ADVANTEST®

ADVANTEST CORPORATION

R4262

SYNTHESIZED SIGNAL SOURCE

INSTRUCTION MANUAL

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
- Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this instrument with the case open.
- Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.

- When using the product on a cart, fix it with belts to avoid its drop.

- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.

- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.

- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

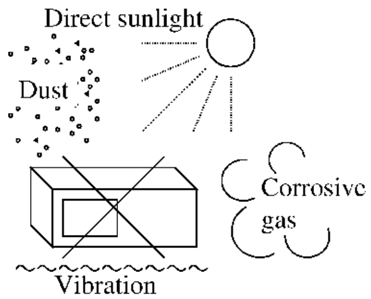
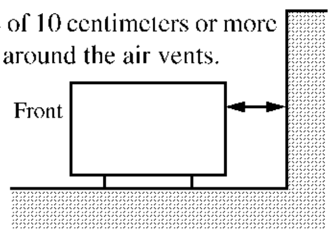


Figure-1 Environmental Conditions

- Operating position

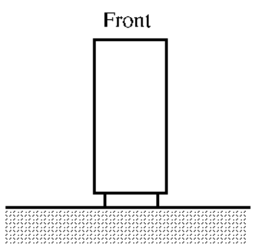
A clear space of 10 centimeters or more must be kept around the air vents.



The instrument must be used in a horizontal position.
A cooling fan, which prevents the internal temperature from rising, is equipped with the instrument.
The air vents on the case must be unblocked.

Figure-2 Operating Position

- Storage position



This instrument should be stored in a horizontal position.
When placed in a vertical (upright) position for storage or transportation, ensure the instrument is stable and secure.

-Ensure the instrument is stable.
-Pay special attention not to fall.

Figure-3 Storage Position

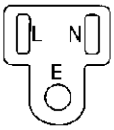
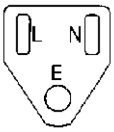
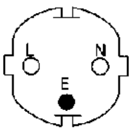
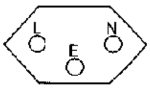
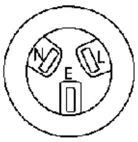
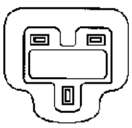
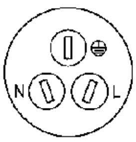
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

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LIST OF TABLES

1. GENERAL

1.1 Structure of This Instruction Manual

1. General Information	Provides general product information and the procedure and cautions in setting up and powering on. Read through this section before operation.
2. Panel Description	Describes the individual parts of the front and rear panels.
3. Operating Procedure	Describes basic and detailed operating procedures.
4. GPIB Interface	Describes a procedure of controlling the R4262 from the external controller with the GPIB.
5. Operating Principle	Describes the operating principles for the individual blocks of the R4262.
6. Specifications	Describes the specifications and supplemental characteristics for the individual parts.
APPENDIX	Provides a message list, GPIB command list, operation map, etc.

1.2 General Information

(1) General Information on R4262

The R4262 Synthesized Signal Source is Advantest's unique signal generator (SG) that provides the combined functions of a highpurity standard signal generator based on the frequency synthesize system and an analog sweep signal generator. The basic features of the R4262 are described below.

The R4262 allows wide and accurate frequency settings, i.e.a carrier wave frequency range of 100kHz to 4.5GHz and a resolution of 0.1Hz.

It assures an absolute accuracy of ± 1dB for its amplitude of −120dBm or more.

It realizes an extremely high signal purity, i.e. the SSB phase/noise characteristics of −137dBc/Hz (offset of 10kHz) and non-harmonic spurious of −90dBc (carrier wave frequency of 62.5MHz to 1GHz : off-carrier of 10kHz or more) with a carrier wave frequency of 1GHz.

Besides these basic features, the R4262 provides a wide variety of features such as amplitude modulation (AM), frequency modulation (FM), WIDE FM, phase modulation, pulse modulation, BPSK, phase sweep, level sweep, analog frequency sweep, digital frequency sweep, etc. As such, it is applicable to research and development in pseudo-microwave radiocommunication and performance evaluation and characteristics test in mobile radiocommunication, satellite communication, electronic navigation marine satellite communication, etc.

Further, the R4262 provides enhanced memory and standard GPIB features, which support measurement simplification and automatic measuring system formation.

(2) Accessories

<u>TR45101 Wide FM Driver</u>

Combined with the R4262, this FM driver allows wide-range frequency modulation that is optimum for satellite broadcasting (BS) receiver setting and device testing.

By connecting the TR45101 output to the R4262 WIDE FM2, the maximum modulation rate of 8.5MHz (option) and the maximum deviation of $28MHz_{P-P}$ can be yielded.

(3) Option

Option 08 : Rear Output

This option outputs RF signals from the rear panel. When this option is specified, any output from the front panel is disabled.

Options 22 and 23 : Internal Reference Crystal Oscillator

These options improve the stability of the internal reference crystal oscillator for the R4262 to the values shown in the table below :

	Option 22	Option 23
Aging rate	2×10^{-9}/day 2×10^{-8}/month	5×10^{-10}/day 1×10^{-8}/month
Long-term stability	5×10^{-8}/year	2×10^{-8}/year
Short-term stability	$\pm1\times10^{-8}$	$\pm5\times10^{-9}$

Options 32, 42, and 44 : Power

These options change the source voltage of the R4262 (AC line) as follows:

Option 32 : 103VAC to 132VAC
Option 42 : 198VAC to 242VAC
Option 44 : 207VAC to 250VAC

1.3 Preparation for Use

1.3.1 Visual Inspection and Accessories Inspection

First visually inspect the R4262 for any shipping damage.

Then inspect the standard accessories (listed in Table 1-1). If any shipping damage is detected, contact the ATCE, any nearby Advantest office, or agent.

The telephone numbers of the ATCE and Advantest offices are listed at the end of this instruction manual.

WARNING

To avoid hazardous electrical shock, do not power on the equipment if there are signs of shipping damage to any portion of the equipment including its outer enclosure.

Table 1 - 1 Standard Accessories

Item name	Type name	Stock number	Quantity	Remarks
Power cable	MP-43A		1	
Fuse	GDL5 MDA-5A	DFT-AM5A	2	In case of Standard and Option 32
	MDX-2.5A	DFT-AF2R5A	(2)	In case of Standard and Option 42 and 44
Input/output cable	MI-02		1	BNC-BNC
Output cable	MI-04		1	N-N
Conversion adapter	JUG-201A-U		1	N-BNC
Instruction manual		JR4262	1	Japanese
		ER4262		English

(Note) When placing additional orders for accessories, specify their type name (or stock number).

1.3.2 Preparation for Use and General Instructions

(1) Power Requirements Confirmation

The standard and optional specifications for the power of the R4262 are shown in the table below.

Confirm that there is no error in the source voltage to be used for the R4262.

Option	Source voltage	Source frequency
Standard	AC 100V (90 to 110V)	48 to 66Hz
Option 32	AC 120V (103 to 132V)	
Option 42	AC 220V (198 to 242V)	
Option 44	AC 240V (216 to 250V)	

The source voltage for the R4262 is preset at the time of shipment to the value specified in the purchase contract. This preset source voltage can be changed by readjusting the AC LINE connector of the rear panel. When such change is desired after delivery, contact any nearby Advantest office. Note that the fuse ratings differ for different source voltages.

(2) Power Cable Connection

Confirm that the power switch on the front panel is off and then connect the attached power cable to the AC LINE connector on the rear panel.

The attached power cable has three pins, one of which is a round shaped grounding pin in the middle of its plug.

When using a 2-pin power cable, connect the attached 3-pin/2-pin power plug conversion adapter A09034 (KPR-18) to the 3-pin power cable. In this case, be sure to ground the grounding pin of the equipment (see Figure 1-1 (a)) or the grounding terminal on the rear panel.

The A09034 eonforms to the Electrical Appliance Regulation.

Because the two electrodes of the A09034 have different widths (A and B shown in Figure 1-1 (b)), insert the A09034 into any appropriate AC power plug receptacle in the right direction.

Should the A09034 not fit the AC power plug receptacle in use, substitute an optional adapter KPR-13 for the A09034.

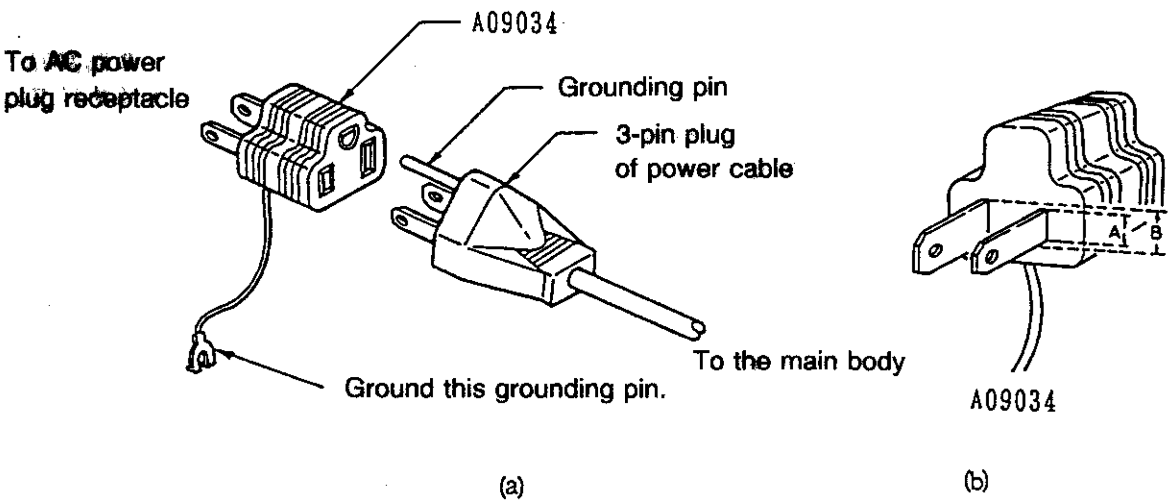


Figure 1 - 1 3-pin/2-pin power plug conversion adapter

WARNING

To ensure safety of the equipment and its operator, be sure to ground its main body.

(3) Power Fuse Replacement

When replacing the power fuse, first turn off the power switch and remove the power cable from the AC LINE connector.

Next slide to the left the plastic cover of the fuse box at the right of the AC LINE connector. Then pull the lever marked "FUSE PULL" to this side, and the power fuse can be removed (see Figure 1-2).

Be sure to observe the fuse specifications designated in the table below.

Standard and Option 32	5A (DFT-AF5A)
Options 42 and 44	2.5A (DFT-AF2R5A)

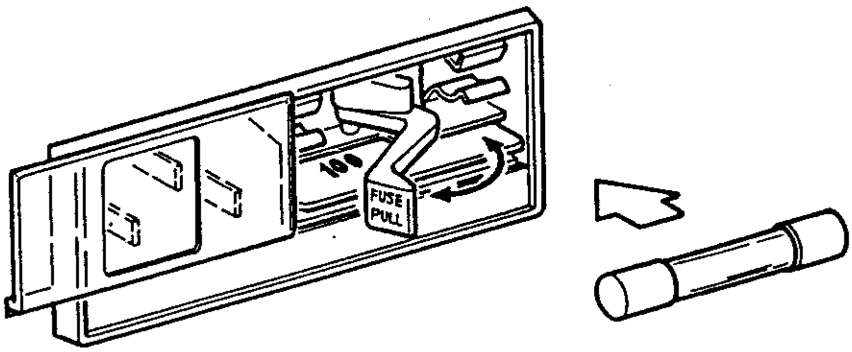


Figure 1 - 2 Power Fuse Replacement

(4) Operating Environment Considerations

① The equipment should not be used in those places which are exposed to dust, direct sunlight, or corrosive gas. It should be sued at ambient temperatures of 0 to 40℃ and ambient humidities of 85 % or less.

② The equipment should be installed in such a manner as not to interrupt cooling air blowing in from the right and left sides of the instrument and blowing off from the fan on the rear panel.

③ The equipment is carefully designed to eliminate noise from the AC power line. However, the equipment should be used in those placed which are free from noise to the greatest possible degree. If it must be used in noisy places, noise should be eliminated with such means as a noise filter.

④ The equipment should not be used in those places which are subject to vibrations.

(5) Storage and Shipment

Storage Environment

The equipment should be stored in a dry environment free from direct sunlight. The following environmental limitations apply to both storage and shipment of the instrument:

Temperature range : −20℃ to + 60℃
Humidity range : 20% to 80%

Shipment Considerations

If the equipment is being shipped, it should be packaged with the factory packaging material used for delivery. If the factory packaging material has been lost, the following general instructions should be used for repackaging with commercially available materials:

① Wrap the equipment in such materials as vinyl.

② Use a corrugated fibreboard container with a width of 5mm or more. Place appropriate shock absorbing material with a thickness of 50mm or more inside the container.

③ Use the shock absorbing material around sides of the instrument to provide firm cushion and prevent movement in the container. Then, package the accessories with appropriate cushoning material in the container. Close the container and fix its outside with packing braids.

④ Mark the container with FRAGILE to ensure careful handling.

1.4 Inspection before Request for Repair

If the equipment should fail to operate or make correct measurements, it should be inspected in terms of the items listed in the table below before it is being returned for servicing. In no few cases, a simple operational mistake or error will be detected as a result of the initial inspection. If the equipment still fails to operate normally after the initial inspection, contact the ATCE or any nearby Advantest office.

