OPERATION MANUAL

RADIO DATA SIGNAL GENERATOR

KSG 3400

Second Edition

KIKUSUI ELECTRONICS CORPORATION

(KIKUSUI PART NO. Z1-478-220)

M-90121

Power Requirements of this Product

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

☐ Input voltage

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

☐ Input fuse

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

WARNING

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

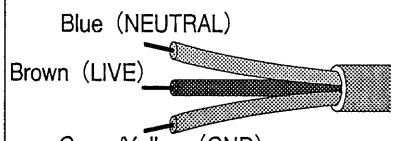
☐ AC power cable

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

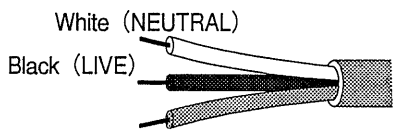
WARNING

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

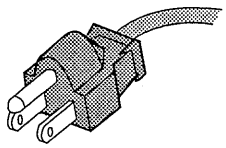
☐ Without a power plug



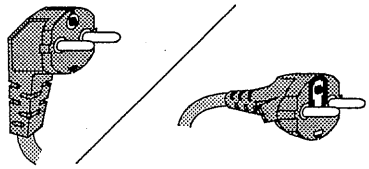
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

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

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

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1. GENERAL DESCRIPTION

1.1 Outline

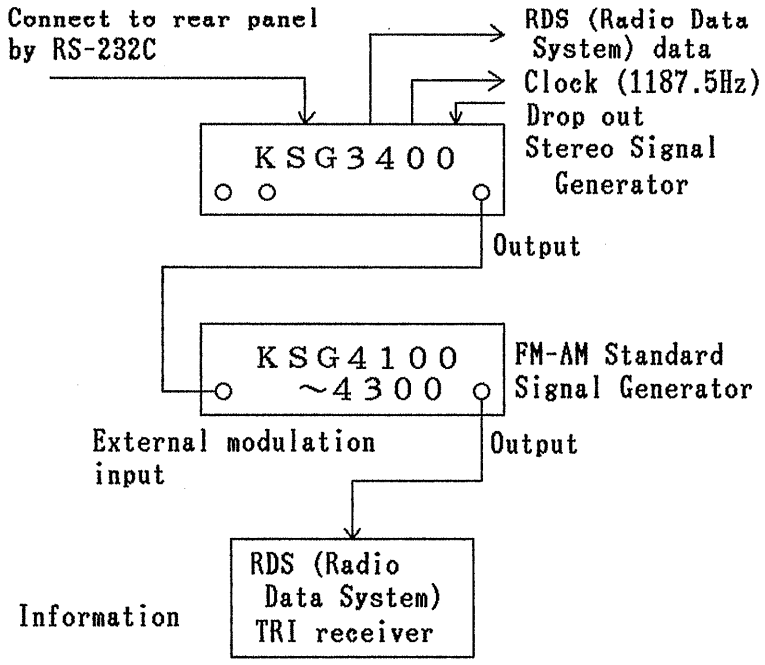
The KSG3400 Radio Data Signal Generator generates the TRI (=ARI) signal and the RDS (Radio Data System) signal described in the EBU Tech. 3244-E & Supplement No. 1, and it may be used for studying, developing, adjusting, and inspecting the RDS IC chips and receivers.

Applying the output signal of the KSG3400 to the SCA input terminal of a stereo signal generator (KSG3100 - 3200) multiplexs the RDS and TRI signals.

The output signal from the stereo signal generator is applied to the external modulation input terminal of an FM-AM standard signal generator (KSG4100 - 4300). The high frequency output of the FM-AM standard signal generator supplies the signal to an RDS TRI receiver.

The RDS and clock signal (1187.5 Hz) are output from the rear panel of the KSG3400 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 KSG3400 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 KSG3400.

1.2 Features

(1) Data to be generated or edited is displayed on the LCD of the KSG3400.

(2) 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.

(3) Depending on the input data, the KSG3400 extracts necessary codes from the data sets automatically, generates group data, and outputs the required data on a realtime basis.

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

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

(6) The phase of the 57kHz sub-carrier can be set to 0% or 90% (for the third harmonic of the 19kHz pilot signal).

(7) The phase of the 57kHz sub-carrier is variable by ±10% in 1% increment.

(8) Excellent 57kHz carrier suppression ratio.

(9) The KSG3400 has an output connector with buffer and a phase adjuster for external synchronization of the pilot signal, making phase calibration of the external pilot signal and 57kHz sub-carrier easy.

(10) The modulation level and output level can be specified by numeric keys. Continuous vernier adjustment also provides by a rotary knob.

(11) All data displayed on the panel and data input by personal computer may be stores in memory. Up to 100 points of data can be stored and recalled.

(12) The data stored in the memory of one KSG3400 can be copied to the memory of another KSG3400 by pressing the DUMP key.

(13) 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.

(14) Standard GP-IB and RS-232C interfaces allow remote control using either format.

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

2. SPECIFICATIONS

(1) Data can be generated and edited by the LCD, numeric keys, and rotary knob on the front panel.

(2) Data can also be generated and edited by an external personal computer (PC9801, MS-DOS* Ver 2.0 or higher) and the software.
*MS-DOS is the trademark of Micro Soft Corp. of U.S.A.

2.1 RDS (Radio Data System) Data Generation and Output Format

2.1.1 Generating and editing data

(1) Data can be generated and edited in the forms of data sets such as PI, PS, and AF.

(2) The group type sequence (ex. 0A, 1B, 2A,.....) by which to send the data sets can be generated and edited.

(3) Based on the input data and according to the group type sequence, the necessary codes are extracted from data sets and output sequentially.

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

(5) Group type sequence

a) Thirty-two group types in total (type 0A to 15B) and user-defined special group types ("UD1" and "UD2") can be used repeatedly.

b) If "CT-ON" explained in Paragraph (2) of Section 2.1.3 is selected, type 4A is inserted into sequence every one minute automatically.

(6) Data sets

a) PI, PS, PTY, TP, TA, M/S, DI, AF, PIN, ON, RT, CT (MJD)

b) The data sets are sent by the group types of 0A, 0B, 1A, 1B, 2A, 2B, 3A, 3B, 4A, and FB (15B).

c) The information words (excluding PI, group type code, B_0, TP and PTY) of other group types and the spare bits of the above group types can be input in hexadecimal mode.

2.1.2 Data set input format

(1) PI: Program Identification
HEX Four digits hhhh

(2) PS: Program Service name
ASCII Eight characters N aaaaaaaa
- The PS is addressed and output in units of two characters sequentially starting from the leftmost character.
- "N" specifies the code table (optional).
  0, 1, 2: Code table
  N: No code table
- When a code table is specified, the code corresponding to the code table is output to address 0.

(3) PTY: Program TYpe
0-31 Decimal number nn

(4) TP: Traffic Program identification
Input "1" or "0" by the TP ON/OFF key on the front Panel.

(5) TAn: Traffic Announcement identification
Input "1" or "0" by the TA ON/OFF key on the front panel.
- "n" specifies how many groups of type 15B are to be inserted when TA is changed (by PC9801 or by the key manipulation on front panel). "n" is optional.
  n: 0-9

(6) M/S: Music/Speech switch
Input "1" or "0" by the M/S ON/OFF key on the front Panel.

(7) DI: Decoder Identification

0-15 Decimal number nn

(8) AF: Alternative Frequencies

mm.mM:nn.nM,＊nn.nM...

- "mm.mM" is for the header frequency, and "nn.nM" is for the alternative frequency.
- "＊nn.nM" means the AF of adjacent region.
- As the header frequency, only an FM band frequency is allowed to be input in units of 100 kHz, but as the alternative frequency, either an FM band frequency with offest (ex. 99.75 MHz), an LF or MF band frequency, or the filler code "FL" can be input.

  FM: 87.5 - 107.9 MHz

  MF: 531 - 1602 KHz

  LF: 155 - 281 KHz
- When data is output, the following operations are done automati-cally: (1) Generation of the code that represents the number of AFs, (2) Pairing of the header frequency and AF when Method B is selected, and (3) Splitting of the list consisting of more than 12 AFs.

(9) PIN: Program Item Number

day, hour, minute Input in decimal mode. dd-hh-mm

(10) ON: Other Networks

The information on up to eight other networks (0-7) can be input.

- The input formats of PI, PIN, TP, PTY, TA, and AF for other networks are the same as those of PI, PIN, TP, PTY, TA, and AF as data sets.
- *Note, however, that "n" of TA for other network specifies how many groups of address 2 are to be inserted when the TA is changed (by PC9801 or by the key manipulation on front panel). The default value is 0.*

(11) RT: Radio Text

ASCII 64 characters (max) aaaa...

Flag b

- "b" is the initial value of Text A/B flag. It is "0" for Text A and "1" for Text B.
- The character string is addressed and output sequentially in units of four characters (in units of two characters for group type 2B) starting from the leftmost character.

(12) MJD: Modified Julian Day

year, month, day, hour, minute, ± hour

Input in decimal mode. 19yy-mm-dd hh:mm:±nn.n

- The input value is used as the initial value.
- The day specified for MJD must be within the period from March 1, 1900, to February 28, 2100.
- The MJD represents the initially set time (hh:mm) and offset time (±nn.n).

(13) CT: Clock Time and date

year, month, day, hour, minute 19yy-mm-dd hh:mm

- The value of the minute is incremented by 1 every minute by the internal clock or each time the state of "CT" switch is changed from OFF to ON as explained in Paragraph (2) of Section 2.1.3.

2.1.3 Changing output data

The contents of the data sets being output and their group type sequence can be changed in the same way as they are generated and edited (see Section 2.1.1).

Note: It takes about 0.7 seconds for the changed data to be actually output from the KSG3400 because there are eight output buffers (for eight groups).

(1) Realtime changing of switching data

The data can be changed by the method explained in Section 2.1.2 (by PC9801, etc.), but TP, TA, and M/S can be changed at any time by the key manipulation on the front panel.

(2) CT output

A "CT" switch (ON/OFF toggle operation) is provided as software key, and each time the state of this switch is changed from OFF to ON, the value of minute is incremented by 1 and the group data of type 4A is generated and inserted into output data.

If the ON state of the "CT" switch continues, the value of minute is incremented by 1 at every one minute by an internal clock and the group data of type 4A is generated and inserted into output data.

2.1.4 Setting error patterns

(1) Error patterns (XOR, OR, AND) can be set.

(2) Error blocks can be generated at intervals of some output data blocks, and the number of the output data blocks in between can be specified within the range from 0 to 255.

2.1.5 Checking contents of memory

The contents of memory can be checked on the CRT of the PC9801 connected to the KSG3400 or on the front panel display of the KSG3400. The data is displayed in the format in which it is generated/edited.

