.
-- Output data is all 1 --	The data of continuous 1 is set as RDS (Radio Data System) data. When this message is displayed, changing of the RDS data on the screen by numeric keys or rotary knob does not affect the output data. To terminate the output of all 1 data, select "RDS (Radio Data System)" on the 〈Hard set Information〉 screen.
ERROR < memory full >	If more data should be stored, the amount of the stored data would exceed the maximum memory capacity of the KSG3400A, which is 5K bytes. Therefore, the store operation cannot be executed.
ERROR < Time out in dump >	The KSG3400A to receive the memory dump data is not connected.
ERROR <number full>	An attempt was made to specify more than 99 EON networks.
ERROR <not exist data>	An attempt was made to delete data when the data to be deleted does not exist.