Trouble	Probable cause	Corrective action
The power will not come on.	The power cable is disconnected.	Insert the power cable into appropriate AC power plug receptacle.
	The fuse is blown.	Replace it with a rated fuse. If the fuse melts frequently during operation, confirm the requirements described in Section 1.3 and contact the ATCE or any nearby Advantest office.
	The power cable receptacle is not supplied with power.	Inspect the breaker and fuse box for the power cable receptacle.
The fuse melts often.	The preset source voltage is not appropriate.	The standard source voltage for the equpment is 100VAC and can be changed to the optional source voltages of 120VAC, 220VAC, AND 240VAC. If the commercial power supply in use does not accept these optional source voltages, the fuse may melt.
	The cooling fan will not run.	Confirm that there is no foreign matter blocking the air hole of the fan.
The system will not start or will stop during operation.	The GPIB cable is disconnected.	Connect the GPIB cable.
	The GPIB address setting is wrong.	Correct the GPIB address setting.
	The GPIB address setting is overlapping.	Correct the GPIB address setting.
	The GPIB cable is too long.	Set the total length of the GPIB cable within 20m

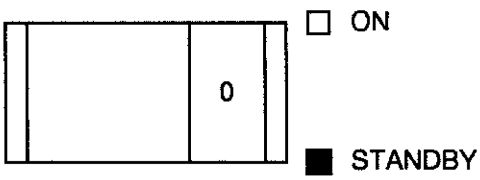
2. PANEL DESCRIPTION

2.1 Front Panel Description

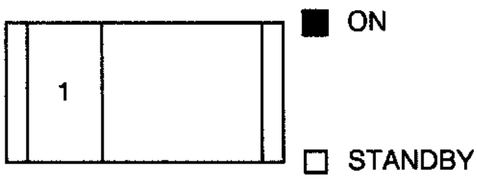
Figure 2-1 shows the front panel of the R4262 Synthesized Signal Source. This section describes the individual parts of the front panel.

① Power Switch

When '0' is displayed on the power switch, the power is off and the STANDBY lamp (green) at the right of the switch is on. When '1' is displayed on the power switch, the power is on and the ON lamp (red) at the right of the switch is on. (Note that the STANDBY lamp will not come on when the power cable is not connected to the AC LINE plug receptacle.)



When the power is off



When the power is on

② Carrier Wave Frequency Display Lamps

The carrier wave frequency display lamps indicate the currently set carrier wave frequency. When frequency sweep, offset frequency display, and relative frequency display are specified, the display lamps listed in the table below will come on above the carrier wave frequency display lamps.

Lamp	Meaning
A.SWP	Wide-band analog frequencies are swept.
D.SWP	Digital frequencies are swept.
$\pm\Delta$F	Narrow-band analog frequencies are swept.
START	The displayed frequency indicates the start of sweep.
STOP	The displayed frequency indicates the stop of sweep.
CENTER	The displayed frequency indicates the center of sweep.
SPAN	The displayed frequency indicates the span of sweep.
OFS	Offset frequency display is specified.
REL	Relative frequency display is specified.
MKR	Marker frequency display is specified.

③ Frequency Digit Setting Keys

The frequency digit setting keys are used to set frequency digits. Any frequency digits set with these keys can be incremented or decremented with the frequency digit adjustment knob and the frequency step keys.

[←] HOLD .... Shifts frequency digits to the left.

[→] INC .... Shifts frequency digits to the right.

When pressed after the [SHIFT] key, the frequency digit setting keys perform the following functions :

[SHIFT] [←] HOLD ..... Disables (holds) the frequency digit setting keys, frequency digit adjustment knob, and frequency step keys.

[SHIFT] [→] INC ..... Sets an increment step size for carrier wave frequencies.

④ Frequency Digit Adjustment Knob

The frequency digit adjustment knob is used to increment or decrement the frequency digits set with the frequency digit setting key. Turning this knob clockwise and counterclockwise will increment and decrement the frequency digits, respectively.

⑤ Frequency Step Keys

The frequency step keys are usually used to increment or decrement by one the frequency digits set with the frequency digit setting keys.

[↑] .... Increments frequency digits by one.

[↓] .... Decrements frequency digits by one.

When the [SHIFT] and [→] INC keys are pressed to set an increment step size for carrier wave frequencies, any frequency digits set with the frequency digit setting keys will be incremented or decremeted by the set step size.

⑥ Amplitude Display Lamps

The amplitude display lamps indicate the currently set amplitude. When amplitude sweep, offset amplitude display, and relative amplitude display are specified, the displays listed in the table below will be made above the carrier wave frequency display lamps.

Lamp	Meaning
SWP	Output level sweep is specified.
START STOP SLOPE	The displayed amplitude indicates the start of sweep. The displayed amplitude indicates the stop of sweep. The displayed amplitude indicates the slope of sweep.
OFS REL	Offset amplitude display is specified. Relative amplitude display is specified.
EMF	Output level display is made in units of open ended electromotive force.

⑦ Amplitude Digit Setting keys

The amplitude digit setting keys are used to set amplitude digits. Any amplitude digits set with these keys can be incremented or decremented with the amplitude digit adjustment knob and the amplitude sted keys.

[←] HOLD .... Shifts amplitude digits to the left.

[→] INC .... Shifts amplitude digits to the right.

When pressed after the SHIFT key, the amplitude digit setting keys perform the following functions :

SHIFT [←] HOLD ..... Disables (holds) the amplitude digit setting keys, amplitude digit adjustment knob, and amplitude step keys.

SHIFT [→] INC ..... Sets an increment step size for amplitudes.

⑧ Amplitude Digit Adjustment Knob

The amplitude digit adjustment knob is used to increment or decrement the amplitude digits set with the amplitude digit setting key. Turning this knob clockwise and counterclockwise will increment and decrement the amplitude digits, respectively.

⑨ Amplitude Step Keys

The amplitude step keys are usually used to increment or decrement by one the amplitude digits set with the amplitude digit setting keys.

[↑] .... Increments amplitude digits by one.

[↓] .... Decrements amplitude digits by one.

When the SHIFT [ ] and [→] INC keys are pressed to set an increment step size for amplitudes, any amplitude digits set with the amplitude digit setting keys will be incremented or decremented by the set step size.

⑩ Modulation Display Lamps

The modulation display lamps indicate the currently set modulation parameter, showing the modulation frequency on their left half and the modulation depth (modulation deviation) on their right half. When the "AM", "FM", "øM ", and "øSWP" modulations are all off, the modulation display lamps will not come on. The modulation parameters (listed in the table below) indicate the type of modulation, to which the modulation frequency digit setting keys, modulation frequency digit adjustment knob, modulation depth/modulation deviation digit setting key, and modulation depth/modulation deviation digit adjustment knob will apply.

Lamp	Meaning
AM	AM parameter is specified.
FM	FM parameter is specified.
ø M	øM parameter is specified.
ø SWP	Phase sweep parameter is specified.
DEPTH	AM modulation depth parameter is specified.
DEV	FM and øM modulation deviation parameters are specified.
SPAN	Phase sweep span parameter is specified.

⑪ Modulation Frequency Digit Setting Keys

The modulation frequency digit setting keys are used to set modulation frequency digits. Any modulation frequency digits set with these keys can be incremented or decremented with the modulation frequency digit adjustment knob.

[←] HOLD .... Shifts modulation frequency digits to the left.

[→] .... Shifts modulation frequency digits to the right.

When pressed after the [SHIFT] key, the modulation frequency digit setting keys perform the following functions :

[SHIFT] [←] HOLD ..... Disables (holds) the modulation frequency digit setting keys, modulation frequency digit adjustment knob, and modulation frequency step keys.

⑫ Modulation Frequency Digit Adjustment Knob

The modulation frequency digit adjustment knob is used to increment or decrement the modulation frequency digits set with the modulation frequency digit setting key. Turning this knob clockwise and counterclockwise will increment and decrement the modulation frequency digits, respectively.

⑬ Modulation Depth/Modulation Deviation Digit Setting Keys

The frequency depth/modulation deviation digit setting keys are used to set frequency depth/modulation deviation digits. Any frequency depth/modulation deviation digits set with these keys can be incremented or decremented with the frequency depth/modulation deviation digit adjustment knob.

[←] HOLD .... Shifts frequency depth/modulation deviation digits to the left.

[→] .... Shifts frequency depth/modulation deviation digits to the right.

When pressed after the [SHIFT] key, the frequency depth/modulation deviation digit setting keys perform the following functions:

[SHIFT] [←] HOLD ..... Disables (holds) the frequency depth/modulation deviation digit setting keys, frequency depth/modulation deviation digit adjustment knob, and frequency depth/modulation deviation step keys.

⑭ Modulation Depth/Modulation Deviation Digit Adjustment Knob

The frequency depth/modulation deviation digit adjustment knob is used to increment or decrement the frequency depth/modulation deviation digits set with the frequency depth/modulation deviation digit setting key. Turning this knob clockwise and counterclockwise will increment and decrement the fequency depth/modulation deviation digits, respectively.

⑮ Date Entry Keys

The data entry keys, or ten keys, are used to enter data for parameters selected with key switches at their left. For example, when setting a carrier wave frequency to 2.4GHz and setting an amplitude to -12 dBm, press the following keys:

[FREQUENCY] [2] [.] [4] [GHz / +dBm]

[AMPLITUDE] [1] [2] [MHz / +dBm]

The functions of the key switches are as follows:

[FREQUENCY] ..... Specifies setting of carrier wave frequencies with ten keys.

[AMPLITUDE] ..... Specifies setting of amplitudes with ten keys.

MODULATION

- AM ..... Specifies setting of AM depth with ten keys. Turns on the AM display when it is off.
- FM ..... Specifies setting of FM deviation with ten keys. Turns on the FM display when it is off. Specifies setting of øM deviation with ten keys when pressed after the SHIFT key.
- MOD FREQ ..... Specifies setting of modulation frequencies for modulations specified by the modulation display with ten keys. Will not work when AM, FM, and øM are all off.

FREQ SWEEP

- START ..... Specifies setting of the start frequency for wide-band analog and digital frequency sweeps.
- STOP ..... Specifies setting of the stop frequency for wide-band analog and digital frequency sweeps.
- CENTER ..... Specifies setting of the center frequency for wide-band analog, narrow-band analog, and narrow-band digital frequency sweeps with ten keys.
- SPAN ..... Specifies setting of the span of analog, narrow-band analog, and narrow-band digital frequency sweeps with ten keys.

If wide-band analog, narrow-band analog, and narrow-band digital frequency sweeps are off, the key switches concerning frequency sweep will come on when any one of them that is used last is selected. (At the time of initialization, analog frequency sweep is on.)

AMPTD SWEEP

- START ..... Sets of the start amplitude for the analog and digital amplitude sweep function with ten keys.
- STOP ..... Sets of the stop amplitude for the analog and digital amplitude sweep function with ten keys.
- SLOPE ..... Sets of the slope of the analog and digital amplitude sweep function with ten keys.

If both analog and digital amplitude sweeps are off, the key switches concerning amplitude sweep will come on when either one of them that is used last is selected. (At the time of initialization, analog amplitude sweep is on.)

⑯ Modulation Setting Keys

The modulation digit setting keys have the following functions:

PULSE .... Turns on the pulse modulation function.

AM .... Turns on the AM function. Enables the AM display and AM frequency digit adjustment knob when pressed together with the FM and øM keys.

FM / BPSK .... Turns on the FM function. Enables the FM display and FM frequency digit adjustment knob when pressed together with the AM and PULSE keys. Turns on the BPSK modulation function when pressed after the SHIFT key.

øM / øSWP .... Turns on the øM function. Enables the øM display and øM frequency digit adjustment knob when pressed together with the AM and PULSE keys. Turns on the phase modulation function when pressed after the SHIFT key.

INT / WIDE FM1 .... Switches the modulation signal for the currently specified modulation to an internal oscillator. Turns on Wide FM 1 when pressed after the SHIFT key.

EXT AC / WIDE FM2 .... Switches the modulation signal for the currently specified modulation to an AC connection for external output. Turns on Wide FM 2 when pressed after the SHIFT key.

EXT DC / WIDE FM3 .... Switches the modulation signal for the currently specified modulation to an DC connection for external output. Turns on Wide FM 3 when pressed after the SHIFT key.

MOD OFF .... Turns off the currently specified modulation function. Turns on the modulation frequency digit adjustment knob for any other modulation functions that are currently on.

ALL OFF .... Turns off all the modulation functions.

⑰ Special Modulation Display Lamp

The three special modulation display lamps indicate the following:

øSWP .... Indicates that phase sweep is on.

BPSK .... Indicates that BPSK modulation is on.

WIDE FM .... Indicates that any one of Wide FM 1, 2, and 3 is on.

⑱ GPIB Status Display Lamps and Local Switches

The four GPIB status display lamps indicate the control status of the GPIB.

○ SRQ .... Indicates that the equipment makes service request when the SRQ can be sent.

○ TALK .... Indicates that the equipment has received talker addresses.

○ LISTEN .... Indicates that the equipment has received listener addresses.

○ REMOTE .... Indicates that the equipment is being or has been remotely controlled by an external controller.

When the REMOTE lamp is on, all the key switches and knobs on the front panel are disabled. To release the REMOTE lamp, press the LOCAL key. (When "LOCAL LOCKOUT" is specified, pressing the LOCAL key will not release the REMOTE lamp. In this event, specify "LOCAL" from an external controller.)

By pressing the LOCAL key after the SHIFT key, the GPIB address can be set for the equipment.

⑲ SHIFT Key

SHIFT .... Used to operate the functions marked in blue above and below the key switches on the front panel. This key is on when its inside lamp is on.

⑳ RF Output ON/OFF Key

RF OUTPUT ON/OFF .... Turns on and off the RF output. The RF output is on when the lamp of this key is on.

㉑ Function/Memory Key Switches

The ten function/memory key switches (shown below) perform different functions depending on the settings of the FUNCTION/PRESET and MEMORY/SAVE keys.

FUNCTION/MEMORY

0	1	2	3	4	5	6	7	8	9
A SWP	D SWP	±ΔF	SWP TIME	SPCL MOD	BAND	MKR	SPCL FUNCTION	PRGM	SEQ

FUNCTION / PRESET .... Switches the above ten key switches to function key switches for performing functions marked below them.

MEMORY / SAVE .... Switches the above ten key switches to memory key switches for saving data in memory of the number marked above them.

NO YES .... Used to enter affirmative and negative answers to messages displayed during function setting.

The lamps above the ten key switches 0 (A SWP) to 9 (SEQ) will go off when the corresponding functions are initialized and come on when any changes are made to the corresponding functions.

㉒ Message Window

The message window displays messages during function setting and in the event of error occurrence.

㉓ Pulse Modulation Signal Input Terminal

Input voltage range	:	0 to 5V
Input threshold voltage level	:	1.5V

This terminal is used to input pulse modulation signals.

㉔ External AM Signal Input Terminal

Absolute maximum input voltage	:	±12V
Input voltage range	:	±1V
Input impedance	:	100kΩ

This terminal is used to input AM signals when the EXT AC AM and EXT DC AM functions are set. When the EXT AC AM function is set, the Auto Gain Control (AGC) circuit incorporated in the equipment will automatically calibrate the modulation depth to a preset value if the peak-to-peak voltage of the input AM signal ranges from 0.9 to 1.1V.