2.2 Hardware Section

(1) RDS (Radio Data System) signal

Frequency/Accuracy:	57kHz ±6Hz
Level range:	0 to 10%
Resolution:	0.01%
Frequency phase:	0° or 90°
Phase adjustable range:	±10° (for the third harmonic of the 19kHz pilot signal)
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

(2) TRI (= ARI) signal

SK (Trasmitter Identification Signal)

Frequency/Accuracy:	57kHz ±6Hz
Range:	0 to 10%
Resolution:	0.1%

DK (Announcer Identification Signal)

Modulation:	Amplitude modulation w/SK signal as carrier
Modulation frequency:	125Hz
Modulation level:	0 to 35% (prescribed level 30%)
Resolution:	1%

BK (Area Identification Signal)

Modulation:	Amplitude modulation w/SK signal as carrier
Modulation frequency:	A to F (23.75Hz to 53.98Hz)
Modulation level:	0 to 64% (prescribed level 60%)
Resolution:	1%

(3) Output level: 0 to 5.00Vp-p
Resolution: 0.01Vp-p

(4) Impedance: 75Ω ±5% (unbalanced)

(5) 19kHz pilot

Input

Impedance:	10kΩ ±5%
Level:	0.5 to 1.5Vrms

CALOUT Buffered output of input pilot signal

Impedance:	600Ω ±5%
Level:	0.5 to 1.5Vrms

(6) Display function

Menu screens can be switched by F1 to F5, and generated/edited data and specified output levels can be displayed.

(7) Data input

Numeric keys and rotary knob

(8) Memory function

100 points can be used (10 points × 10, or 100 points × 1). Data, output levels, specified modes, etc. can be memorized.

a) Store (with indicator)

b) Recall

c) Increment/decrement of memory address

d) Returning of memory address

(9) DUMP function

By using the DUMP key, the contents of the 100-point memory can be transferred to another instrument of the same model.

(10) Data output

TTL level (rear panel)

(11) 1187.5 Hz clock output

TTL level (rear panel)

(12) Drop-out input

TTL level (rear panel)

(13) GP-IB interface

SH1, AH1, T6, L3, TE0, LE0, SR1, RL1, PP0, DC1, DT0, C0

(14) 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

(15) Backup Battery Provided

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

Frequency : 50Hz/60Hz

Power dissipation: Approx. 26VA

(17) Size and Weight

Dimensions : 430(W) × 99(H) × 300(D) mm
(16.93(W) × 3.90(H) × 11.81(D) in.)

445(W) × 119(H) × 355(D) mm (Full envelope)
(17.52(W) × 4.69(H) × 13.98(D) in.)

Weight : Approx. 6kg (13 lbs)

(18) Environmental Conditions (temperature and humidity)

Range to satisfy: 5 to 35°C (41 to 95°F); 85% or less
specifications

Allowable range: 0 to 40°C (32 to 104°F); 90% or less
for operation

(19) Accessories :

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

3. PREPARATION FOR USE

3.1 Unpacking and Inspection

Before being shipped from the factory, the KSG3400 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 KSG3400, and the instrument can be used in the selected voltage range.

Before connecting the power supply cord to the instrument, verify that the voltage selection is matched to the power source. When the voltage range is changed, change the fuse also according to the table below.

Application of a voltage beyond the selected range will cause in complete operation or failure.

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

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

The KSG3400 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 instru-ment will be shortened.

The instrument requires the warm-up time of 30 minutes. Do not use the instrument near a strong magnetic field or electromagnetic waves.

4. OPERATION

The front panel and rear panel are illustrated in Sections 4.3 and 4.4. The numbers ① to ㉔ 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 KSG3400 is powered on; when it is pressed again, the KSG3400 is powered off.

When the KSG3400 is powered on, all the indicators on the front panel lights up first. Then, the indicators return to their respective states found when the KSG3400 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 modulation level, output level, cursor position, and RDS (Radio Data System) data shown on the front panel 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 ⑱ 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 ⑱ 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.

⑧-b Store method

(1) Press ⑱ 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 and output level is stored in the first column of a block.

(2) Press ⑱ YE, STO (RCL), and NEXT (△), and the data such as modu-lation level and output level is stored in the row address next to the displayed row address.

(3) Press ⑱ 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 and output level is stored in the column and row specified by the number.

(4) Press ⑱ 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 and output level is stored in the row specified by the number.

(5) Press ⑱ 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.

(6) Press ⑱ YE and DUMP (▽), and the data stored in ② memory addres-ses 00-99 is transferred to an instrument of the same type through the REMOTE terminal on the rear panel. During the data transfer, the message "Memory dump mode" is displayed on ⑦ LCD.

④ 19kHz LOCK indicator

The indicator lights up when the output signal is synchronized with the 19kHz pilot signal for external synchronization.
The input level is 0.5 to 1.5V rms.

⑤ PILOT INPUT

BNC connector to input the 19 kHz pilot signal for external synchronization.
This connector is connected to the pilot signal output terminal of a stereo signal generator (KSG3100～3210), and if the output signal is synchronized with the 19kHz pilot signal, the ④ 19kHz LOCK indicator is on. If the 19kHz pilot signal is not input, the output signal is synchronized with the signal generated by the internal reference crystal oscillator.

⑥ PILOT CAL OUT

The signal input through ⑤ PILOT INPUT is buffered and output through this BNC connector (PILOT CAL OUT). This connector is used for calibrating the phase of the pilot signal.
The output impedance is approximately 600Ω.
The output level is the same as the input level.

⑦ LCD

The LCD displays such information as the modulation level of RDS (Radio Data System) signal, output level, RDS (Radio Data System) data, and modulation level and area of TRI signal.
By using numeric keys and rotary knob, the 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 RADIO DATA

ON/OFF keys for RDS (Radio Data System) signal.
Realtime changing ON/OFF switches for TP, TA, and M/S bits in RDS signal group data, and ON/OFF switch for RDS signal (57kHz carrier suppression DSB signal).
The indicators light up in the ON state.

⑪ TRAFFIC RADIO INFORMATION

ON/OFF keys for traffic information signals.
The SK, DK, and BK keys are used to turn on/off the signals.
The indicators light up in the ON state.

⑫ LOCAL key

(1) LOCAL key

When the KSG3400 is controlled by an external instrument, the REMOTE indicator lights up in red color, but the KSG3400 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 KSG3400 is in local lock out state.

(2) REMOTE indicator

The REMOTE indicator lights up when the KSG3400 is in remote control state and goes off when it is in local control state.

(3) ADDRESS key (⑬ YE + LOCAL)

Press the ⑬ YE key and LOCAL Key successively, and the ⑦ LCD displays "11", the device address of GP-IB.
To return to the preceding screen, press a MENU key.

⑬ 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) RADIO DATA, TRI, ON (YE RADIO DATA), and SYSTEM (YE TRI) keys
These keys switch the current screen to 〈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) ～ 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.

⑭ 57kHz PHASE
Use this dial for matching the phase of the internal 57kHz signal to the phase of the third harmonic of the 19kHz pilot signal for external synchronization.

⑮ "OUTPUT" Z=75Ω
BNC output connector for RDS (Radio Data System) signal and TRI signal. The output impedance is approximately 75Ω.

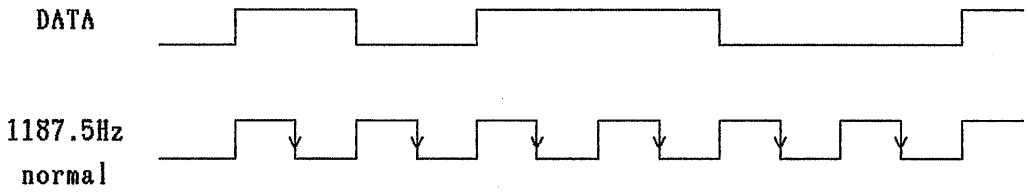
4.2 Rear Panel Features

⑯ SIO

Use this connector for controlling the KSG3400 through a serial interface (RS-232C).

⑰ 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 4.7.14).

⑱ 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.

⑲ OUTPUT (TTL) 1187.5Hz

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

⑳ FUSE

Fuse for AC power source.

The fuse must match the AC line voltage. The applicable fuse is indicated on the rear panel.

㉑ AC connector

AC power inlet.

㉒ 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

㉓ GP-IB

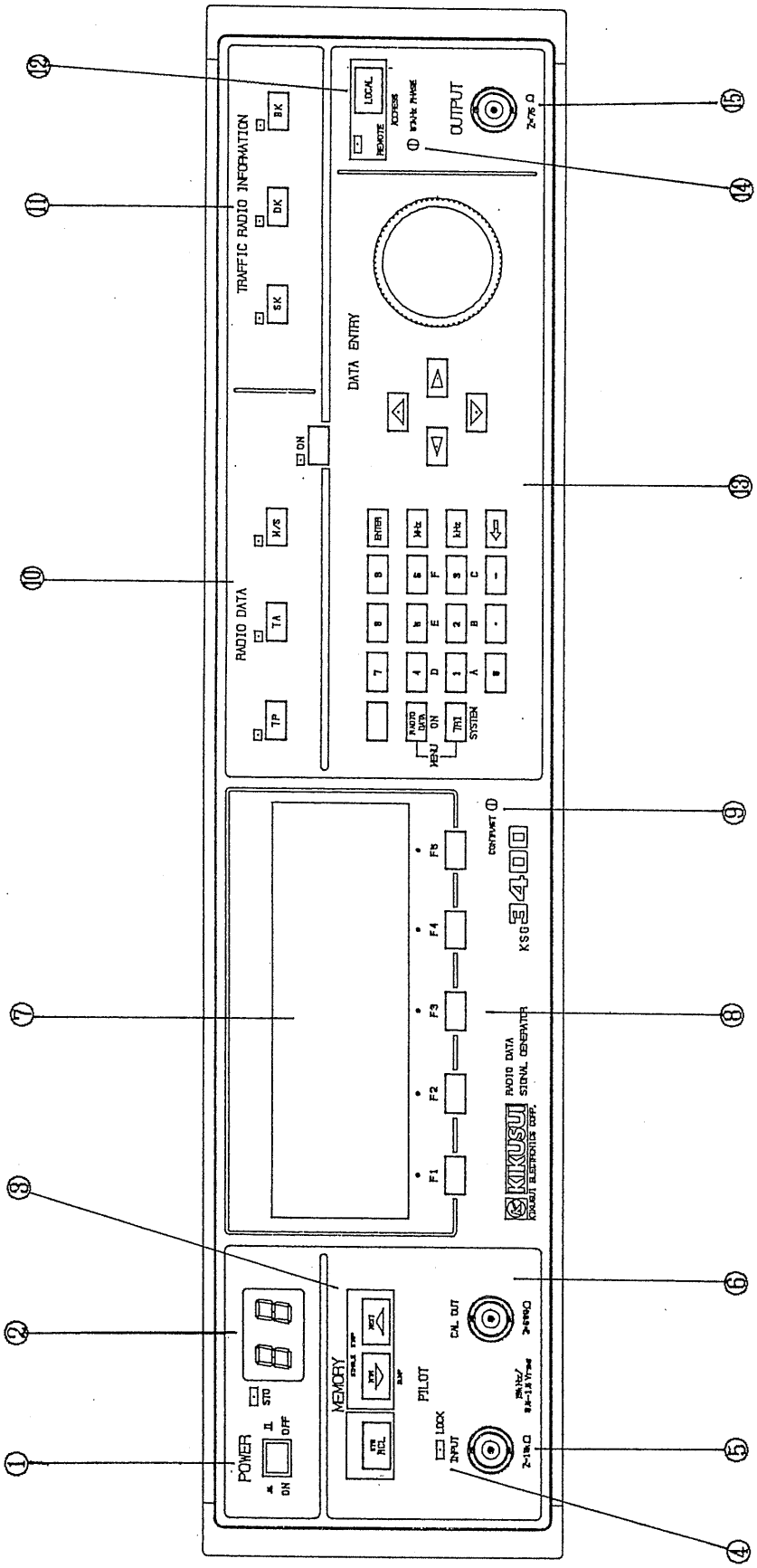
Use this connector for controlling the KSG3400 through GP-IB.

㉔ VOLTAGE SELECTOR

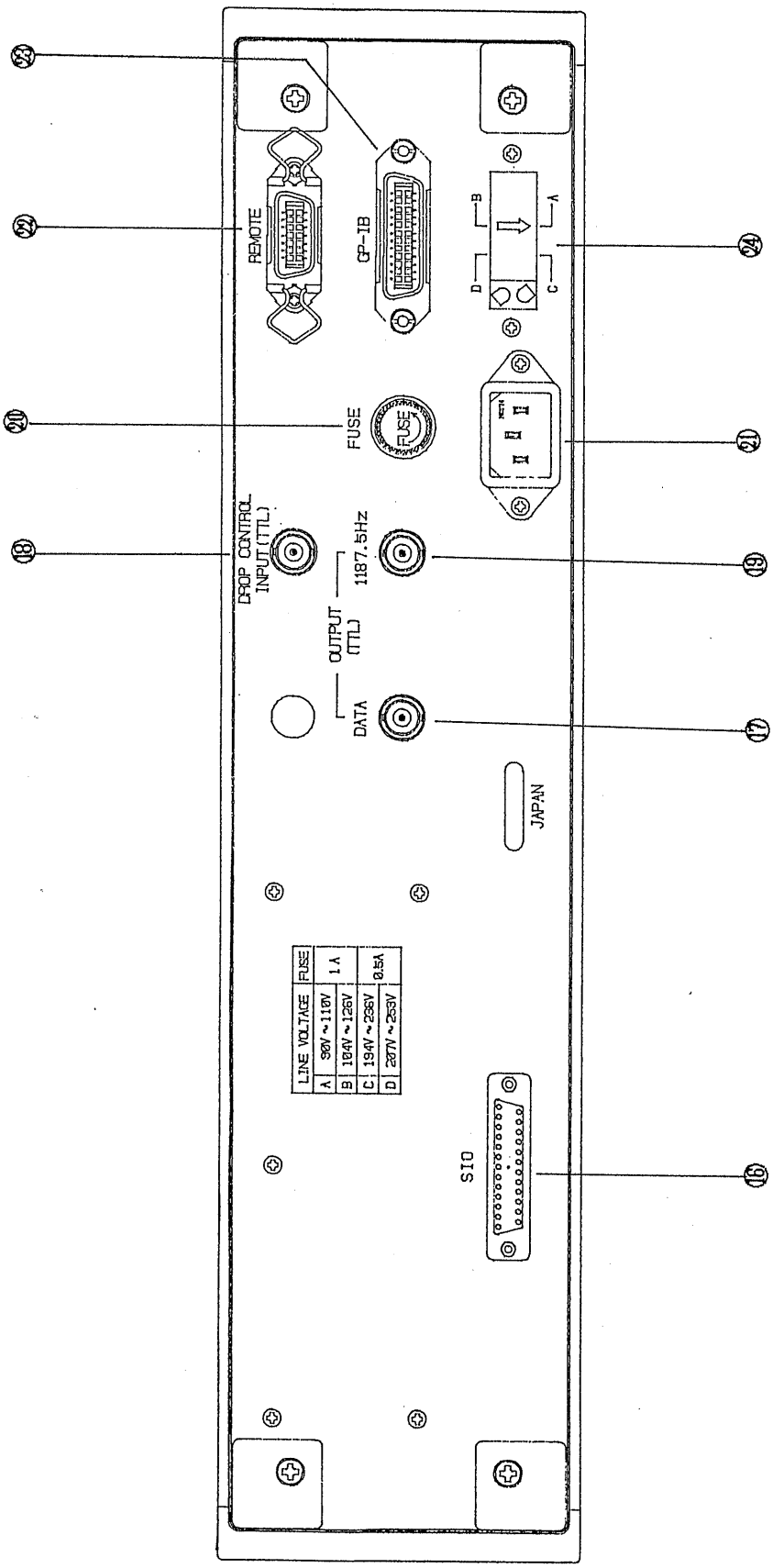
AC power source voltage selector.

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 KSG3400 is shipped from factory, the 100-point memory (00-99) contains the initial values; that is, "all 0" as RDS (Radio Data System) data and "SK 4.7%, DK 30%, BK 60%, area A" as traffic information (TRI). 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 KSG3400.

4.6 Screen (LCD) Operation Flow

Sections 4.6.1, 4.6.2, 4.6.3, and 4.6.4 explain the screen flows selected by the MENU RADIO DATA, ON (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.

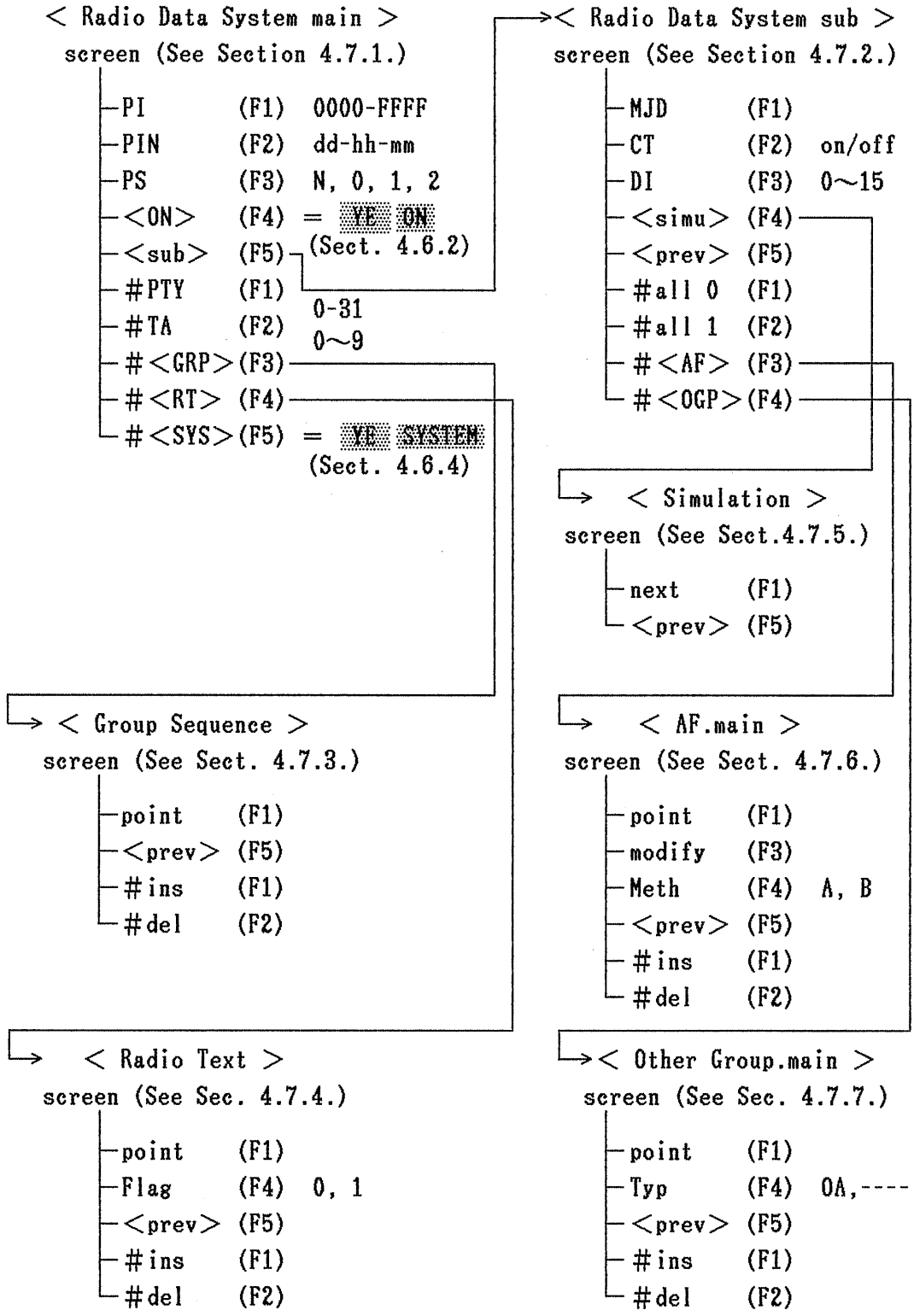
(2) When the YE key is pressed, the mark "＊" which indicates the shift function state appears in the lower right-hand corner of the screen. In this state, if the key pressed after the YE key is a function key, the corresponding shift function is selected, and if the key pressed after the YE key is not a function key, the function indicated in yellow letters is selected.
When the YE key is pressed again, the KSG3400 is released from the shift function state.
See Section 4.7 for the explanation of each screen.

(3) Any screens can be directly switched to the screens selected the MENU RADIO DATA, TRI, ON (YE RADIO DATA), and SYSTEM (YE TRI) keys.
To switch a screen in the shift function state to the screen selected by RADIO DATA or TRI, release the KSG3400 from the shift function state by pressing the YE key or press the 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.

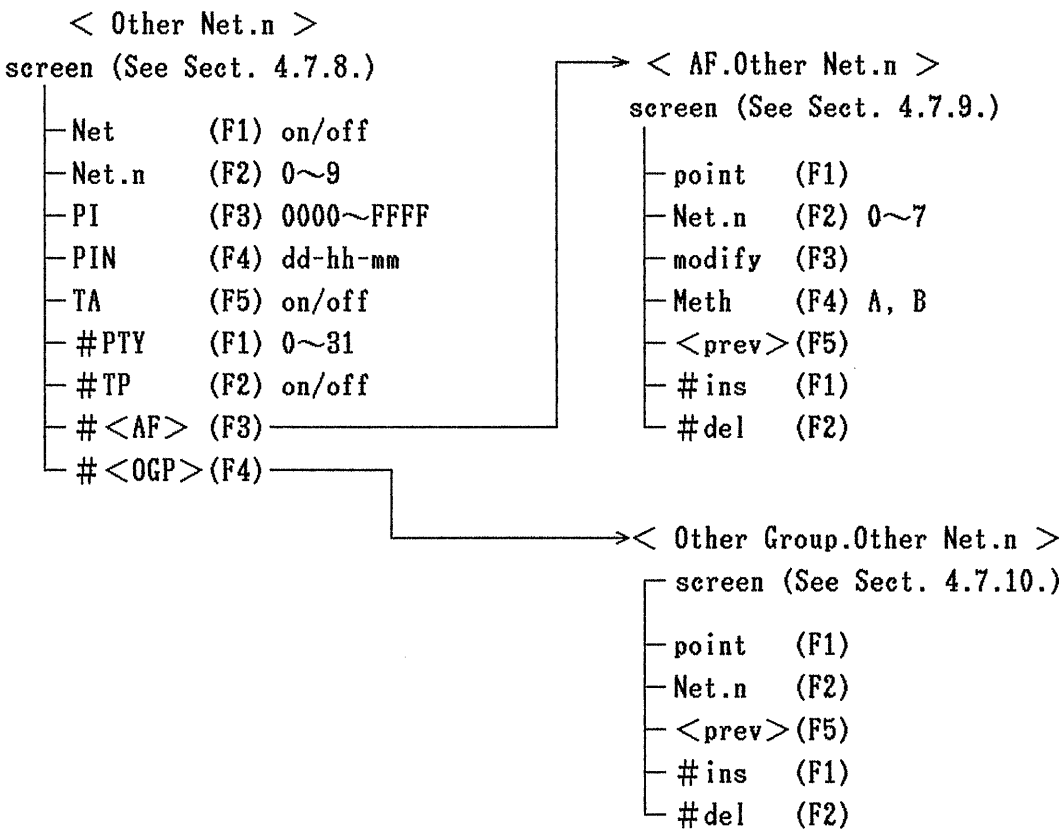
4.6.1 Flow selected by MENU [RADIO DATA] key

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



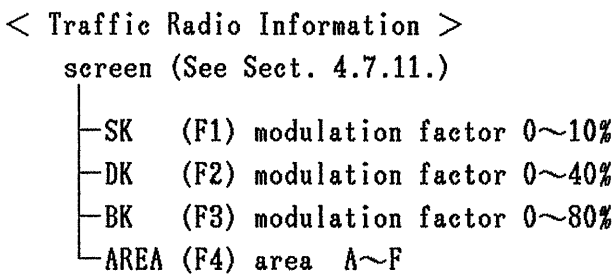
4.6.2 Flow selected by MENU [ON] key

When the MENU [ON] key ([YE] [RADIO DATA]) is pressed, the 〈Other Net.n〉 screen is displayed.