When the EXT DC is specified, however, the modulation depth must be calibrated manually by inputting an AM signal with a peak-to-peak voltage range of 1V ± 1%. If the input AM signal exceeds the above specified voltage limits for both the EXT AC and EXT DC, the modulation display lamps will display the following:

Hi .... The input AM signal exceeds the upper limit of the peak-to-peak voltage range.

Lo ... The input AM signal exceeds the lower limit of the peak-to-peak voltage range.

To calibrate the modulation depth when either of the above displays appears, adjust the amplitude of the input AM signal until the display disappears.

㉕ External FM Signal Input Terminal

Absolute maximum input voltage	:	±12V
Input voltage range	:	±1V
Input impedance	:	100kΩ

This terminal is used to input FM signals when EXT AC FM and EXT DC FM functions are set. When the EXT AC FM function is set, the Auto Gain Control (AGC) circuit incorporated in the equipment will automatically calibrate the modulation deviation to a preset value if the peak-to-peak voltage of the input FM signal ranges from 0.9 to 1.1V. When the EXT DC is specified, however, the modulation deviation must be calibrated manually by inputting an FM signal with a peak-to-peak voltage range of 1V ±1%. If the input FM signal exceeds the above specified voltage limits for both the EXT AC FM and EXT DC FM functions, the modulation display lamps will display the following :

Hi .... The input FM signal exceeds the upper limit of the peak-to-peak voltage range.

Lo ... The input FM signal exceeds the lower limit of the peak-to-peak voltage range.

To calibrate the modulation deviation when either of the above displays appears, adjust the amplitude of the input FM signal until the display disappears.

The external FM signal input terminal can also be used to input external øM signals.

㉖ Wide-band FM Signal Input Terminal

Absolute maximum input voltage	:	±12V
Input voltage sensitivity	:	Approx. 6kHz/mV (Wide FM 2)
Input Impedance	:	50Ω (Wide Fm 2)
		10kΩ (Wide FM 1)

This terminal is used to input wide-band FM signals.

㉗ AM Signal Output Terminal

Output impedance	:	600Ω
Frequency range	:	20Hz to 100kHz
Output peak-to-peak amplitude range	:	1V (under 600Ω load)
Output peak-to-peak amplitude resolution	:	$1mV_{P-P}$

This terminal is used to output internal AM signals.

㉘ FM Signal Output Terminal

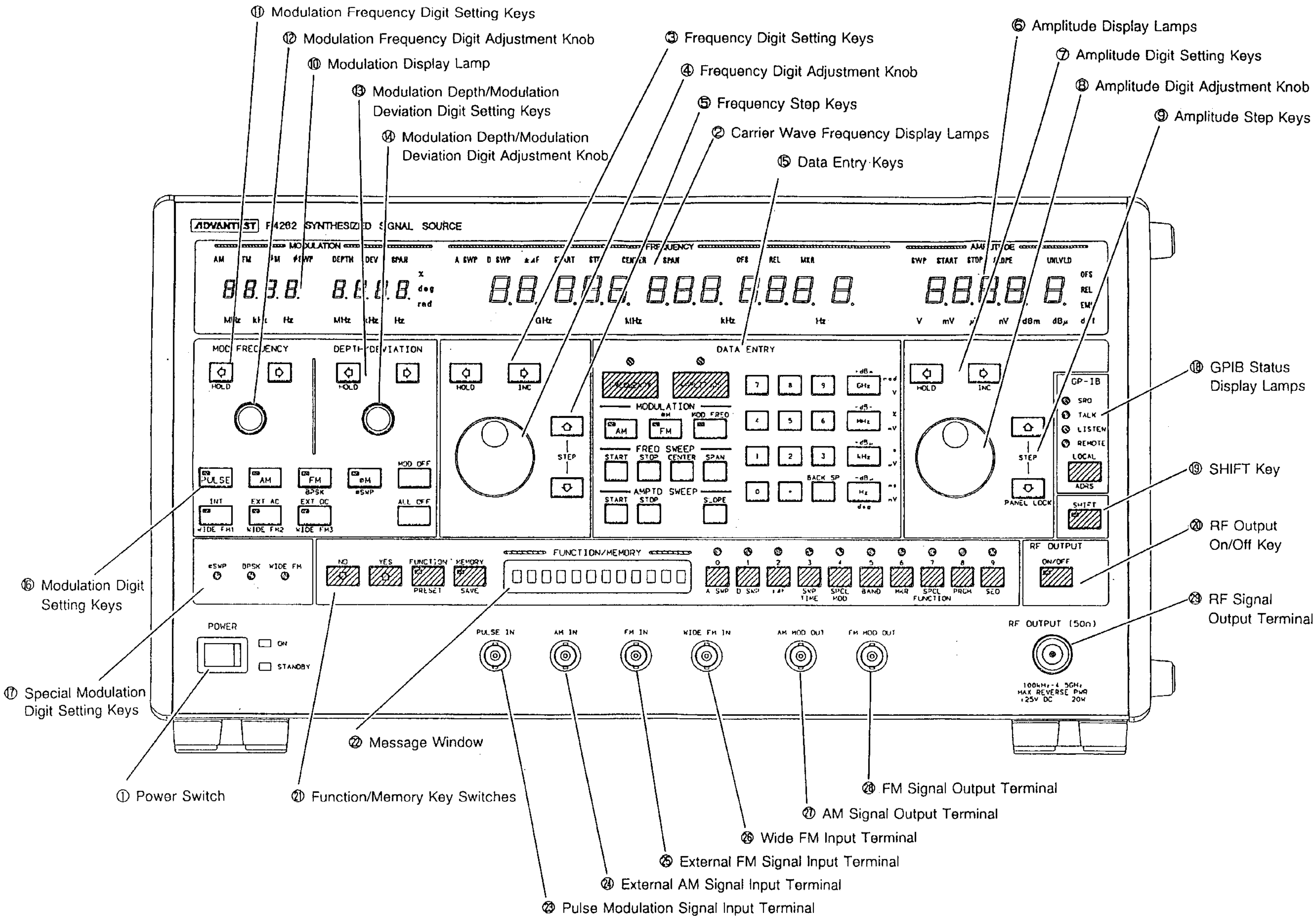
Output impedance	:	600Ω
Frequency range	:	20 to 100kHz
Output peak-to-peak amplitude range	:	$1V_{P-P}$ (under 600Ω load)
Output peak-to-peak amplitude resolution	:	$1mV_{P-P}$

This terminal is used to output internal FM signals.

㉙ RF Signal Output Terminal

This terminal is used to output RF signals.

Output impedance	:	50Ω (nominal value)
Frequency range	:	100kHz to 4.5GHz
Output level range	:	−140dBm to +16dBm
SWR	:	< 1.5 (< 0dBm)
		< 2.0 (< +5dBm)
Counter electromotive force protection	:	20W, ± $25V_{DC}$


① Power Switch
② Carrier Wave Frequency Display Lamps
③ Frequency Digit Setting Keys
④ Frequency Digit Adjustment Knob
⑤ Frequency Step Keys
⑥ Amplitude Display Lamps
⑦ Amplitude Digit Setting Keys
⑧ Amplitude Digit Adjustment Knob
⑨ Amplitude Step Keys
⑩ Modulation Display Lamp
⑪ Modulation Frequency Digit Setting Keys
⑫ Modulation Frequency Digit Adjustment Knob
⑬ Modulation Depth/Modulation Deviation Digit Setting Keys
⑭ Modulation Depth/Modulation Deviation Digit Adjustment Knob
⑮ Data Entry Keys
⑯ Modulation Digit Setting Keys
⑰ Special Modulation Digit Setting Keys
⑱ GPIB Status Display Lamps
⑲ SHIFT Key
⑳ RF Output On/Off Key
㉑ Function/Memory Key Switches
㉒ Message Window
㉓ Pulse Modulation Signal Input Terminal
㉔ External AM Signal Input Terminal
㉕ External FM Signal Input Terminal
㉖ Wide FM Input Terminal
㉗ AM Signal Output Terminal
㉘ FM Signal Output Terminal
㉙ RF Signal Output Terminal
ADVANTEST
SYNTHESIZED SIGNAL SOURCE
MODULATION
FREQUENCY
AMPLITUDE
DATA ENTRY
FUNCTION/MEMORY
RF OUTPUT
POWER
GP-IB
SHIFT
PULSE IN
AM IN
FM IN
WIDE FM IN
AM MOD OUT
FM MOD OUT
RF OUTPUT (50Ω)

2.2 Description of Rear Panel

Figure 2-2 shows the rear panel of the R4262 Synthesized Signal Source. This section describes the individual parts of the rear panel.

① AC Line Connector (Fuse)

The AC line connector is used to connect the power cable to the equipment. The standard source voltage for the equipment is 100VAC and can be changed to the optional source voltages of 120VAC, 220VAC, and 240VAC.

Standard	:	100VAC (90 to 110V)
Option 32	:	120VAC (103 to 132V)
Option 42	:	220VAC (198 to 242V)
Option 44	:	240VAC (216 to 250V)

When the equipment is being left out of use for a long time, the power cable should be disconnected from the equipment .

When the power fuse, which is accommodated in the AC line connector, is being replaced, the power cable should also be disconnected from the equipment and the procedure described in Section 1.3.2 (3) Fuse Replacement should be followed.

② Grounding Terminal

The grounding terminal is used to ground the equipment. This terminal should be grounded when the attached 3-pin/2-pin power plug conversion adapter A09034 (KPR-18) is connected to the 3-pin power cable.

③ Cooling Fan

The cooling fan is used to cool the inside of the equipment .

To ensure safety, never block the air hole of the cooling fan.

④ External Reference Signal Input Terminal (REFERENCE EXT IN)

The external reference signal input terminal is used to input a 10MHz external reference signal to match the reference voltage of the equipment with that of any other unit.

Input reference frequency	:	1MHz, 2MHz, 5MHz, and 10MHz
Peak-to-peak signal voltage	:	$\geq 1V_{P\text{-}P}$
Input impedance	:	1kΩ

⑤ Internal Reference Signal Output Terminal (REFERENCE 10MHz OUT)

The internal reference signal output terminal is used to output an internal 10MHz reference signal to match the reference voltage with that of any other unit.

Input reference frequency	:	10MHz
Peak-to-peak signal voltage	:	≥1V
Output impedance	:	50Ω

⑥ External Trigger Input Terminal (EXT TRIG IN)

The external trigger input terminal is used to input an eternal trigger to start frequency sweep and amplitude sweep when they are specified.

Input signal level : TTL level (0V to 5V)
High (Not triggered) : > 2.4V
Low (Triggered) : < 0.4V

⑦ Auxiliary Modulation Signal Input Terminal (AUX MOD IN)

The auxiliary modulation signal input terminal is used to input an external modulation signal in combination with the AM signal input terminal "AM IN" and the FM signal input terminal "FM IN" on the front panel. Any external modulation signal to be input from this terminal can be selected and synthesized with the SPECIAL MOD function.

⑧ Sweep Voltage Input/Output Terminal (SWEEP IN/OUT)

The sweep voltage input/output terminal is used to input or output sweep voltage for frequency sweep and amplitude sweep when they are specified. Input or output of sweep voltage can be specified with the A SWP ±ΔF function. When sweep voltage output is specified, any ramp voltage within a range of 0 to + 8V can be selected. When sweep voltage input is specified, any voltage within a range of 0V to +8V, −4 to +4V, or −8 to +8V with an increment of 8V can be selected.

⑨ Sweep Stop Signal Input Terminal (STOP SWEEP)

The sweep stop signal input terminal is used to input a signal for stopping frequency sweep and amplitude sweep when they are specified.

Input signal level : TTL level (0V to 5V)
High (Sweep start) : > 2.4V
Low (Sweep stop) : < 0.4V

⑩ Sweep Blanking Signal Output Terminal (BLANK OUT)

The sweep blanking signal output terminal is used to output a signal indicating a time interval between start and stop of frequency sweep and amplitude sweep when they are specified.

The voltage of the output sweep stop signal can be selected within a range of 0V to −5V or 0V to +5V with the A SWP ±ΔF function.

Output signal level : 0V to +5V or 0V to −5V
0V : Sweep
±5V : Blanking

⑪ Marker Signal Output Terminal (MARKER OUT)

The marker signal output terminal is used to output a signal with a preset marker frequency when frequency sweep is specified.