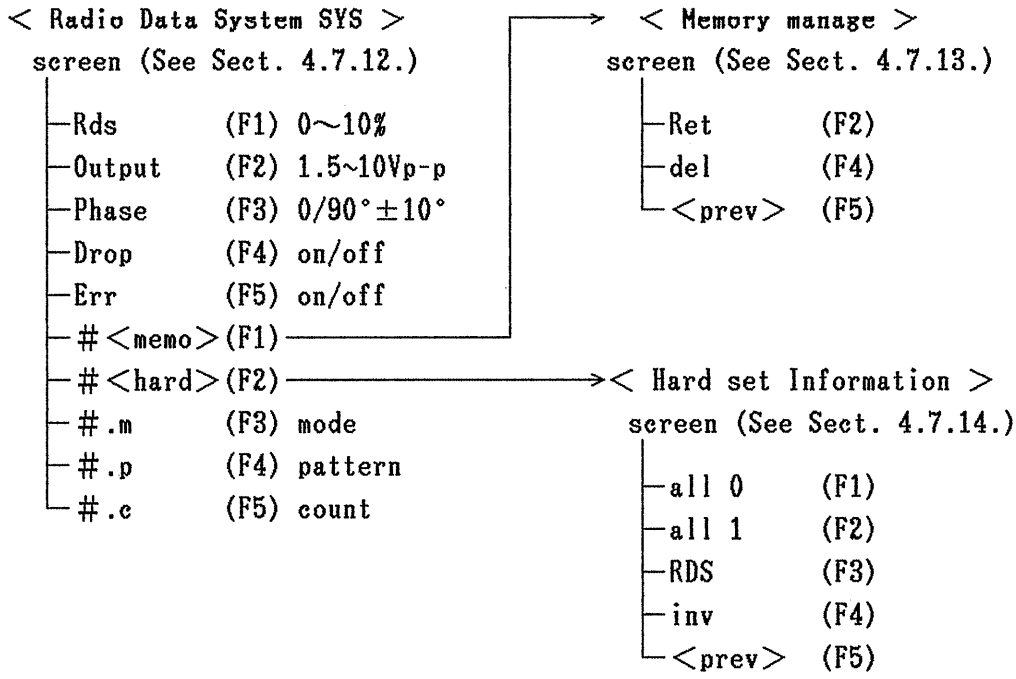
4.6.3 Flow selected by MENU [TRI] key

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



4.6.4 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.



4.7 Screen Explanation and Operation

4.7.1 〈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, and minute should be connected by hyphens (example: 20-10-15). The hyphens can be entered by the [illegible] 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 leftmost character.

〈ON〉: Selecting 〈ON〉 on this screen is equivalent to the pressing of ON (YE RADIO DATA) key explained in Section 4.6.2;
That is, the current screen is switched to the 〈Other Net.n〉 screen explained in Section 4.7.8.

〈sub〉: The 〈Radio Data System sub〉 screen explained in Section 4.7.2 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 4.7.3 is displayed.

〈RT〉: The 〈Radio Text〉 screen explained in Section 4.7.4 is displayed.

〈SYS〉: Selecting 〈SYS〉 on this screen is equivalent to the pressing of [SYSTEM] ([YES] [TRI]) key explained in Section 4.6.4; that is, the current screen is switched to the 〈Radio Data System SYS〉 screen explained in Section 4.7.12.

4.7.2 〈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 4.7.1.

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 func-tions are disabled. When the KSG3400 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 monaural/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 4.7.5.

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

When the [redacted] 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 4.7.6 is displayed.

〈OGP〉: The 〈Other Group.main〉 screen explained in Section 4.7.7 is displayed.

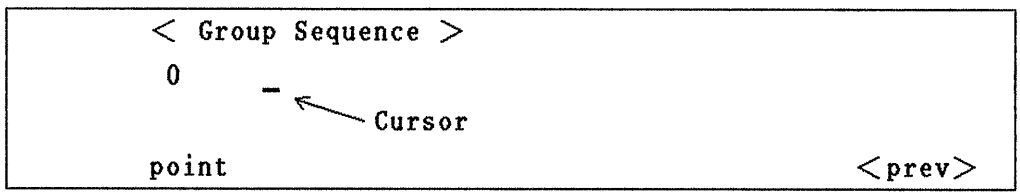
4.7.3 〈Group Sequence〉 screen

4.7.3.1 Screen explanation and operation

The 〈Group Sequence〉 screen is displayed when the [redacted] key and 〈GRP〉 key are pressed successively on the 〈Radio Data System main〉 screen explained in Section 4.7.1
The group sequence (group type sequence for the data to be output from KSG3400) 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:

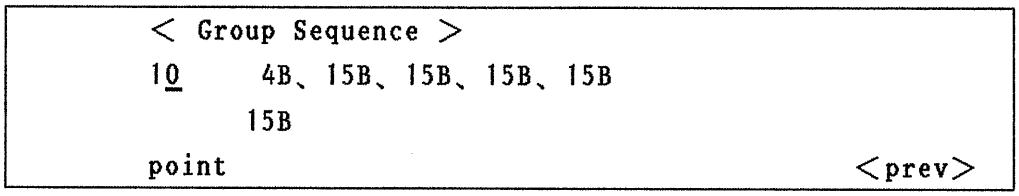
```
        < Group Sequence >
        1       0A,  0B,  1A,  1B,  2A,
                2B,  3A,  3B,  4A,  4B,
               15B, 15B, 15B, 15B, 15B
        point                                    <prev>
```

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 [YB] 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.

4.7.3.2 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 KSG3400, a check word is calculated for the information word and the specified offset word is added.

Offse 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 KSG3400 without being processed.

See Section 4.7.7 for the method of editing UD1 and UD2.

4.7.4 〈Radio Text〉 screen

The 〈Radio Text〉 screen is displayed when the [illegible] key and 〈RT〉 key are pressed successively on the 〈Radio Data System main〉 screen explained in Section 4.7.1.
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 F) key in the same method that is explained in Section 4.7.3.
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 4.7.3. 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 4.7.3.

4.7.5. 〈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 KSG3400 in hexadecimal mode according to the group type sequence specified in Section 4.7.3.

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 KSG3400.

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 4.7.12.

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 hexa-decimal 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 [illegible] key, the data of only one group is displayed because the data of the next group is displayed.

4.7.6 〈AF.main〉 screen

Press the 〈sub〉 key on 〈Radio Data System main〉 screen and the 〈AF〉 key (F6 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 4.7.3.
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 4.7.3. 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 4.7.3.

4.7.7 〈Other Group.main〉 screen

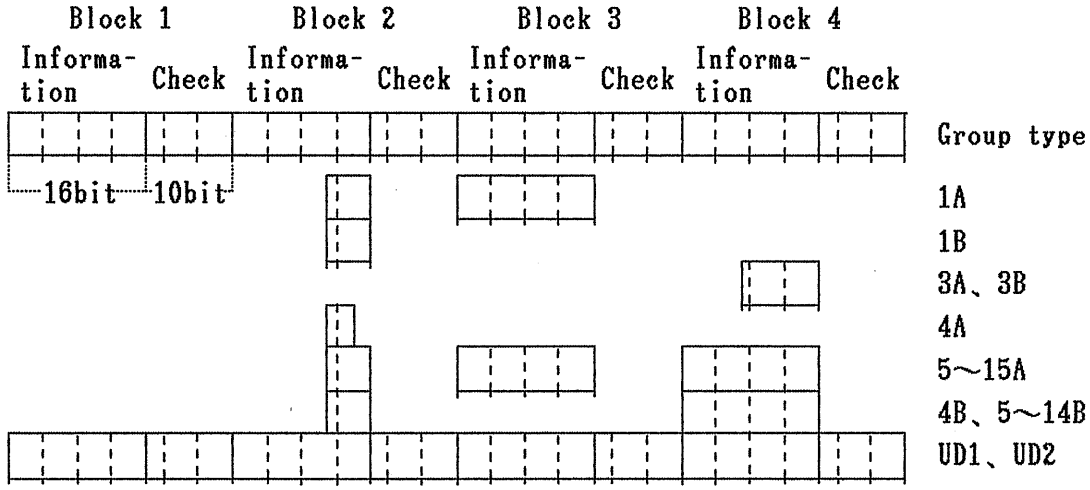
Press the 〈sub〉 key on 〈Radio Data System main〉 screen and the 〈OGP〉 key (YE F4) on 〈Radio Data System sub〉 screen, and the 〈Other Group.main〉 screen is displayed.
On this screen, the spare bits of other groups (group types other than 0A, 0B, 2A, 2B, 3A, 3B, and 15B and user-defined group types UD1 and UD2) can be edited. The KSG3400 treats 1A, 1B, and 4A as other groups. As for 3A and 3B, see Section 4.7.8.

point: This function indicates how the other group displayed at the beginning of the first line of the data edit area of 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.

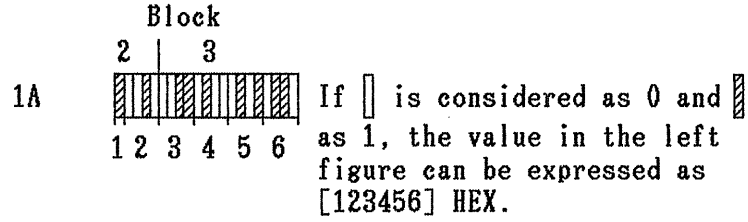
〈prev〉: The current screen is switched back to the preceding screen.

Data entry: The data entry method is the same as that explained in Section 4.7.3. 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:



The data of each other group type is considered to be continuous.
See the EBU report for details.

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



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

ins: The data insertion method is the same as that explained in Section 4.7.3. 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 4.7.3.