Output signal level : +5V to −5V
+5V : Blanking
øV : Sweep
−5V : Marker frequency

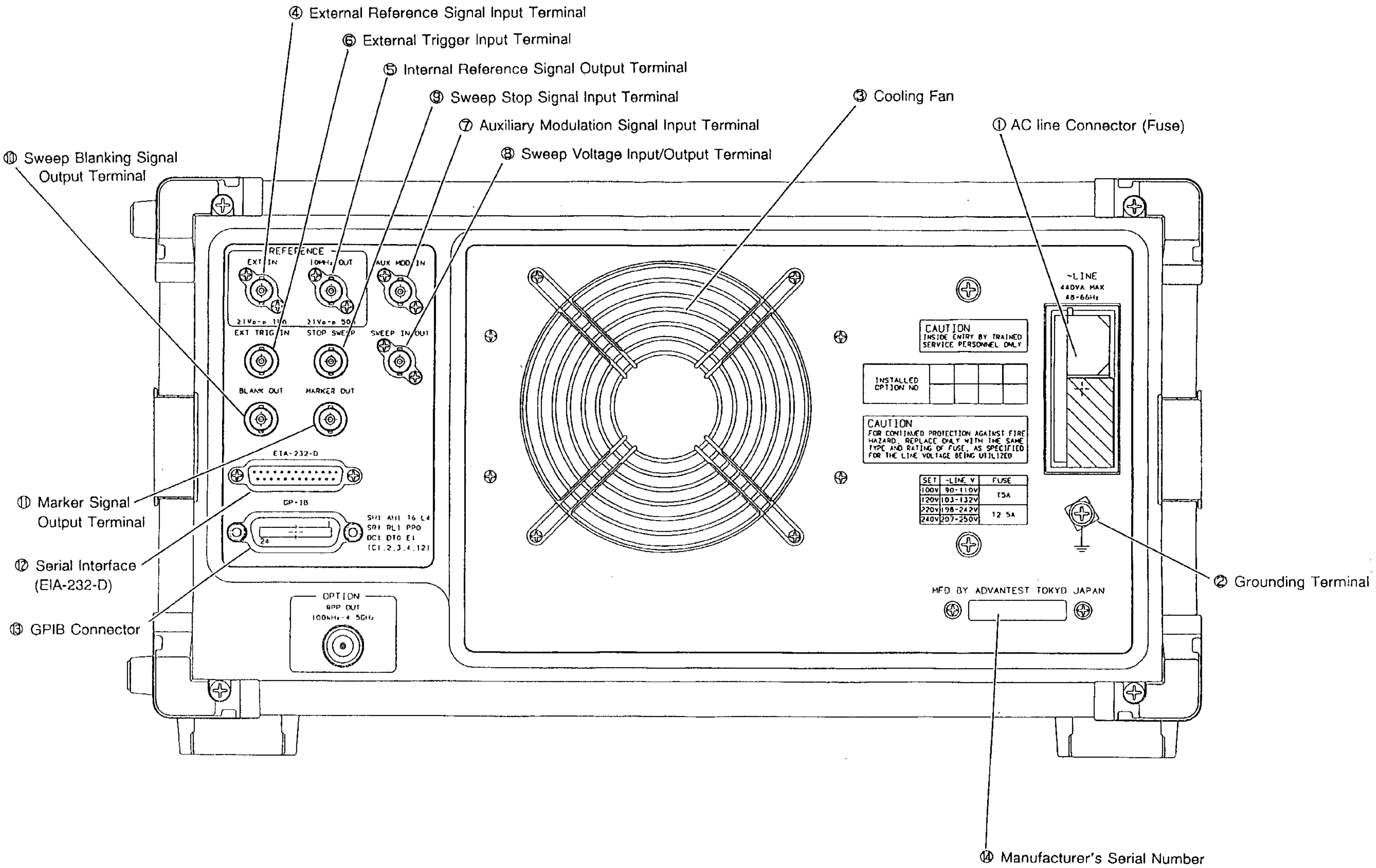
⑫ Serial Interface (EIA-232-D)

The serial interface, conforming to the ANSI/EIA-232-D-1986, is used to connect terminal equipment, personal computers, etc. as a program editor for the controller function to the equipment. When any options are specified, the serial interface is equipped with a 25-pin D-sub connector.

⑬ GPIB Connector

The GPIB connector, conforming to the IEEE 488-1978, is a standard interface for measuring equipment and used to control all the operations performed on the front panel.

IEEE-488 functions: SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1


④ External Reference Signal Input Terminal
⑥ External Trigger Input Terminal
⑤ Internal Reference Signal Output Terminal
⑨ Sweep Stop Signal Input Terminal
⑦ Auxiliary Modulation Signal Input Terminal
⑧ Sweep Voltage Input/Output Terminal
③ Cooling Fan
① AC line Connector (Fuse)
⑩ Sweep Blanking Signal Output Terminal
⑪ Marker Signal Output Terminal
⑫ Serial Interface (EIA-232-D)
⑬ GPIB Connector
② Grounding Terminal
⑭ Manufacturer's Serial Number
REFERENCE
EXT TRIG IN
STOP SWEEP
SWEEP IN/OUT
BLANK OUT
MARKER OUT
EIA-232-D
GP-IB
OPTION
~LINE
CAUTION
INSTALLED OPTION NO
MFD BY ADVANTEST TOKYO JAPAN

3. OPERATING PROCEDURE

3.1 Basic Operating Procedure

3.1.1 Operations

This section describes ordinary key operation, shift key operation, function/memory switch key (located on the lowermost line of the front panel) operation, and GPIB control codes, all of which are performed on the R4262.

(1) Ordinary Key Operation

Ordinary key operation refers to direct operation of the functions marked above or on the key switches (ordinary key functions). The key switches are represented with symbols indicative of their respective names. e.g. [FREQ], [AMPTD], [+dBm / MHz] rad, etc.

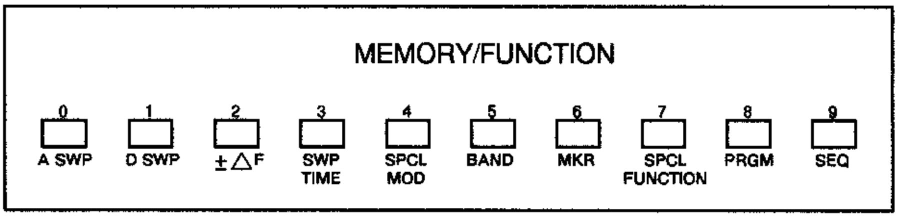
(2) Shift Key Operation

Shift key operation refers to pressing of the blue [SHIFT] key and individual key switches in this order. When pressed after the [SHIFT] key, the individual key switches will perform not their respective functions but those functions which are marked in blue below them (shift key functions). For example, the [FUNCTION / PRESET] key switch, when pressed after the [SHIFT] key, will perform the PRESET function, which is marked below it. Shift key operation is represented by adding the shift key symbol to the individual key switch symbols, e.g. [SHIFT] [FUNCTION / PRESET].

Note here that any shift key function will be released once performed. For example, once the [SHIFT] and [FUNCTION / PRESET] keys perform the shift key function "PRESET", the [FUNCTION / PRESET] key alone will perform the ordinary key function "FUNCTION".

(3) Function/Memory Switch key Operation

Function/memory switch key operation refers to pressing the [FUNCTION / PRESET] and [MEMORY / SAVE] key to switch the ten function/memory switch keys shown below to function switch keys and memory switch keys, respectively. When the lamp of the [MEMORY / SAVE] key is on, the ten function/memory key switches will function as function switch keys to perform the functions marked below them. When the lamp of the [FUNCTION / PRESET] key is on, the ten function/memory key switches will function as memory key switches to save data in memory of the number marked above them.



(4) GPIB Control Codes

The GPIB control codes (commands) associated with the individual functions are listed on the APPENDIX.

3.1.2 Setting Procedure

The R4262 Synthesized Signal Source Provides the functions of setting parameters including:

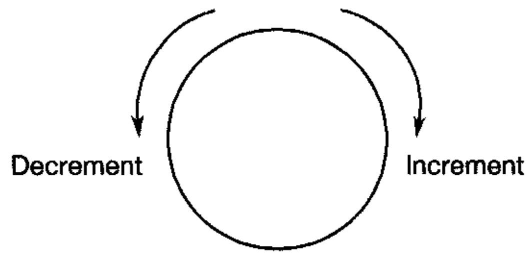
① Carrier wave frequency
② Amplitude
③ AM, FM, WIDE FM, phase modulation (øM), pulse modulation, and BPSK modulation
④ Phase sweep and phase offset
⑤ Wide-band analog frequency sweep
⑥ Digital frequency sweep
⑦ Narrow-band analog frequency sweep
⑧ Analog level sweep
⑨ Digital level sweep

The setting functions for all the above parameters and many others can be specified on the front panel and through the GPIB Interface. Section 3.1.3 describes operations of the basic key switches.

All the above parameters can be set by such means as knobs, step keys, ten keys, etc. The following paragraphs describe the procedures of setting those parameters by the individual means.

(1) Parameter Setting by knobs

The equipment provides four knobs for setting the four parameters: carrier wave frequency, amplitude, modulation frequency, and modulation depth (deviation). The individual knobs can be used to set the respective parameters directly without requiring any additional operation (regardless of the active functions when the ten keys are used). Turning each knob clockwise and counterclokwise will increment and decrement parameter digits, respectively. Any parameter digit that reaches 9 or 0 will be shifted to the next upper or lower digit, respectively.



Parameter digits to be incremented or decremented with the individual knobs can be set with the digit setting keys [←] and [→] in them. When pressed, the digit setting keys will shift a parameter digit to the direction of their respective arrow, making the shifted digit blink.

[←] ..... Shifts a parameter digit to the left (to the next upper digit).

[→] ..... Shifts a parameter digit to the right (to the next lower digit).

(2) Parameter Setting by Step Keys

The step keys on the right side of the knobs can be used to set the two parameters: carrier wave frequency and amplitude. Like the knobs, the step keys increment or decrement parameter digits set with the digit setting keys. When an increment step size is set, any parameter digits set with the digit setting keys will be incremented or decremented by the set step size. (On the contrary, operation of the knobs will not be affected by setting of an increment step size.)

[↑] ..... Increments parameter digits.

[↓] ..... Decrements parameter digits.

For more information on setting of an increment step size, see the section on "RF FREQUENCY" or "AMPLITUDE" in Chapter 3 "Operating Procedure."

(3) Parameter Setting by Ten Keys

The ten keys can be used to enter parameter digits. Before any parameter is being set, its type should be specified. For example, when setting a carrier wave frequency, specify its parameter type by pressing the [FREQUENCY] key, Then, press the FUNCTION [▫] PRESET key, enter desired parameter digits, and press the unit key.

(4) Examples of Parameter Setting on Panel

When setting a carrier wave frequency to 3200MHz and an amplitude to −40dBm:

[FREQUENCY] [3] [2] [0] [0] [MHz / −dBm]

[AMPLITUDE] [4] [0] [MHz / −dBm]

The carrier wave frequency 3200MHz can be set as follows by converting it into 3.2GHz:

[FREQUENCY] [3] [·] [2] [GHz]
(+dBm)

When any wrong parameter digits are entered with the ten keys, they can be deleted in the reverse order of entry by pressing the BACK SP key and replaced with correct digits, or correct digits can be entered from the beginning after pressing the [FUNCTION / PRESET] key.

When the modulation digit setting keys [AM], [FM], and [φM] are pressed, the ten keys for setting the modulation depth (deviation) for the modulation type indicated by the pressed keys will be enabled like the data entry keys [AM] and [FM]. When the [SHIFT] and [FUNCTION / PRESET] keys are pressed, the equipment will be initialized.

BPSK φSWP φM

(5) Example of Parameter Setting by GPIB

All the functions of the equipment can be performed by controlling the GPIB with the GPIB control codes (commands). For more information on the GPIB control codes, see the individual sections in Chapter 3 "Operating Procedure" or Chapter 4 " GPIB Interface".

The following paragraphs show the examples of controlling the GPIB with such means as a personal computer.

<u>Using PC-9801 Series by Nippon Electric Company</u>

① Setting a carrier wave frequency and amplitude for the equipment

```
PRINT @ 1 ; "FR812MZ, AP-12DM"
```

- AP-12DM — Sets an amplitude to −12dBm.
- FR812MZ — Sets a carrier wave frequency to 812MHz.
- 1 — Indicates the GPIB address of the equipment.

② Reading a carrier wave frequency set for the equipment

```
PRINT @ 1 ; "OPCW"
```

- OPCW — Specifies output of a carrier wave frequency set for the equipment.
- 1 — Indicates the GPIB address of the equipment.

```
INPUT @ 1 ; FREQ
```

- FREQ — Specifies reading of a carrier wave frequency set for the equipment into the numeric variable FREQ.
- 1 — Indicates the GPIB address of the equipment.

Using Series 200 by Hewlette Packard in USA

① Setting a carrier wave frequency for the equipment

OUTPUT 701 ; "FR812MZ, AP-12DM"

- AP-12DM: Sets an amplitude to −12dBm.
- FR812MZ: Sets a carrier wave frequency to 812MHz.
- 701: Indicates the GPIB address of the equipment.

② Reading a carrier wave frequency set for the equipment

OUTPUT 701 ; "OPCW"

- OPCW: Specifies output of a carrier wave frequency set for the equipment.
- 701: Indicates the GPIB address of the equipment.

ENTER 701 ; FREQ

- FREQ: Specifies reading of a carrier wave frequency set for the equipment into the numeric variable FREQ.
- 701: Indicates the GPIB address of the equipment.

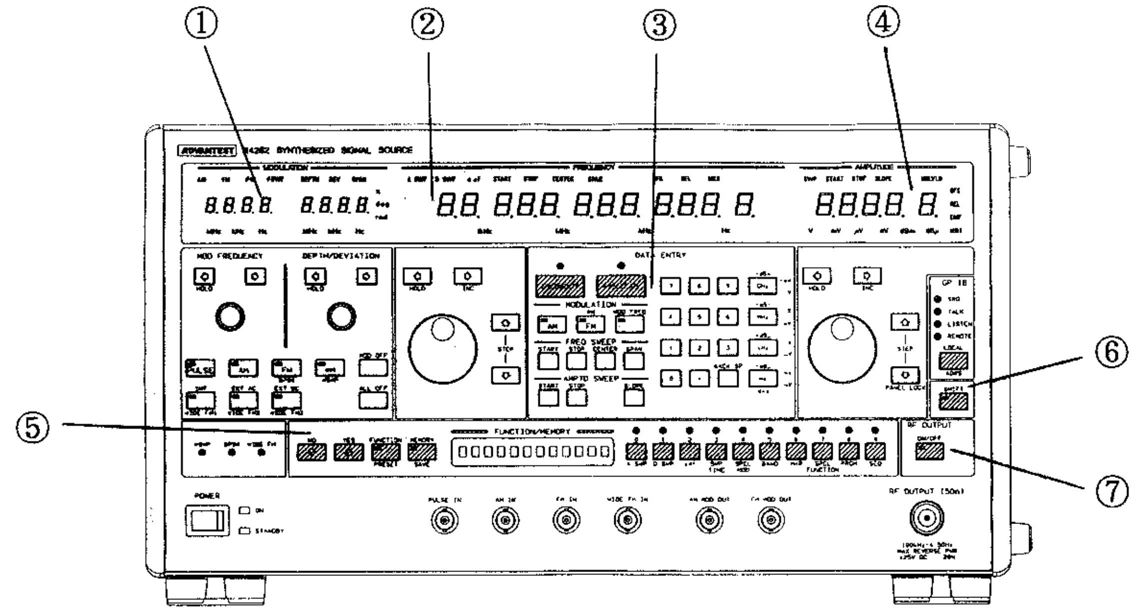
For the detailed operating procedure for the personal computers by the two manufacturers, refer to the instruction manual attached to the computers, application manuals, etc.