4.7.8 〈Other Net.n〉 screen

Press the 〈ON〉 key (F4) or ON key (YE RADIO DATA) on the 〈Radio Data System main〉 screen explained in Section 4.7.1, and the 〈Other Net.n〉 screen is displayed.
On this screen, the information on other networks can be edited.

Net: Turns on/off the other network state.
The state can be turned on/off by the rotary knob also.
When the state is on, other networks are incorporated into the group type sequence one by one to be output.

Net.n: The cursor moves to the position of Other Network number. Enter an address within the range from 0 to 7.

PI: See Section 4.7.1 for the method of entering PI.

PIN: See Section 4.7.1 for the method of entering PIN.

TA on/off n: Turns on/off the TA for other network. The TA can be turned on/off by the rotary knob also.
"n" specifies the number of the times the group of address 2 is inserted when TA is changed.
Enter a value within the range form 0 to 9.

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

PTY: See Section 4.7.1 for the method of entering PTY.

TP: Turns on/off the TP for other network. The TP can be turned on/off by the rotary knob also. When the TP is turned on or off, the preceding screen is displayed.

〈AF〉: The 〈AF.Other Net.n〉 screen explained in Section 4.7.9 is displayed.

〈OGP〉: The 〈Other Group.Other Net.n〉 screen explained in Section 4.7.10 is displayed.

4.7.9 〈AF.Other Net.n〉 screen

Press the 〈ON〉 key on 〈Radio Data System main〉 screen and the 〈AF〉 key (YES F3) on 〈Other Net.n〉 screen, and the 〈AF.Other Net.n〉 screen is displayed.
On this screen, the alternative frequencies for other networks can be edited.

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

Net.n: The cursor moves to the position of Other Network number. Enter a value within the range from 0 to 7.

The methods of manipulating other function keys are the same as those explained in Section 4.7.6.

Data entry: See Section 4.7.6.

4.7.10 〈Other Group Other Net.n〉 screen

Press the 〈ON〉 key on 〈Radio Data System main〉 screen and the 〈OGP〉 key (F6 F4) on 〈Other Net.n〉 screen, and the 〈Other Group.Other Net.n〉 screen is displayed.
On this screen, the spare bits (address code 2) in the 4th block of the group 3A and 3B can be edited.
The data can be entered in the form of a 3-digit hexadecimal number within the range from 000 to 1FF.

point: Indicates how the spare bit displayed at the beginning of the first line of the data edit area of the screen is located among the entire spare bits.

Net.n: The cursor moves to the position of Other Network number. Enter a value within the range from 0 to 7.

The methods of manipulating other function keys are the same as those explained in Section 4.7.3.

Data entry: See Section 4.7.3.

4.7.11 〈Traffic Radio Information〉 screen

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

SK: Specify the modulation level of SK signal within the range from 0% to 10%. When 10% is specified, data is output at the predetermined output level.
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.

4.7.12 〈Radio Data System SYS〉 screen

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

Rds: Specify the modulation level of RDS (Radio Data System) signal within the range from 0% to 10%.
When 10% is specified, data is output at the predetermined 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/10% = 0.9Vp-p).

Output: This function displays the output level (peak to peak) obtained when the modulation level of either RDS (Radio Data System) signal or TRI signal is set to 10%.
As the output level, specify the voltage that corresponds to the SCA input voltage sensitivity required for the SCA 10% modulation of the stereo signal generator to be used with the KSG3400.
See Section 4.8.
The output level of the RDS signal means the output level for the all-0 data. The output level of the TRI signal means the output level of the SK signal only, with the DK and BK signals in the OFF state. Therefore, the output level increases when the DK and BK signals are on.
When the RDS and TRI signals are modulated simultaneously, the output level increases because the vector sum of the 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 4.10 "57kHz 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 4.11 "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 4.7.13.

〈hard〉: Switches the current screen to the 〈Hard set Information〉 screen explained in Section 4.7.14.

.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 4.7.5.
The number of blocks should be specified within the range from 0 to 255 by the numeric keys or rotary knob.

4.7.13 〈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.

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; therefore, to set the RTN for all the 100 points, the memory manipulation (Section 4.12.5) must be done on the front panel.

del: Clears data from the displayed memory address.

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

Explanation of screen titles

Memory: Memory address
See Section 4.12 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

4.7.14 〈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 KSG3400.

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.

4.8 Connection to Stereo Signal Generator KSG3200

(1) Connection and setting of output level

Connect the ⑮ OUTPUT terminal of the KSG3400 to the SCA input terminal on the rear panel of KSG3200.

Since the SCA input voltage sensitivity for the 10% modulation of the KSG3200 is approximately 1Vrms (= 2.83Vp-p), set the output level of the KSG3400 to 2.83Vp-p by using the numeric keys and ⑬ rotary knob.

In other words, the output level must correspond to the SCA input voltage sensitivity for the SCA 10% modulation of the stereo signal generator to be used.

Note that the values of the SCA input voltage sensitivity vary with the type of the stereo signal generator; to obtain the accurate value, measure the stereo level, pilot level, and SCA level ratio by an oscilloscope.

(2) Changing levels of RDS and TRI signals incorporated into stereo signal

When the output level is set as above, the RDS modulation level and TRI modulation level displayed on ⑦ LCD match the modulation ratio for the 100% stereo signal.

After the output level is set as above, the levels of the RDS and TRI signals to be incorporated into the stereo signal are changed when the RDS modulation level and TRI (SK) modulation level are changed.

4.9 57kHz Phase Calibration

(1) Connect the KSG3400 Radio Data Signal Generator, KSG3200 Stereo Signal Generator, and X-Y oscilloscope as shown in Figure 4-1.

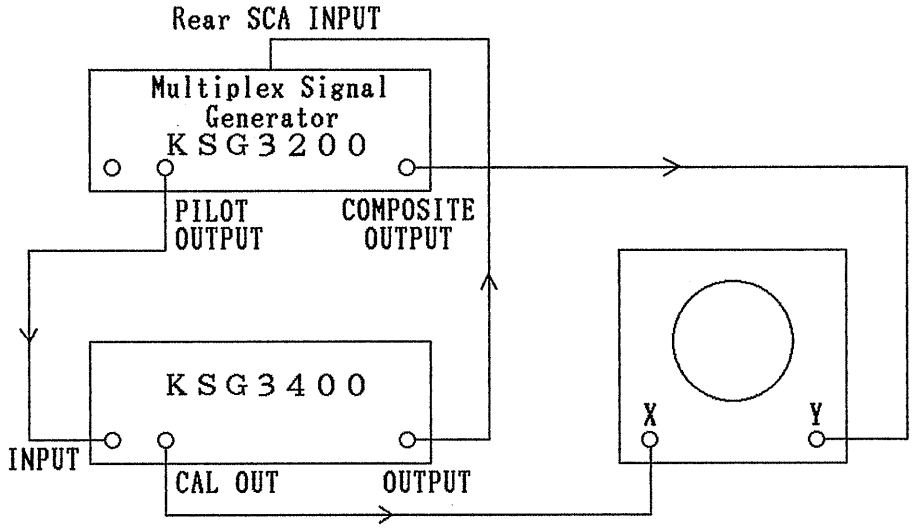
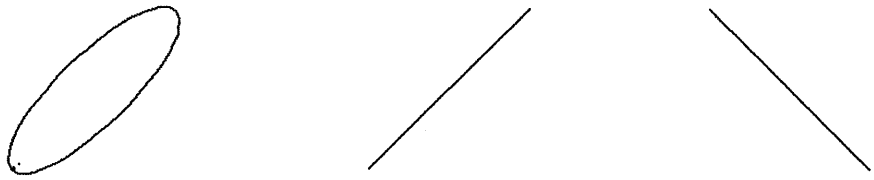


Figure 4-1

Confirm that the ④ "19kHz LOCK" indicator of the KSG3400 is on.

(2) Stop the modulation of the KSG3200, turn on the pilot level 10%, and maximize the composite output level.

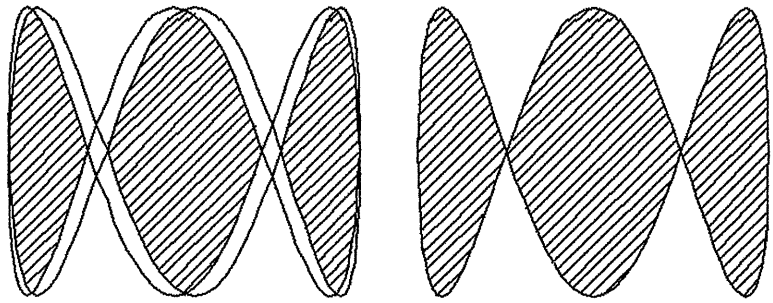
(3) Set the modulation level to 1.60%, output level to approximately 3Vp-p, phase to 90°, and S (Shift) to 0° on the 〈Radio Data System SYS〉 screen displayed on the ⑦ LCD of the KSG3400, and switch off the ⑩ ON key and ⑪ SK key.
When the input sensitivity of the oscilloscope is set to X INPUT = 500mV/DIV and Y INPUT = 50mV/DIV, a waveform, some examples of which are shown in Figure 4-2, appears on the oscilloscope. Turn the SCOPE PHASE half-fixed adjuster of the KSG3200 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

(4) Turn off the PILOT key of the KSG3200, keeping the input sensitivity of the oscilloscope as above.
Press the ⑩ ON key of the KSG3400 to the ON state. Then, a waveform, some examples of which are shown in Figure 4-3, appears on the oscilloscope. Turn the ⑭ "57kHz PHASE" half-fixed adjuster till the waveform (b) in Figure 4-3 is obtained.
By this operation, the phase difference between the third harmonic of the 19kHz pilot signal for external synchronization and the RDS 57kHz sub-carrier signal becomes 90°.



(a) Out of phase | (b) In phase

Figure 4-3

4.10 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.

(1) When the 19kHz pilot signal for external synchronization is connected:

The phase difference between the 57kHz sub-carrier and the third harmonic of the 19kHz pilot signal for external synchronization input to ⑤ PILOT INPUT can be made 0° or 90° by the toggle operation of the Phase key on the 〈Radio Data System SYS〉 screen displayed on ⑦ LCD. 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.

(2) When the internal 57kHz sub-carrier is used:

In the same way as (1), the phase difference between the 57kHz sub-carrier and the SK 57kHz sub-carrier can be made 0° or 90°, and it can be modified within the range of ±10° by the step of 1°.

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

4.11 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 ⑱ 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 ⑮ 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 ⑱ DROP CONTROL INPUT (TTL) terminal on the rear panel and turn off the drop out function.

4.12 Memory

4.12.1 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 ⑬ numeric key 0 ~ 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 ⑬ · 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 ⑬ - 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 addresses by rotary knob

Turn the rotary knob when the 〈Memory manage〉 screen is displayed, and the addresses "00" to "99" can be called consecutively.

Example 2: To call memory address "10"

Press the ③ RCL key, and the ⑬ numeric key 1, and the value "10" appears on the ② MEMORY display. The rows in block 1 (column 1) can be called consecutively by pressing the ③ ▲ or ▼ key.

Example 3: To call memory address "56" directly

Press the ③ RCL key and ⑬ . key, and the ② MEMORY display is cleared.

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

Example 4: To call memory address "58" directly

Press the ③ RCL key and ⑬ - key, and the row of ② MEMORY display is cleared.

Press the ⑬ numeric key 8 and "58" is displayed.

4.12.2 Memory store method

As explained in Section 4.12.1, 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:

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) Output level (Vp-p)

[Preparation for store]

(1) To store all 0 or all 1
Sele at "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 ⑬ YE, ③ STO (RCL), and ⑬ numeric key 0 ～ 9.

(b) To store data in the next row, press ⑬ 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 ⑬ 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 RDS (Radio Data System) modulation level, TRI modulation level, or other item on the front panel.

b) Press ⑬ YE, ③ STO (RCL), and the ⑬ 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 ⑬ 1, press ③ △ twice. Then, the value "12" appears on the ② MEMORY display.

b) Specify the value of RDS (Radio Data System) modulation level, TRI modulation level, or other item on the front panel.

c) Press ⑬ 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 RDS (Radio Data System) modulation level, TRI modulation level, or other item.

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

c) Press the ⑬ 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 RTN (▽) key explained in Section 4.12.3 cannot be used in the direct store method.

4.12.3 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, ⑬ 1, △	Press three times	"13"	
⑬ YE, ③ STO (RCL), RTN (▽)		"13"	RTN command is stored

[How to use the function]

③ RCL, ⑫ 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)

4.12.4 How to release RTN key

The following two methods are available:

(1) Display "19" by ③ RCL, ·, ⑬ 1, ③ 9 keys

Press ⑬ 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, ⑬ 1, and ③ △ keys (Press three times)

Press ⑬ YE, ③ STO, △ keys	"14"	RTN command is stored at "14"
	..	
	..	
⑬ YE, ③ STO (RCL), △ keys (Press five times)	"19"	

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

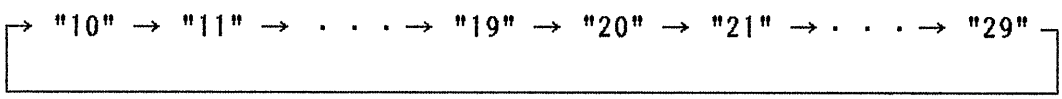
4.12.5 Recalling more than ten columns continuously (Setting NEXT key)

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 ⑱ YE, ③ STO (RCL), and NEXT (△) keys; then, another ten columns can be recalled 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
⑱ YE, ③ STO (RCL)	"19"	STO LED comes on
③ NEXT (△)	"20"	STO LED comes off

The memory addresses are recalled as follows:



4.12.6 How to release NEXT key

Display the memory address ("09", "19", ..., or "89") at which the function is to be released, and press the ⑱ 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
⑱ YE, ③ STO (RCL)	"19"	STO LED comes on
③ RTN (▽)	"19"	STO LED comes off

4.12.7 Copying memory data to another KSG3400

(1) The 100-point memory data can be copied to another unit of KSG3400.

(2) Memory data copying method

a) Turn on the power for the local and remote signal generators.

b) Connect the ㉒ remote control terminals on rear panel of the local signal generator to those of remote signal generator, using DUMP cable.

c) Press ⑬ YES, ⑧ DUMP (▽), and the copying is started.

d) After the memory copy has finished, remove the DUMP cable, power off the KSG3400 on the slave side, and power it on again.

Note: The DUMP cable has the amphenol type 14-pin connectors. Among the 14 pins, Pins 8-10 are not used but all the other pins are used.

The DUMP cable of SA510 type is sold separately.

5. REMOTE CONTROL

5.1 General Description

5.1.1 Outline

The KSG3400 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.

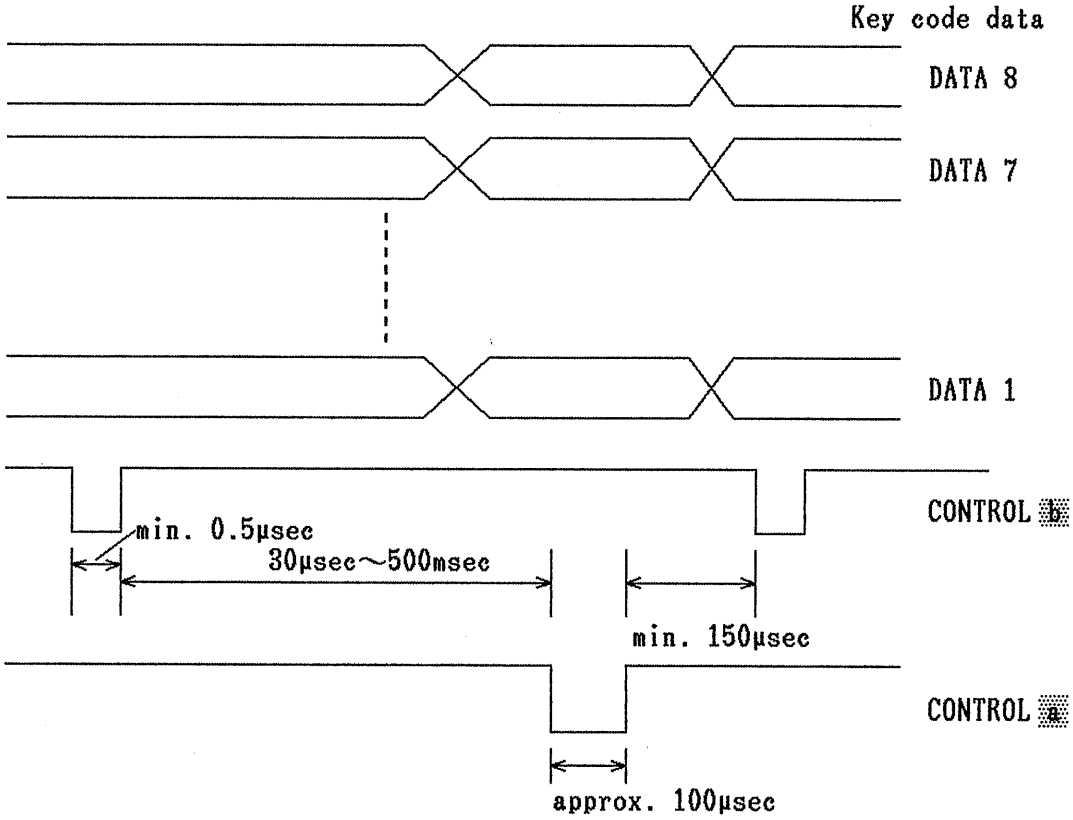


Figure 5-1

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

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

CONTROL [a] : This signal is set to "0" 30µsec to 500msec after CONTROL [b] is accepted. It is set to "0" for approximately 100µsec, and data is read during this period.
CONTROL [b] cannot be accepted for 150µsec 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.

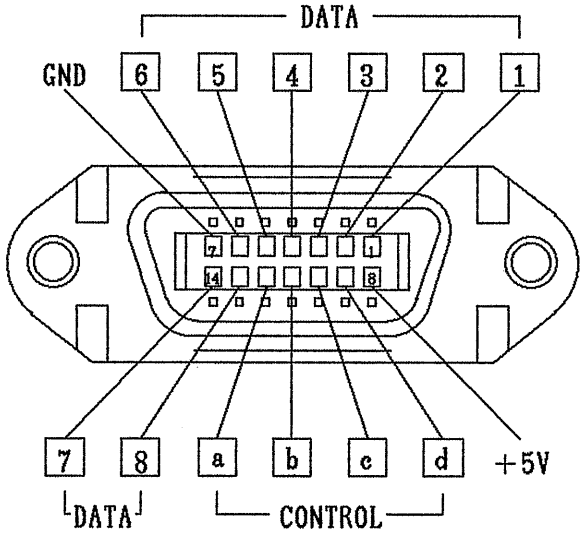


Figure 5-2

[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 KSG3400. 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 13msec, and its cycle is about 87.6msec.

(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.

Table 5-1

Key name	DATA input pin number 6	5	4	3	2	1
	MSB	←	Key Code		→	LSB
MEMORY RCL / STO	0	0	0	1	0	0
MEMORY ▽ / RTN (DUMP)	0	0	0	1	1	1
MEMORY △ / NEXT	0	0	0	1	1	0
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
RADIO DATA TP	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	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
MENU RADIO DATA (ON)	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

(Cont'd)

Table 5-1

Key name		MSB	←	Key Code		→	LSB
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
MODIFY	△	0	1	0	1	1	1
MEMORY	▽	0	1	1	0	0	0
MEMORY	◁	1	1	1	1	0	0
MEMORY	▷	1	1	1	1	1	0
MEMORY	Rotary knob UP	0	0	0	0	0	0
MEMORY	Rotary knob DOWN	0	0	0	0	0	1
LOCAL	(REMOTE)	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".

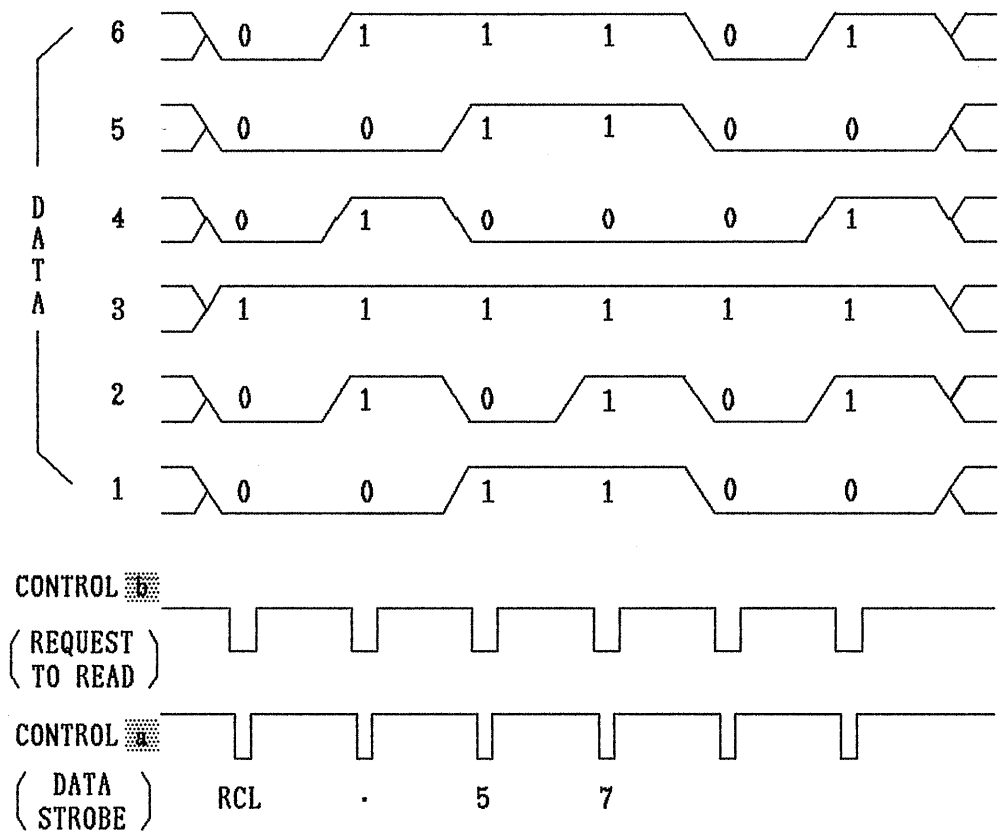


Figure 5-3

(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 KSG3400S.