3.1.3 Operation of Front Panel key in Individual Modes

This section provides general information on operation of the following keys on the front panel:

(1) Basic keys
(2) RF frequency keys
(3) Amplitude keys
(4) Analog frequency sweep keys
(5) Digital frequency sweep keys
(6) ±ΔF frequency sweep keys

(1) Basic Key Operation



① The lamps and keys are used to display and set modulation parameters, respectively. The left knob is used to set modulation frequency while the right knob is used to modulation depth or deviation.

② The lamps and keys are used to display and set RF frequency digits, respectively. The knob is used to increment and decrement RF frequency digits set with the digit setting keys.

③ The ten keys are used to set RF frequency, amplitude, modulation, and other parameters. The unit keys is used to enter measuring units for selected parameters.

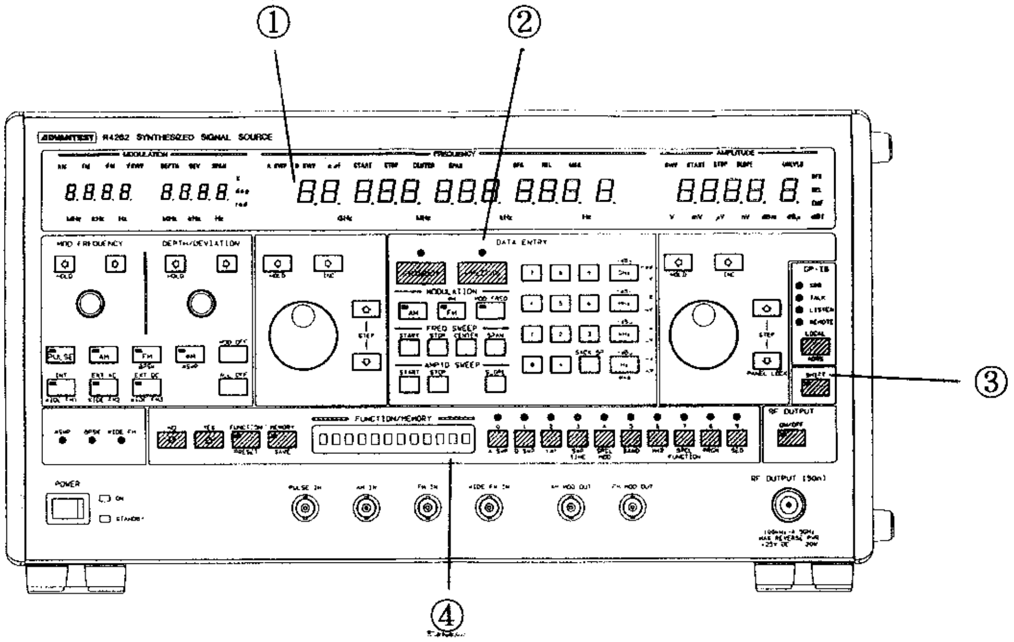
④ The lamps and keys are used to display and set amplitude digits, respectively. The lamps are off when the RF OUTPUT OFF is specified. The knob is used to increment and decrement amplitude digits set with the digit setting keys.

⑤ The keys are used to perform the memory function or the special functions.

⑥ The key switches are used to perform the functions marked in blue below them (shift key functions).

⑦ The keys are used to turn on and off RF output signals.

(2) RF Frequency Key Operation



① Both offset display and relative display are available to RF frequency. The former is indicated by "OFS" displayed on the RF frequency display lamps while the latter is indicated by "REL" displayed on the same lamps.

The RF frequency digit adjustment knob is used to increment and decrement RF frequency digits set with the RF frequency digit setting keys. Turning the RF frequency digit adjustment knob clockwise and counterclockwise will increment and decrement RF frequency digits, respectively.

The RF frequency step keys, like the RF frequency digit adjustment knob, is used to increment and decrement RF frequency digits set with the RF frequency digit setting keys. When an increment step size is set, however, the RF frequency step keys will increment and decrement RF frequency digits by the set step size.

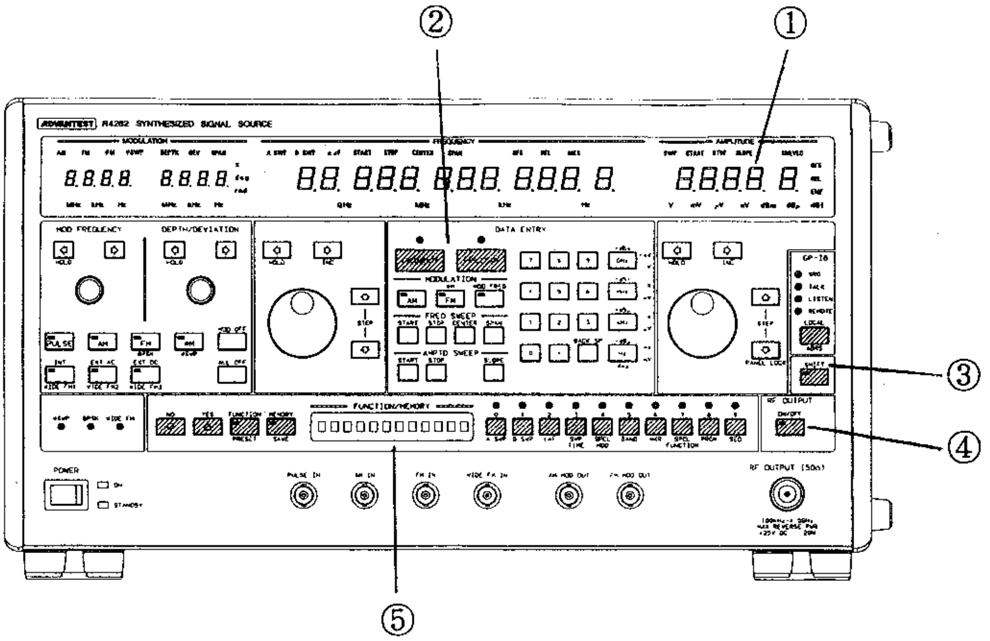
The RF frequency digit setting keys, when pressed after the SHIFT key, will set panel key hold and an increment step size.

② To set RF frequency digits with ten keys, press the FREQ key to enable frequency setting using ten keys. When the lamp of the FREQ key is on, frequency setting using ten keys is enabled. Ordinarily, the RF frequency unit keys correspond to GHz, MHz, kHz, and Hz. When using offset display and relative display for minus RF frequency digits, set the shift key function of the RF frequency unit keys. Then, the RF frequency unit keys will correspond to –GHz, –MHz, –kHz, and –Hz.

③ To set the PRESET function, panel key hold, and an increment step size, use the shift key function.

④ To set an RF frequency band, press the 5/BAND key.
To set NOISE SLOPE, FAST SET, offset display, and relative display, press the 7/SPCL FUNCTION key.
The 5/BAND and 7/SPCL FUNCTION keys should be used when the lamp to the FUNCTION key is on.
To select a menu displayed in the message window, use the YES and NO keys.

(3) Amplitude Key Operation



① Both offset display and relative display are available to amplitude. The former is indicated by "OFS" displayed on the amplitude display lamps while the latter is indicated by "REL" displayed on the same lampes.
The amplitude digit adjustment knob is used to increment and decrement amplitude digits set with the amplitude digit setting keys. Turning the amplitude digit adjustment knob clockwise and counterclockwise will increment and decrement amplitude digits, respectively.
The amplitude step keys, like the amplitude digit adjustment knob, is used to increment and decrement amplitude digits set with the amplitude digit setting keys. When an increment step size is set, however, the amplitude step keys will increment and decrement amplitude digits by the set step size.
When an increment step size is set to ø, the encoder and the amplitude step keys will increment and decrement amplitude digits at the current cursor position.
The amplitude digit setting keys, when pressed after the SHIFT FUNCTION key, will set panel key hold and an increment step size.

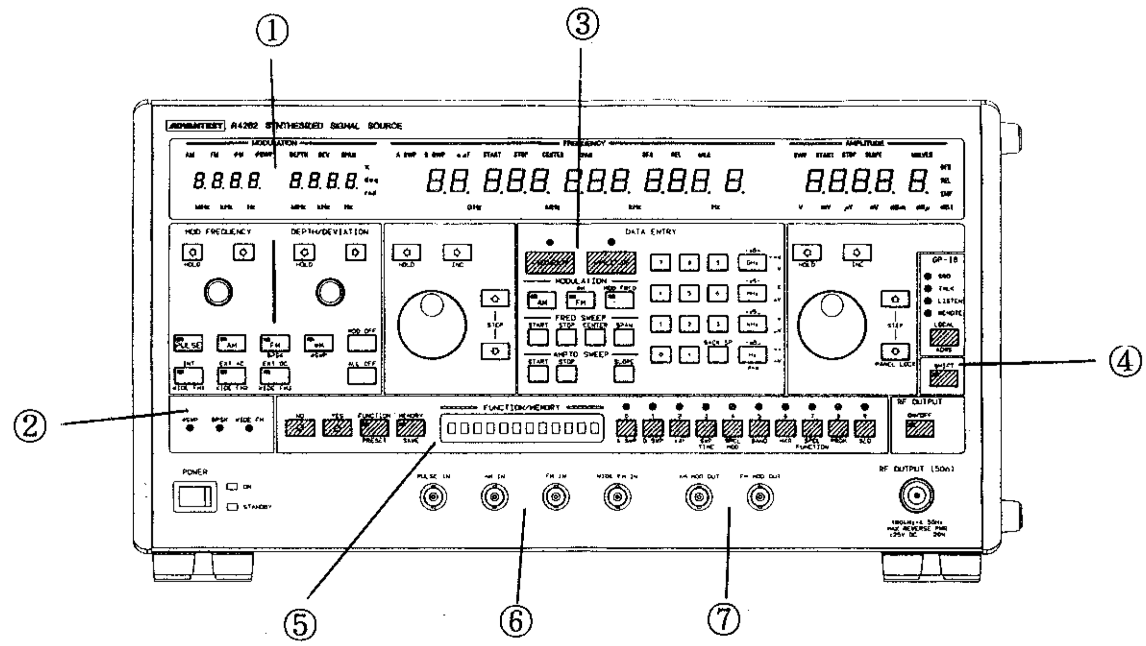
② To set amplitude digits with ten keys, press the [AMPLITUDE] key to enable frequency setting using ten keys. When the lamp of the [AMPLITUDE] key is on, frequency setting using ten keys is enabled.
Ordinarily, the amplitude unit keys correspond to +dBm, −dBm, +dBu, and −dBu. By setting the special function, they can be changed to correspond to +dBf, −dBf, +dBμEMF, −dBμEMF, V, mV, μV, and nV.
To set amplitude sweep, press the [START], [STOP], and [SLOPE] keys to set a start level, stop level, and level slope, respectively.

③ To set the PRESET function, panel key hold, and an increment step size, use the shift key function.

④ The RF output ON/OFF key is used to turn on and off the RF output. When the lamp of the [ON/OFF] key is on, the RF output is on.

⑤ To set unit conversion, ALC ON/OFF, offset display, relative display, and level limiter, press the [7 SPCL FUNCTION] key.
To set analog level sweep, press the [0 A SWP] key when the lamp of the [AMPLITUDE] key is on.
To set the digital level sweep, press the [1 D SWP] key when theLamp of the [AMPLITUDE] key is on.
To set sweep time, use the [3 SWP TIME] key.
The [0 A SWP], [1 D SWP], and [3 SWP TIME] keys should be used when the lamp of the [FUNCTION] key is on.
To select a menu displayed in the message window, use the [YES] and [NO] keys.

(4) Modulation key Operation



① The four right modulation display lamps indicate modulation frequency while the left four modulation display lamps indicate modulation depth and deviation when the modulation digit adjustment knob and ten keys are enabled. The modulation display lamps correspond to the modulation digit adjustment knob and keys below them.

The [PULSE], [AM], [FM] (BPSK), and [øM] (øSWP) keys are used to turn on pulse modulation, amplitude modulation, frequency modulation, and phase modulation function, respectively. Note that following combinations of modulation functions cannot be set:

PULSE-AM, FM-øM, FM-øSWP, øM-øSWP, FM-BPSK, and øM-BPSK

The FM (except WIDE FM), øM, BPSK, and øSWP functions cannot be set when frequency sweep is specified while the AM and PULSE functions cannot be set when output level sweep is specified.

The [MOD OFF] key is used to turn off only the modulation function currently displayed on the modulation display lamp.

The [ALL OFF] key is used to turn off all the modulation functions. The [INT], [EXT AC], and [EXT DC] keys are used to turn on internal modulation, external AC coupled modulation, and external DC coupled modulation functions, respectively. The shift key function can also be used to turn on the WIDE FM function.

② The øSWP lamp will come on when phase sweep is specified. The BPSK lamp will come on when binary phase shift keying is specified. The WIDE FM lamp will come on when any one of the WIDE FM1, 2, and 3 functions.

③ To set modulation depth for the AM function with ten keys, press the [AM] key and then the unit key [MHz] % key. When the AM function is off, this key operation will turn on the AM function.
To set modulation deviation for the FM function with ten keys, press the [FM] key. When the FM function is off, this key operation will turn on the FM function.
To set modulation deviation for the øM function with ten keys, press the [SHIFT] and the [øM FM] key. When the øM function is off, this key operation will turn on the øM function.
The [MOD FREQ] key is used to set the internal modulation frequency for the modulation function (AM, FM, or øM) currently displayed on the modulation display lamp.