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.

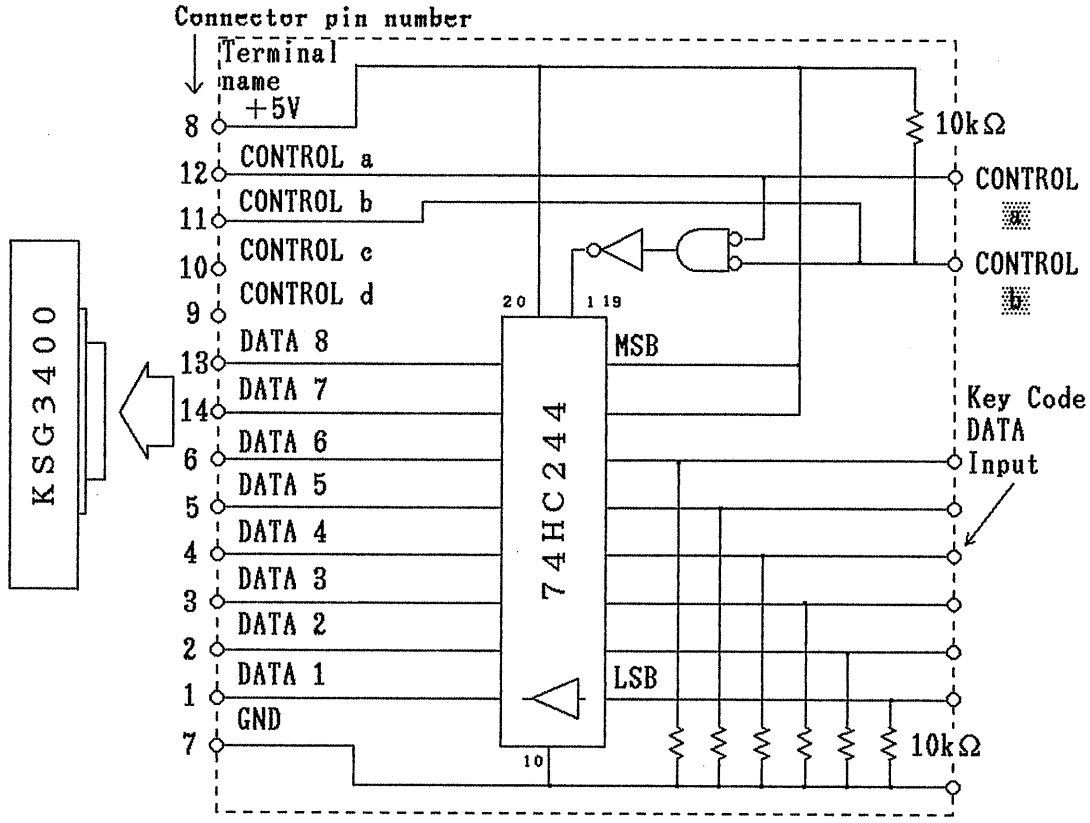


Figure 5-4

Figure 5-4 shows the circuit for controlling the KSG3400 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 10 μsec after the last data is stabilized, set CONTROL b to "0".

CONTROL a is set to "0" 30μsec to 500msec 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 100μsec when CONTROL a is "0", the set key code data is read and processed by the KSG3400. 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 500msec 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.

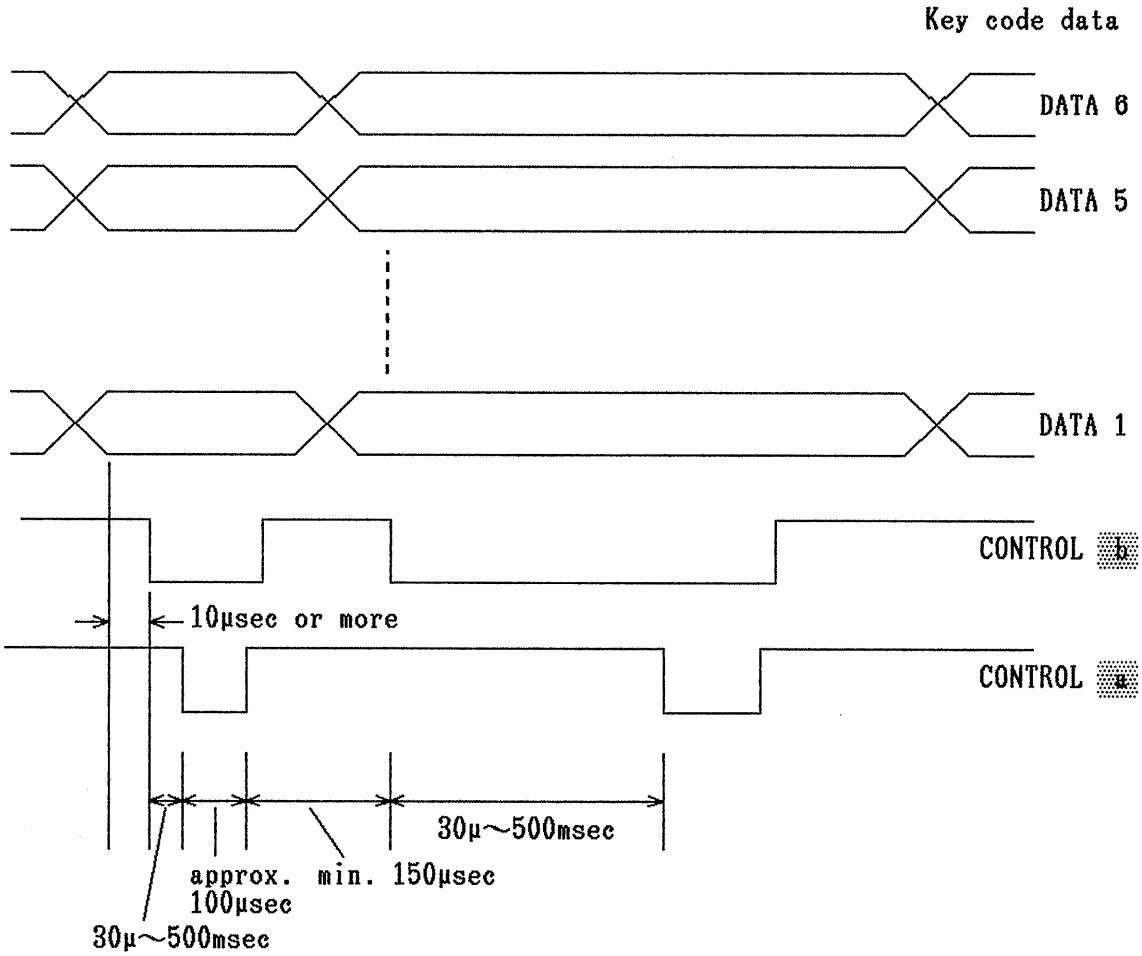


Figure 5-5

5.2.5 Memory display output circuit example

Figure 5-6 shows example circuit.

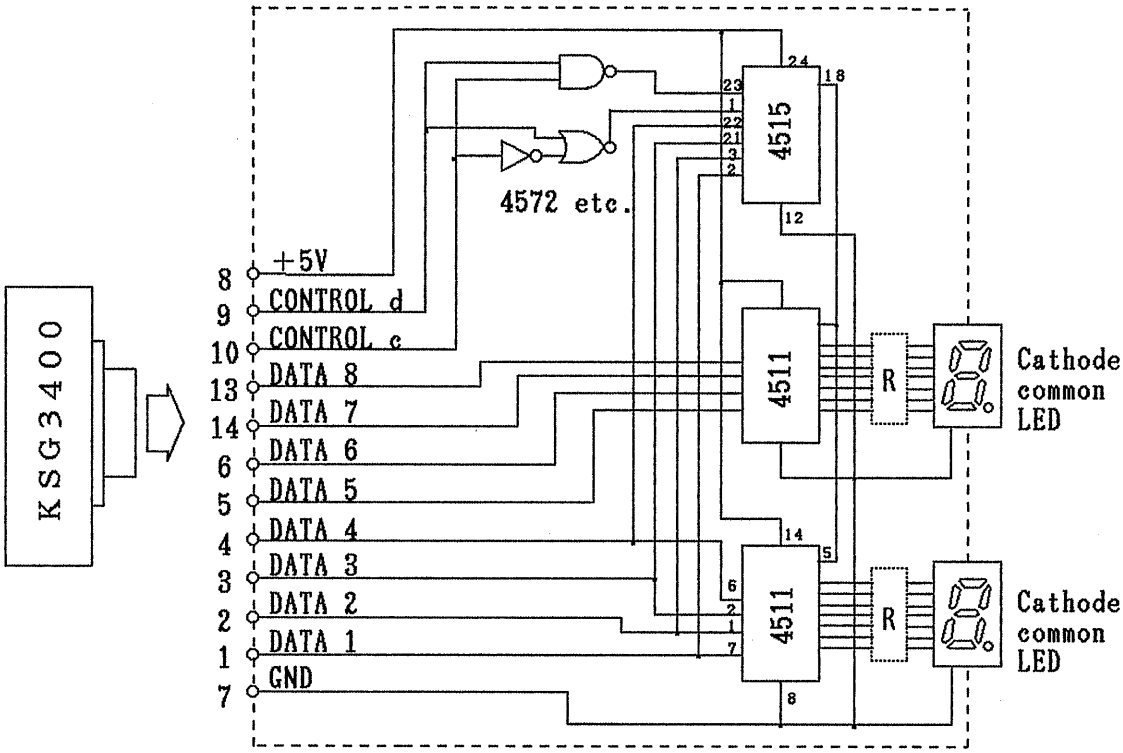


Figure 5-6

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 KSG3400 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 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 KSG3400 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".

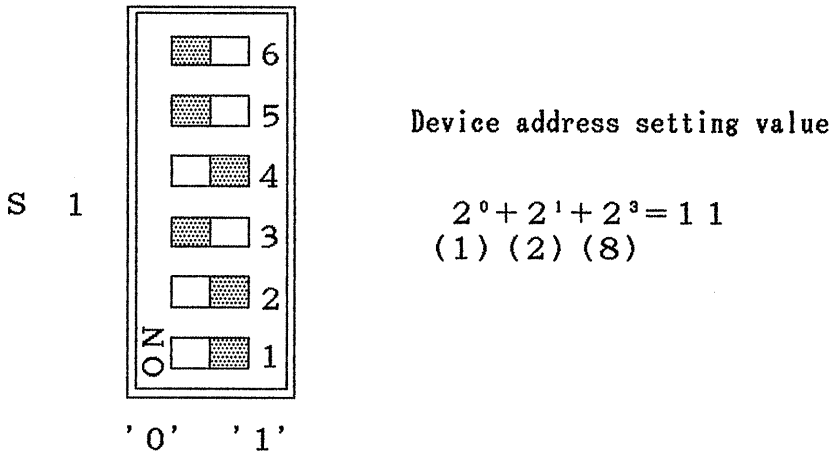


Figure 6-1

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

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

DIP SW

1 = OFF, 0 = ON

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 KSG3400 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

Item	Program code	Data	Unit
Output level	AP	○○.○	V
SK modulation level	SK	○○.○	PC (%)
DK modulation level	DK	○○	PC (%)
BK modulation level	BK	○○	PC (%)
BK area	AREAA-AREAF	○	---
RDS modulation level	AF	○.○○	% (PC)
RDS source	RDSN, 0, 1	○	---
Drop level	DROP	○○○	PC (%)
Phase shift	PHS	±○○	---
Phase 0°/90°	PH	○○	---
Error	ER	○○○	---
Error pattern	ERP	○○○○	---
Error pattern	ERXOR	---	---
Error pattern	EROR	---	---
Error pattern	ERAND	---	---
Memory control			
Memory recall	RC	○○	---
Memory store	ST	○○	---

Note 1: The mark "---" means an optional item.