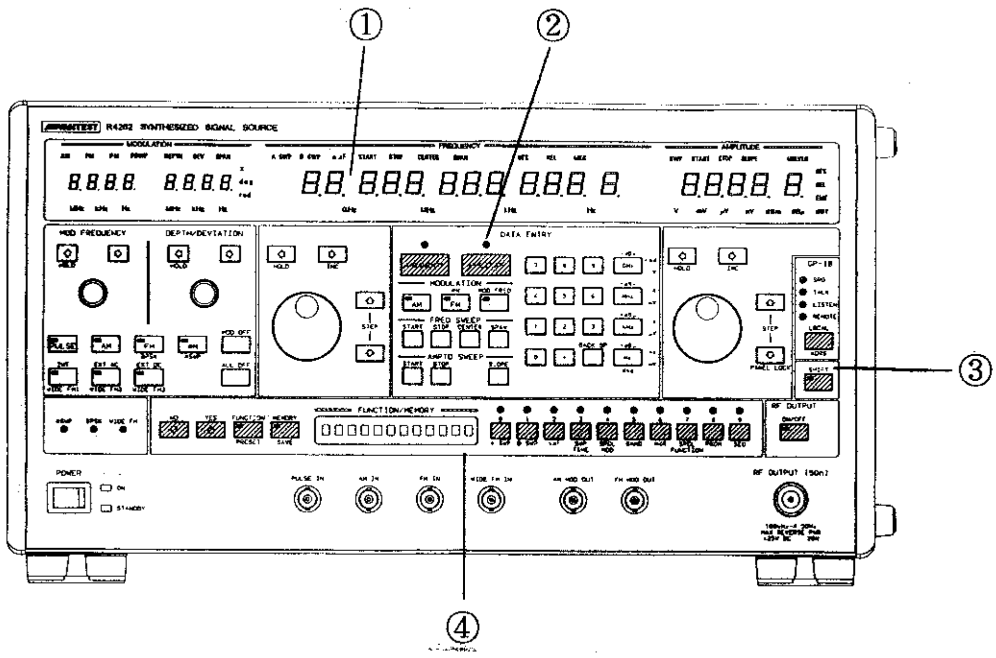
④ The [SHIFT] key is used to set the shift key function when modulation deviation is being for the BPSK, øSWP, WIDE FM 1, 2, and 3, and øM functions with ten keys.

⑤ The [SPCL MOD] key is used to set low-distortion AM, low- distortion FM, FM preemphasis, AM MOD OUT, FM MOD OUT, etc.
The [A SWP] and [SWP TIME] keys are used to set the trigger mode, internal/external sweep, and sweep time for the øSWP function when the lamp of the [FUNCTION] key is on.
To select a menu displayed in the message window, use the [YES] and [NO] keys.

⑥ The terminals are used to input various external modulation signals. To input external øM and BPSK modulation signals, use the FM IN terminal. Also available is the auxiliary modulation signal input termimal AUX MOD IN on the rear panel.

⑦ The terminals are used to output internal modulation signals. They are turned on and off with the [SPCL MOD] key and are off in their initial state.

(5) Analog Frequency Sweep key Operation



① The A SWP lamp will come on when wide-band analog frequency sweep is specified. The START, STOP, CENTER, and SPAN lamps will indicate start frequency, stop frequency, center frequency, and span for wide-band analog frequency sweep.

The analog frequency sweep digit adjustment knob is used to increment and decrement analog frequency sweep digits set with the analog frequency sweep digit setting keys. Turning the knob clockwise and counterclockwise will increment and decrement analog frequency sweep digits, respectively.

The analog frequency sweep step keys, like the analog frequency sweep digit adjustment knob, is used to increment and decrement analog frequency sweep digits set with the analog frequency sweep digit setting keys. When an increment step size is set, however, the analog frequency sweep step keys will increment and decrement analog frequency sweep digits by the set step size.

The analog frequency sweep digit setting keys, when pressed after the SHIFT key, will set panel key hold and an increment step size.

② When any one of the START, STOP, CENTER, and SPAN keys under FREQ SWEEP is pressed, the frequency sweep mode will be set immediately. In this event, the frequency sweep mode will be set-wide to band analog frequency sweep in the initial state. When the mode is set to digital frequency sweep and narrow-band analog frequency sweep, the previously set frequency sweep mode will be selected. To set the mode to wide-band analog frequency sweep, press the 0 (A SWP) key.

When the START, STOP, CENTER, and SPAN keys are pressed, start frequency, stop frequency, center frequency, and span for analog frequency sweep will be displayed, respectively, on the carrier wave frequency display lamps, ready for setting by the frequency digit setting keys, frequency adjustment knob, and frequency step keys.

③ The SHIFT key is used to set PRESET, panel key hold, and an increment step size.

④ To set the frequency sweep mode to wide-band analog frequency sweep, use the A SWP key. To set the sweep trigger mode, internal/external sweep, full sweep mode, etc., also use the A SWP key.

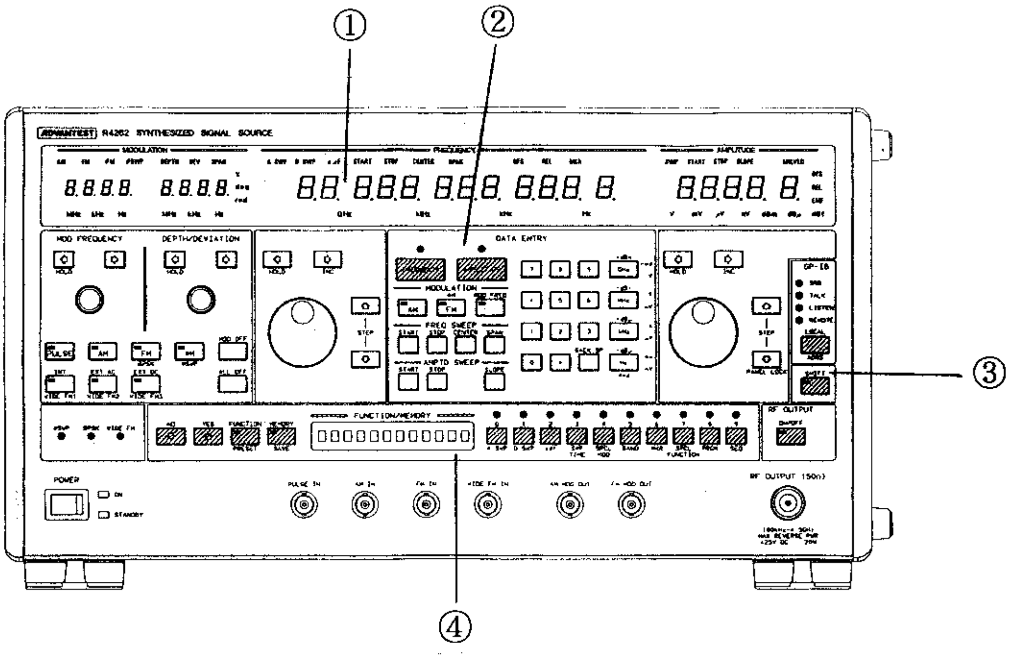
To set sweep time, use the SWP TIME key.

To set a maker, use the MKR key. For more information on marker setting, see Section 3.14.

The A SWP, SWP TIME, BAND, and MKR keys should be used when the lamp of the FUNCTION key is on.

To select a menu displayed in the message window, use the YES and NO keys.

(6) Digital Frequency Sweep Key Operation



① The D SWP lamp will come on when digital frequency sweep is specified. The START, STOP, CENTER, and SPAN lamps indicate start frequency, stop frequency, center frequency, and span for digital frequency sweep.

The digital frequency sweep digit adjustment knob is used to increment and decrement digital frequency sweep digits set with the digital frequency sweep digit setting keys. Turning the knob clockwise and counterclockwise will increment and decrement digital frequency sweep digits, respectively.

The digital frequency sweep step keys, like the digital frequency sweep digit adjustment knob, is used to increment and decrement digital sweep digtis set with the analog frequency sweep digit setting keys. When an increment step size is set, however, the digital frequency sweep step keys will increment and decrement digital frequency sweep digits by the set step size.

The digital frequency sweep digit setting keys, when pressed after the SHIFT key, will set panel key hold and an increment step size.

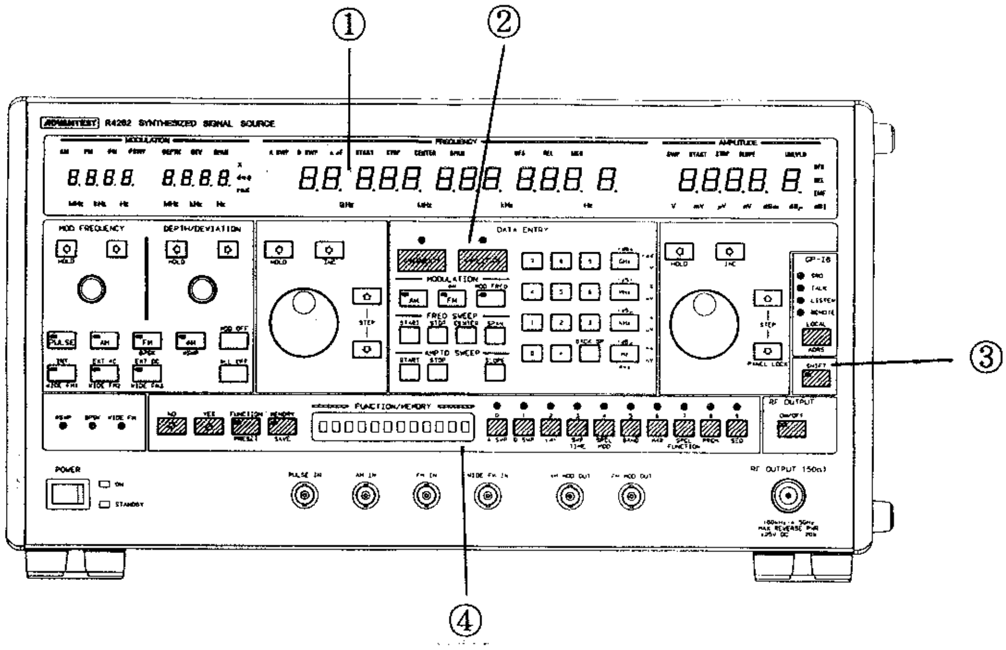
② When any one of the [START], [STOP], [CENTER], and [SPAN] keys under FREQ SWEEP is pressed, the frequency sweep mode will be set immediately. In this event, the frequency sweep mode will be set to digital frequency sweep in the initial state. To set the mode to digital frequency sweep, press the [D SWP] key.

When the [START], [STOP], [CENTER], and [SPAN] keys are pressed, start frequency, stop frequency, center frequency, and span for digital frequency sweep will be displyed, respectively, on the carrier wave frequency display lamps, ready for setting by the frequency digit setting keys, frequency adjustment knob, and frequency step keys.

③ The [SHIFT] key is used to set PRESET, panel key hold, and an increment step size.

④ To set the frequency sweep mode to digital frequency sweep, use the [D SWP] key.
To set stop frequency, stop count, log sweep, etc., also use the [D SWP] key.
To set sweep time, use the [SWP TIME] key.
To set a frequency band, use the [BAND] key.
To set a maker, use the [MKR] key. For more information on marker setting, see Section 3.14.
The [D SWP], [SWP TIME], [BAND], and [MKR] keys should be used when the lamp of the [FUNCTION] key is on.
To select a menu displayed in the message window, use the [YES] and [NO] keys.

(7) ±ΔF Frequency Sweep Key Operation



① The ±ΔF lamp will come on when narrow-band analog frequency sweep is specified. The CENTER and SPAN lamps will indicate center frequency and span for digital frequency sweep. The narrow-band analog frequency sweep digit adjustment knob is used to increment and decrement narrow-band analog frequency sweep digits set with the narrow-band analog frequency sweep digit setting keys. Turning the knob clockwise and counterclokwise will increment and decrement narrow-band analog frequency sweep digits, respectively.
The narrow-band analog frequency sweep step keys, like the narrow-band analog frequency sweep digit adjustment knob, is used to increment and decrement digital sweep digits set with the narrow-band analog frequency sweep digit setting keys. When an increment step size is set, however, the narrow-band analog frequency sweep step keys will increment and decrement narrow-band analog frequency sweep digits by the set step size.
The narrow-band analog frequency sweep digit setting keys, when pressed after the SHIFT key, will set panel key hold and an increment step size.

② When either one of the [CENTER] and [SPAN] keys under FREQ SWEEP is pressed, the frequency sweep mode will be set immediately.
In this event, the frequency sweep mode will be set to wide-band analog frequency sweep in the initial state.
To set the mode to narrow-band analog frequency sweep, press the [2 / ±ΔF] key.
When the [CENTER] and [SPAN] keys are pressed, center frequency and span for narrow-band analog frequency sweep will be displayed, respectively, on the carrier wave frequency display lamps, ready for setting by the frequency digit setting keys, frequency adjustment knob, and frequency step keys.

③ The [SHIFT] key is used to set PRESET, panel key hold, and an increment step size.

④ To set the frequency sweep mode to digital frequency sweep, use the [±ΔF] key.
To set the sweep trigger mode, internal/external sweep, etc. also use the [±ΔF] key.
To set sweep time, use the [SWP TIME] key.
To set a frequency band, use the [BAND] key.
To set maker, use the [MKR] key. For more information on marker setting, see Section 3.14.
The [±ΔF], [SWP TIME], [BAND], and [MKR] keys should be used when the lamp of the [FUNCTION] key is on.
To select a menu displayed in the message window, use the [YES] and [NO] keys.

3.2 RF Frequency

3.2.1 Description

The R4262 converts basic synthesized frequency bands of 2000MHz to 4500MHz to the radiofrequency (RF) bands of 100kHz to 4500MHz as shown in the table below.

Table 3.2 - 1 Radiofrequency Ranges

Electrical characteristics	Range	Setting conditions
Frequency range	100kHz~4500MHz	
Specified resolution	0.1Hz	When the normal mode is set
	1Hz	When the Fast mode is set

The output RF bands of 100kHz to 4500MHz are obtained by dividing the basic synthesized frequency bands of 2000MHz to 4500MHz (Band 7) as shown in the table below. A frequency band of 10MHz to 2000MHz is a heterodyne frequency band (HET Band) that is heterodyned instead of being divided. The HET Band is used to set large modulation deviation for the FM and øM function (set the maximum modulation deviation for each divided frequency band) and wide-band analog sweep.

Table 3.2 - 2 RF Bands

Carrier wave frequency	BAND	Dividing factor
2000.0000001 ~ 4500.0000000MHz	7	1
1000.0000000 ~ 2000.0000000MHz	6	2
500.0000000 ~ 1049.9999999MHz	5	4
250.0000000 ~ 524.9999999MHz	4	8
125.0000000 ~ 262.4999999MHz	3	16
62.5000000 ~ 131.1999999MHz	2	32
0.1000000 ~ 69.9999999MHz	1	4
10.0000000 ~ 2000.0000000MHz	HET	1
0.1000000 ~ 120.0000000MHz	1ex	4

There are intentional overlaps between adjacent RF bands to ensure continuous output of frequencies during switching between the bands. Figure 3.2-2 shows a principle of switching between RF bands.