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.

Table 6-4 GP-IB Program Codes

Alphabetical order

Program code	Explanation	Remarks
AF	RDS (Radio Data System) modulation level	Function mode
AP	Output level	Function mode
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	Function mode
BKOF	BK modulation level OFF	Function mode
BKON	BK modulation level ON	Function mode
DK	DK modulation level	Function mode
DKOF	DK modulation level OFF	Function mode
DKON	DK modulation level ON	Function mode
DROP	Drop level	Function mode
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.	Finction mode
EROF	Error OFF	Function mode
ERON	Error ON	Function mode
ERXOR	Error pattern XOR	Function mode
EROR	Error pattern OR	Function mode
ERAND	Error pattern AND	Function mode
ERP	Error pattern setting	Function mode
OTOF	RDS (Radio Data System) modulation level OFF	Function mode
OTON	RDS (Radio Data System) modulation level ON	Function mode
PH0	Phase 0°	Function mode
PH90	Phase 90°	Function mode
PHS	Phase shift (-10° - +10°)	Function mode

(cont'd)

Program code	Explanation	Remarks
RC	Memory recall	Function mode
RDSN	Output of RDS (Radio Data System) data	Function mode
RDS0	Output of all 0	Function mode
RDS1	Output of all 1	Function mode
SK	SK modulation level	Function mode
SKOF	SK modulation level OFF	Function mode
SKON	SK modulation level ON	Function mode
ST	Memory store	Function mode
V	Output level	Unit
0 - 9	Numeric value	Data
-	Minus sign	Data
.	Decimal point	Data
% (PC)	Modulation level in percent	Unit

Table 6-5 GP-IB Program Codes

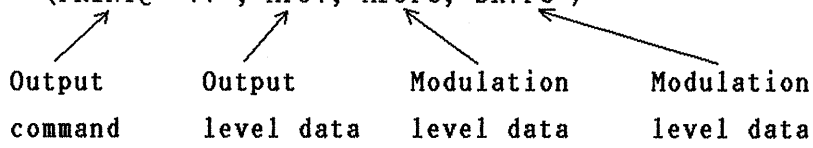
Program code	Returned data	Comment
AF?	d.dd	"d.dd" is the set value. Unit is "%".
AP?	d.dd	"d.dd" is the set value. Unit is "V".
AREA?	c	"c" is a character selected from "A" to "F".
BK?	s n	"s" is replaced by "ON or "OFF". "n" is the set value of one or two digits, and its unit is "%".
DK?	s n	"s" is replaced by "ON or "OFF". "n" is the set value of one or two digits, and its unit is "%".
DROP?	s n	"s" is replaced by "ON or "OFF". "n" is the set value of one, two, or three digits, and its unit is "%".
ER?	s s1 chhhhhhh n	"s" is replaced by "ON" or OFF". "s1" is replaced by "OR", "XOR", or "AND". "chhhhhhh" is replaced by the letter "P" and a 7-digit hexadecimal number. "n" is a 3-digit number.
OT?	s	"s" is replaced by "ON" or "OFF".
PH?	n cn	"n" is replaced by "0" or "90". "cn" is replaced by the letter "s" and a value within the range of ±10.
RDS?	c	"c" is replaced by "N", "0", or "1".
SK?	s d.d	"s" is replaced by "ON" or "OFF". "d.d" is the set value. Unit is "%".

6.3.5 Basic method of setting data

In the following examples, HP9816 or PC9801 is used.

Example 1: The output level, RDS (Radio Data System) modulation level, and SK modulation level are to be set to 3Vp-p, 5%, and 7% respectively.

```
 OUTPUT 711 ;"AP3V, AF5PC, SK7PC"
(PRINT@  11 ;"AP3V, AF5PC, SK7PC")
```



Normally, CRLF OR EIO is sent.

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

```
OUTPUT 711 ;"AP3V"
(PRINT@ 11 ;"AP3V")
OUTPUT 711 ;"AF5PC"
OUTPUT 711 ;"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 output level to 2.83Vp-p, enter "AP2.83V".

Example 5: To set the RDS (Radio Data System) modulation level to 1.6%, enter "AF1.6PC".

Example 6: To specify "A" as BK area, enter "AREAA".

Example 7: To turn off the RDS (Radio Data System) output level, enter "OTOF".

Example 8: To recall memory address "36", enter "RC36".

Example 9: To store data at memory address "36", enter "ST36".

6.3.6 Connector pin allocation diagram

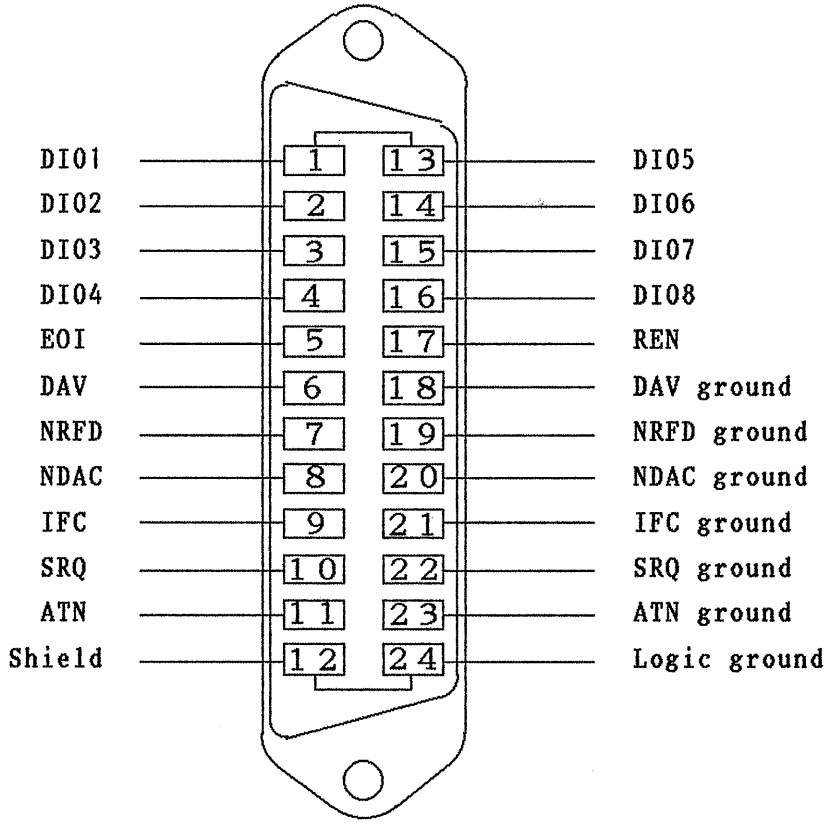


Figure 6-2

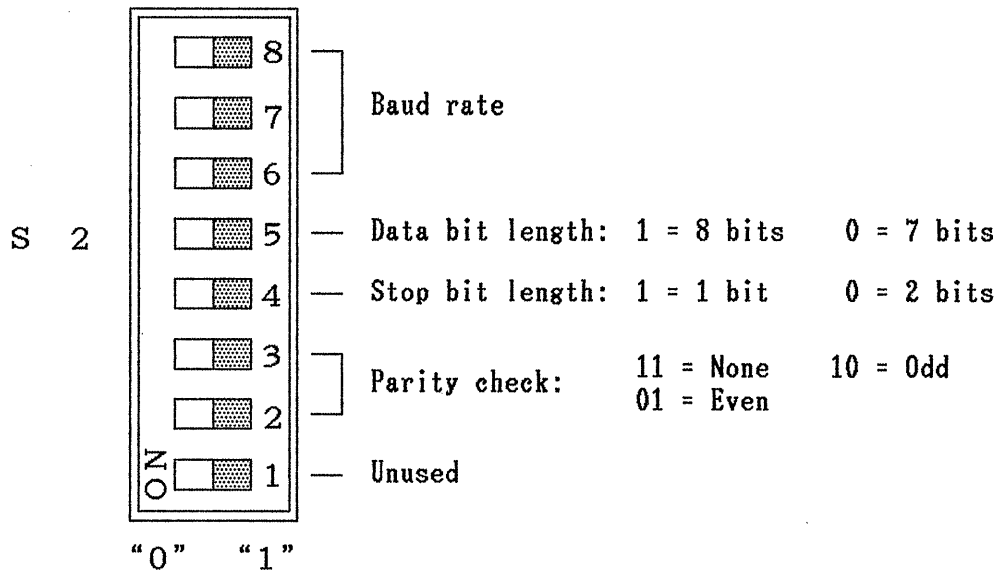
7. SIO INTERFACE

(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 KSG3400 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 KSG3400 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

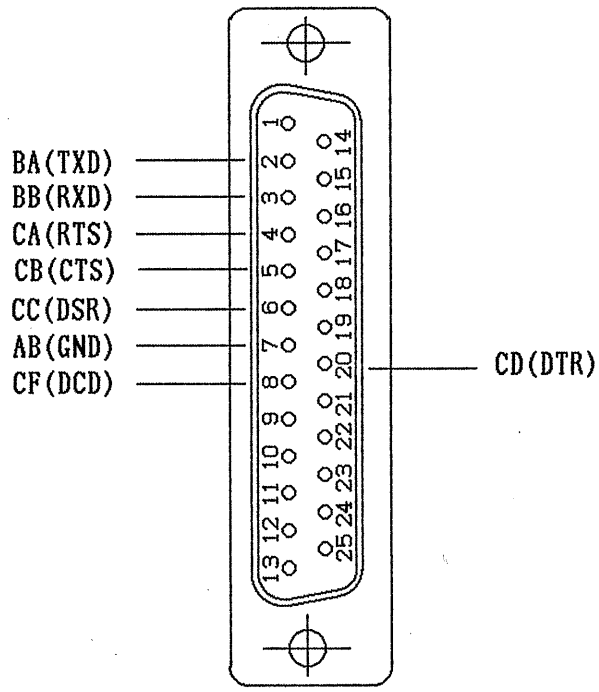


Figure 7-1

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 KSG3400 is powered on and set in the active state.

8. BACKUP BATTERY AND INITIALIZING CPU

8.1 Backup Battery

The KSG3400 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 tempera-ture, humidity, and storage conditions. After about five years, the dis-charge 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 KSG3400, 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 ad-dress are set to their initial values.

(2) Software reset

Turn on the power switch while pressing the [redacted] 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 KSG3400 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 KSG3400, which is 5K bytes. Therefore, the store operation cannot be executed.
ERROR < Time out in dump >	The KSG3400 to receive the memory dump data is not connected.
<<< Memory dump mode >>>	The memory dump data is being sent.
<<< Dump receive mode >>>	The memory dump data is being received.