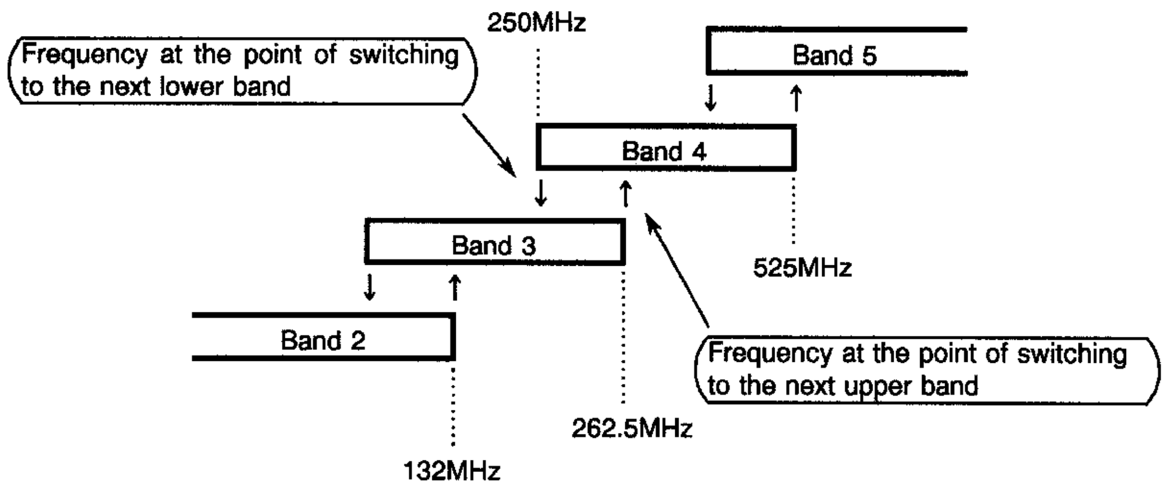


Figure 3.2 - 2 Principle of Switching between RF Bands

Note

1. Depending on which RF band is selected, a range of modulation depth for the AM function, maximum modulation deviation for the FM and øM functions, maximum span of the ±ΔF sweep function, span of the analog phase sweep function, phase offset, and amplitude will differ. For more information, see section 3.2.5 "Radiofrequency Band Setting Procedure" and the description of the relevant function.
2. To initialize the instrument, press the [SHIFT] and [FUNCTION / PRESET] keys in this order.

3.2.2 RF Setting : FREQ

(1) Description

There are three means for RF setting: the ten keys, frequency digit adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the [FREQ] key to select the RF setting function. Then, the unit keys [GHz], [MHz], [kHz], and [Hz] keys on the side of the ten keys will function as the units of GHz, MHz, kHz, and Hz, respectively.

Unlike the ten keys, the frequency adjustment knob and frequency step keys will always function as RF setters and do not, therefore, require selection of the RF setting function with the [FREQ] key. Each time they are pressed, they will increment or decrement, by one, RF digits set with the frequency digit setting keys. (When an increment step size is set, however, they will in crement and decrement RF digits not by one but by the set step size.)

(2) Example

Set RF value to 2.04GHz

	FUNCTION	DATA ENTRY
Key operation	FREQ	[2] [.] [0] [4] [+dBm GHz rad]
GPIB	FR2.04GZ or CW2.04GZ	

Indications

2.	040	000	000	0
GHz	MHz	kHz	Hz	

Then, RF value will be set to 2.04GHz.

3.2.3 Increment Step Size Setting : INC

(1) Description

Ordinarily, the frequency step keys are used to increment and decrement RF digits set with the frequency digit setting keys by one. When the [SHIFT] and [→] keys are pressed in this order to set an increment step size, however, they can be used to increment and decrement RF digits by the set step size.

When an increment step size is set, any RF digit set with the frequency digit keys will be incremented and decremented by the set step size.

Note

The frequency digit setting keys and frequency step keys are [↑] and [↓] keys and [←] and [→] keys, respectively, under the frequency display lamps on the front panel. These digit setting keys and step keys should, therefore, be distinguished from the those under the amplitude display lamps, i.e. the amplitude digit setting keys and amplitude step keys.

(2) Example

Set an increment step size for RF to 12.5kHz.

	FUNCTION	DATA ENTRY
Key operation	SHIFT [ ] [→] INC	[1] [2] [.] [5] [kHz] s (−dBu)
GPIB	ISA12.5KZ	

Then, an increment step size for RF will be set to 12.5kHz, by which RF digits will be incremented and decremented when the frequency step keys [↑] and [↓] are pressed, respectively.

To release an increment step size, set it to 0Hz. Then, RF digits will be incremented and decremented by one as before an increment step size is set.

3.2.4 Panel Key (RF Key) Hold Setting : HOLD

(1) Description

Panel key hold is a function that disables the RF setting keys, i.e. the frequency digit setting keys, frequency digit adjustment knob, and frequency step keys. This function can be set by pressing the SHIFT [ ] and [←] HOLD keys in this order and used to prohibit erroneous change of any set RF digits.

Panel key hold can be released with the same key operation as when it is set : SHIFT [ ] and [←] HOLD

When PRESET is specified, panel key hold will be released forcibly.

(2) Example

Set panel key hold to disable the RF setting keys.

Key operation	FUNCTION
	SHIFT [ ] [←] HOLD
GPIB	KHON or KHAON

Panel key hold can be set to on and off not only with the SHIFT [ ] and [←] keys and but also with a dedicated GPIB command. "KHOF" or "KHAOF" is a dedicated GPIB command for setting panel key hold to off through the GPIB.

3.2.5 RF Band Setting : BAND

(1) Description

When any RF value is set, the R4262 will automatically select an appropriate RF band corresponding to that RF value as shown in Table 3.2-2. For example, RF of 900MHz is set, the corresponding RF band, Band 5, will be selected. Thus, ordinary operation of the instrument does not involve any manual RF band setting. However, this manual setting may be necessary, for example, when modulation deviation is being set to more than 50kHz in modulating a MHz carrier wave with RF value of 200MHz. In this event, the RF band corresponding to the RF value of 200MHz, Band 3, will automatically be selected. But the maximum allowable modulation deviation for Band 3 is 50kHz, thus making it impossible to set the desired modulation deviation of more than 50kHz. A solution to this problem is to manually select HET Band instead of Band 3.

(2) Example

To set any RF band, use the [5 BAND] in the function/memory keys.

NORMAL Performs normal RF band setting. Automatically sets an appropriate RF band corresponding to any set RF. Enabled when PRESET is specified.

BAND FIX Fixes any RF band currently selected. When BAND FIX is set, attempting to set any RF alue exceeding the currently selected RF band will cause an "OVER RANGE" error. For example, when any RF value of more than 70MHz is selected with Band 1 fixed, an error message "OVER RANGE" will be displayed in the message window on the front panel.

100kHz to 62.5MHz Selects Band 1 with RF range of 100kHz to 69.9999999MHz, the maximum FM deviation of less than 200kHz, maximum øM deviation of less than 75rad, and $\pm\Delta F$ sweep spans of 1MHz to 100kHz (Range 1), 99.9kHz to 10kHz (Range 2), and 9.99kHz to 0kHz (Range 3). Restricts analog phase sweep, phaseoffset, etc.

62.5MHz to 125MHz Selects Band 2 with RF range of 62.5 MHz to 131.1999999MHz, the maximum FM deviation of less than 25kHz, maximum øM deviation of less than 9.375rad, and $\pm\Delta F$ sweep spans of 125kHz to 10kHz (Range 1), 9.9kHz to 1kHz (Range 2), and 0.99kHz to 0kHz (Range 3). Restricts analog phase sweep, phase offset, etc.

125MHz to 250MHz Selects Band 3 with RF range of 125MHz to 262.4999999MHz, the maximum FM deviation of less than 50kHz, maximum øM deviation of less than 18.75rad, and $\pm\Delta F$ sweep spans of 250kHz to 25kHz (Range 1), 24.9kHz to 2.5kHz (Range 2), and 2.49kHz to 0kHz (Range 3). Restricts analog phase sweep, phase offset, etc.

250MHz to 500MHz Selects Band 4 with RF range of 250MHz to 524.4999999MHz, the maximum FM deviation of less than 100kHz, maximum øM deviation of less than 37.5rad, and $\pm\Delta F$ sweep spans of 500kHz to 50kHz (Range 1), 49.9kHz to 5.0kHz (Range 2), and 4.99kHz to 0kHz (Range 3). Restricts analog phase sweep, phase offset, etc.

500MHz to 1GHz Selects Band 5 with RF range of 500MHz to 1049.9999999MHz, the maximum FM deviation of less than 200kHz maximum øM deviation of less than 75rad, and $\pm\Delta F$ sweep spans of 1000kHz to 100kHz (Range 1), 99.9kHz to 10.0kHz (Range 2), and 9.99kHz to 0kHz (Range 3). Restricts analog phase sweep, phase offset, etc.

1GHz to 2GHz Selects Band 6 with RF range of 1000MHz to 2000.0000000MHz, the maximum FM deviation of less than 400kHz, maximum øM deviation of less than 150rad, and $\pm\Delta F$ sweep spans of 2000kHz to 200kHz (Range 1), 199.9kHz to 20.0kHz (Range 2), and 19.99kHz to 0kHz (Range 3). Restricts analog phase sweeep, phase offset, etc.

100kHz to 62.5MHz Selects Band 7 with RF range of 2000MHz to 4500.0000000MHz, the maximum FM deviation of less than 800kHz, maximum øM deviation of less than 300rad, and $\pm\Delta F$ sweep spans of 4000kHz to 400kHz (Range 1), 399.9kHz to 40.0kHz (Range 2), and 39.99kHz to 0kHz (Range 3). Restricts analog phase sweep, phase offset, etc.

100kHz to 120MHz Selects Band 1ex with RF range of 100kHz to 120.0000000MHz, the maximum FM deviation of less than 200kHz, maximum øM deviation of less than 75rad, and ±ΔF sweep spans of 1000kHz to 100kHz (Range 1), 99.9kHz to 10.0kHz (Range 2), and 9.99kHz to 0kHz (Range 3). Restricts analog phase sweep, phase offset, etc.

10MHz to 2000MHz Selects HET Band with RF range of 10MHz to 2000.0000000MHz, the maximum FM deviation of less than 800kHz, maximum øM deviation of less than 300rad. and ±ΔF sweep spans of 4000kHz to 400kHz (Range 1), 399.9kHz to 40kHz (Range 2), and 39.99kHz to 0kHz (Range 3). Restricts analog phase sweep, Phase offset, etc.

(3) Note

① As indicated above, RF bands are closely related to individual function parameters. This necessitates setting appropriate values of modulation depth for the AM function, maximum modulation deviation for the FM and øM functions, maximum span of the ±ΔF sweep function, span of the analog phase sweep function, phase offset, and amplitude.

② Once the [NO] key is pressed to select any desired RF band, it will not be set until the [YES] key is pressed. When any function key is pressed instead of the [NO] and [YES] keys, the RF band setting function will be released to execute the function corresponding to the pressed function key. When the [YES] key is pressed to change any set RF band, any subsequently set RF value will automatically be changed to fall within the changed RF band.

(4) Example

Set Band 3 (with a frequency band of 125MHz to 250MHz).

	FUNCTION
Key operation	[FUNCTION / PRESET] [5 / BAND] [NO ↓] [NO ↓] [NO ↓] [YES]
GPIB	BANDC

When setting any RF band through the GPIB, use an appropriate dedicated GPIB command. For more information, see the Appendix 2 "List of GPIB Commands."

When any dedicated GPIB command is used for this purpose, the function/memory mode (turned on when the lamps of the [FUNCTION / PRESET] and [MEMORY / SAVE] keys are on) will not be affected.

3.2.6 SSB Phase Noise Selection : NOISE SLOPE

(1) Description

Normal single sideband (SSB) phase noise occurring in the equipment has offset frequency characteristics represented by the graph in the attached reference material. Special SSB phase noise restricted by a special function "NOISE SLOSE" drops below this normal phase noise at the offset frequencies in the vicinity of several MHz, except that this relation is reversed at the offset frequencies in the vicinity of several 100kHz or less. Figure 3.2-4 shows the difference between the normal and special SSB phase noises.

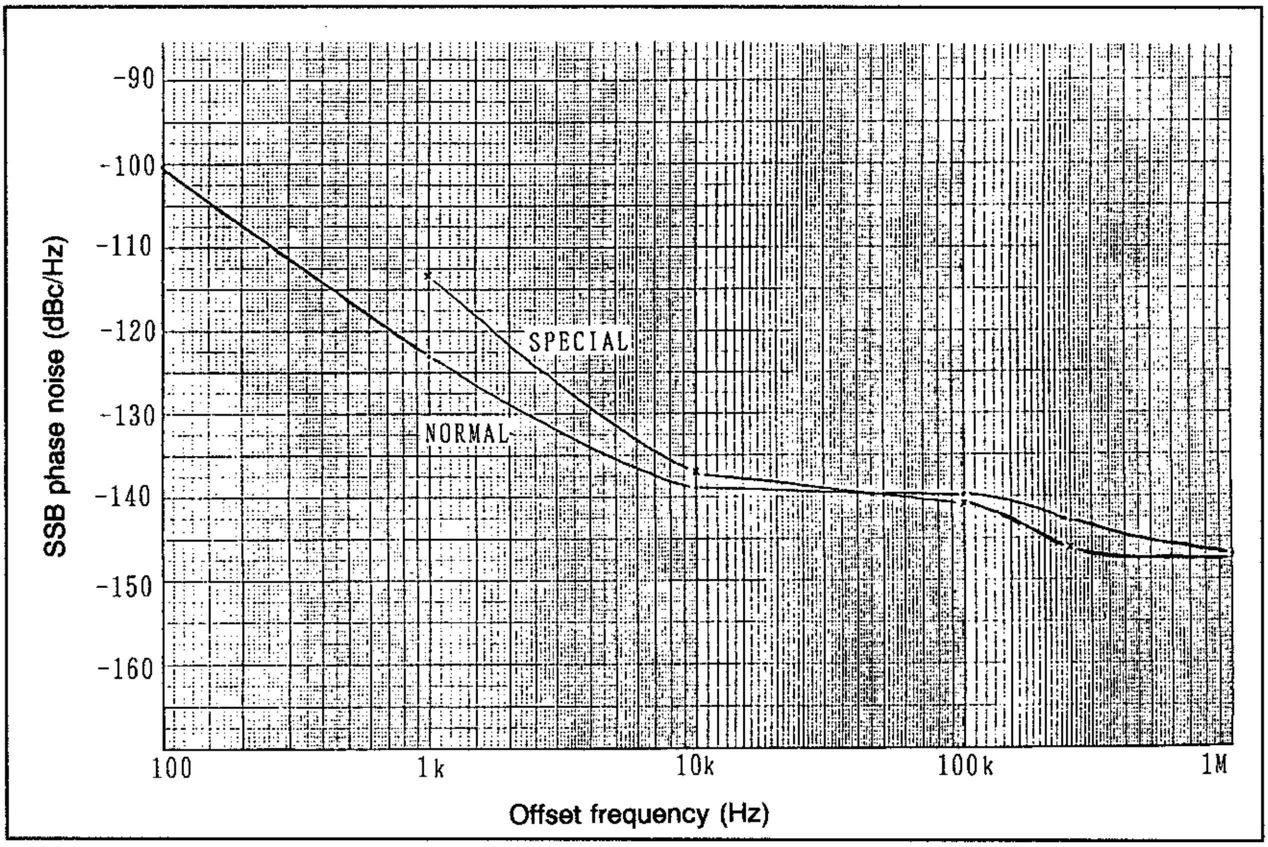


Figure 3.2 - 4 Difference between Normal and Special SSB Phase

(2) Procedure

To switch between normal and special SSB phase noises, use the 7 SPCL FUNCTION key.

(3) Note

① The NO key can only be used to select either normal or special SSB phase noise for display as either "NORMAL" or "SPECIAL" respectively in the message window on the front panel.

To set the selected SSB phase noise, the YES key must be pressed.

② Whether normal or special SSB phase noise is selected, the former will be selected forcibly when the equipment isinitialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

(4) Summary of SSB Phase Noise (NOISE SLOPE) Selection Procedure

① Press the FUNCTION key to turn on its lamp when it is off. Proceed to step 2 when it is on.

② Press the 7 SPCL FUNCTION key to set the NOISE SLOPE function.

③ Press the YES key to set "FREQ FNCT" .

④ Press the NO key to select "Noise Slope" .

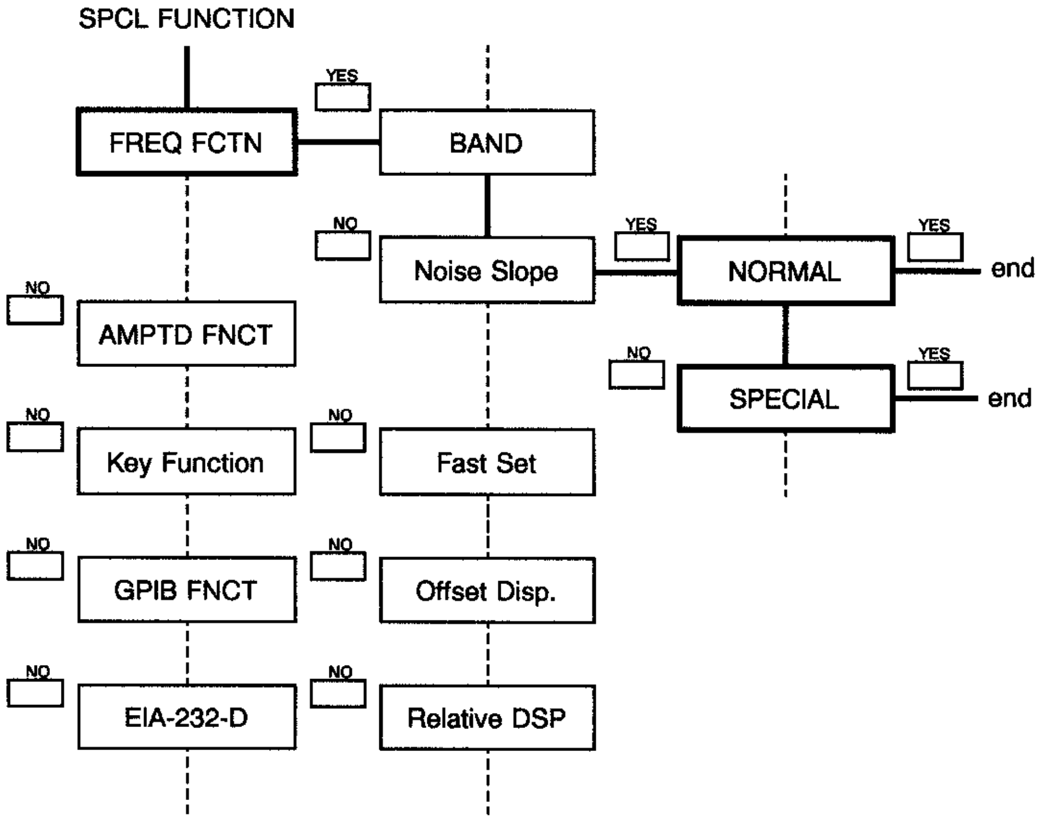
⑤ Press the YES key to set "Noise Slope" .

⑥ Confirm that either normal or special SSB phase noise is currently selected and displayed as "NORMAL" or "SPECIAL" respectively in the message window.

⑦ When changing the currently selected SSB phase noise, press the NO and YES keys in this order. Otherwise, press the YES key or any function key.

⑧ Now the selected SSB phase noise has been set.

(5) Operational Map for NOISE SLOPE Function



3.2.7 Frequency Setting Speed Change : FAST SET

(1) Description

Ordinarily, the R4262 requires approximately 100ms for frequency setting. When a special function "FAST SET" is set to change the preset frequency resolution of 0.1Hz to 1Hz, the frequency setting time can be reduced to approximately 30ms.

The following paragraphs describe the procedure of setting the FAST SET function.

(2) Procedure

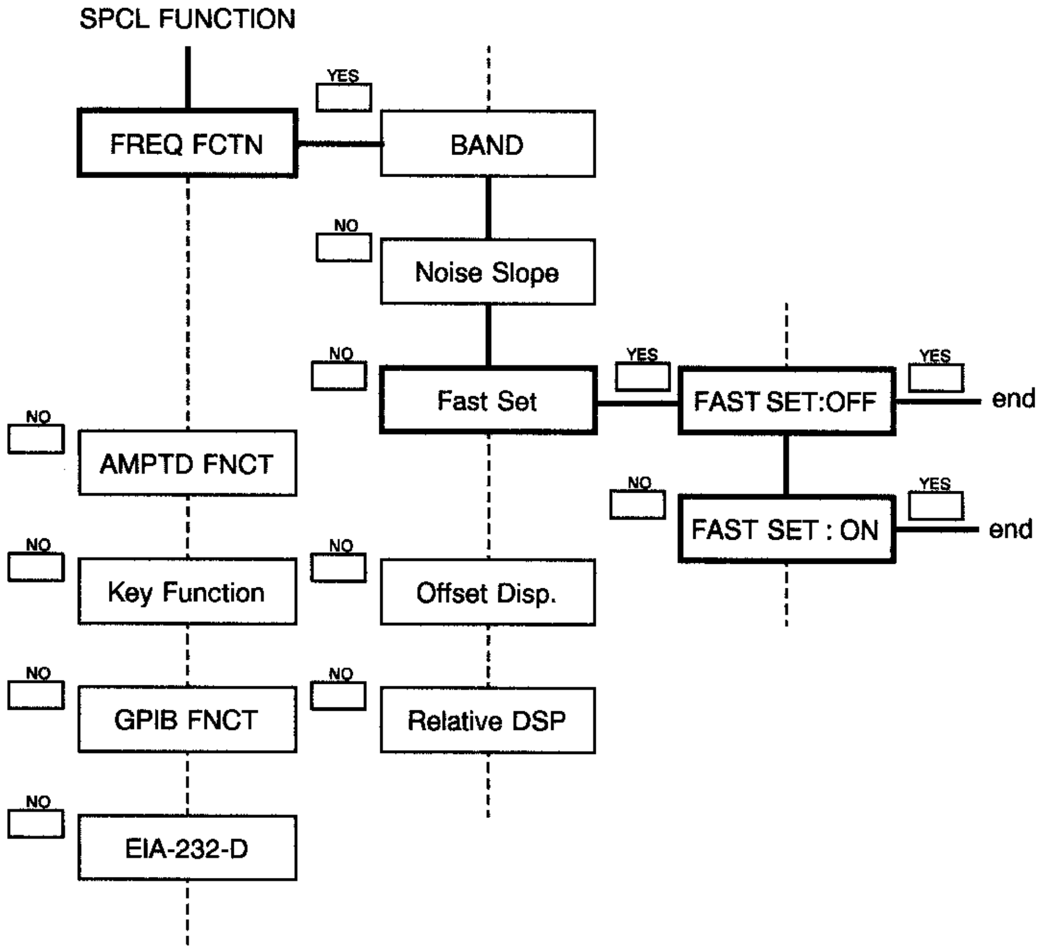
To set the FAST SET function, use the [7 / SPCL FUNCTION] in the function/memory keys.

(3) Note

① The [NO] key can only be used to select whether to set the FAST SET function to on or off for display as "FAST SET: ON" or "FAST SET: OFF" respectively in the message window on the front panel. To actually set the FAST SET function, the [YES] key must be pressed.

② Whether the FAST SET function is set to on or off, it will be set to off forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for FAST SET Function



3.2.8 Offset Display of RF Frequency Selection : OFFSET DISP

(1) Description

The offset display function "OFFSET DISP" adds any predetermined value to RF values for display on the frequency display lamps on the front panel. This function can be used to allow direct detection of intermediate frequencies (if) output from the R4262 when it is used as a downconverter or a local oscillator for a mixer in a superheterodyne reception system.

(2) Procedure

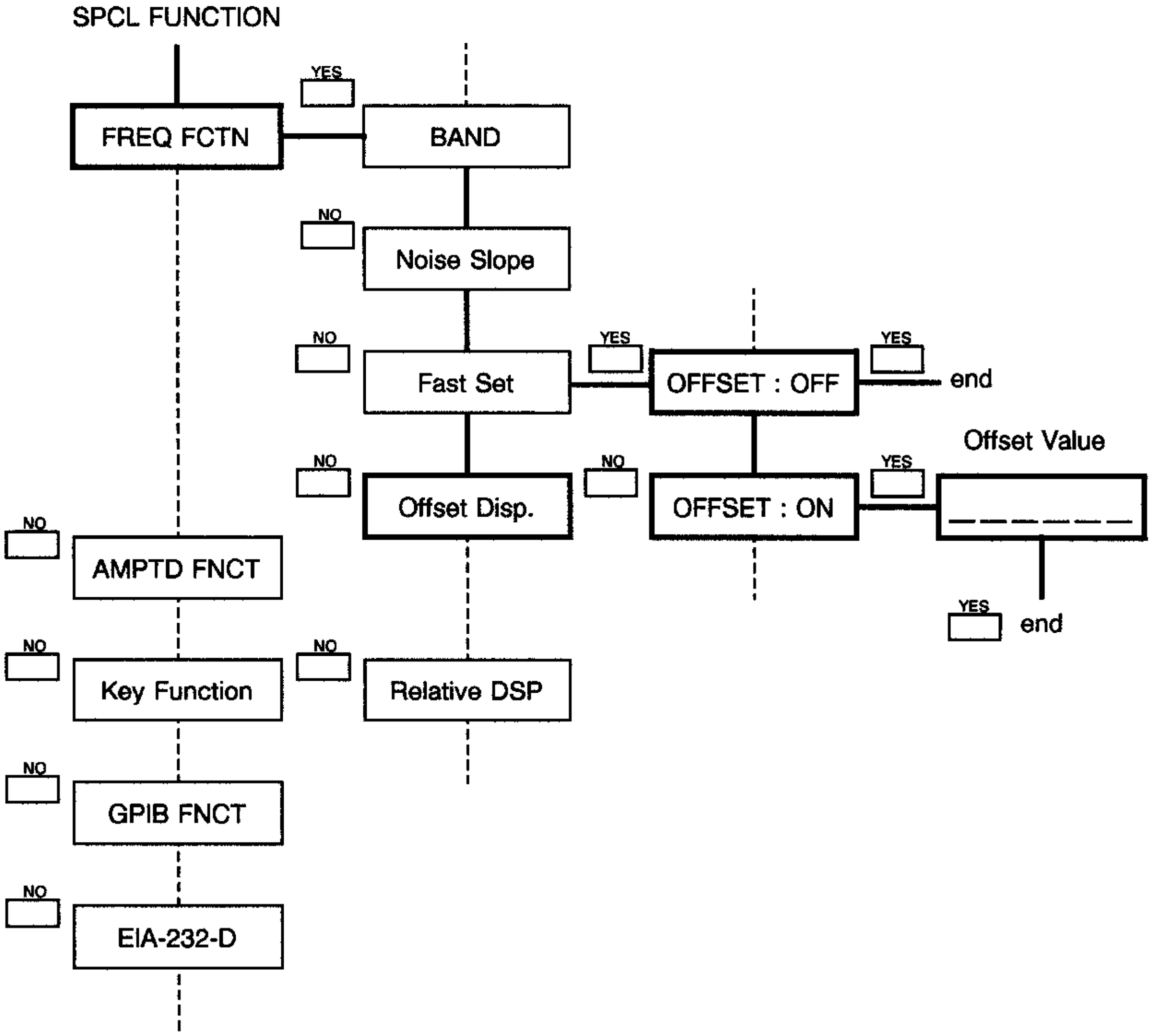
To set the OFFSET DISP function, use the 7 SPCL FUNCTION in the function/memory keys.

(3) Note

To end input operation, press the YES key.

The OFFSET DISP function will be released forcibly when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

(4) Operational Map for OFFSET DISP Function



3.2.9 Relative Display of RF Frequency : RELATIVE DSP

(1) Description

The relative display function "RELATIVE DSP" sets an output reference RF of 0Hz and displays the quantity of change in any other output RF relative to that reference RF on the frequency display lamps on the front panel. This function is useful for using the R4262 as a downconverter or canceling any carrier wave.

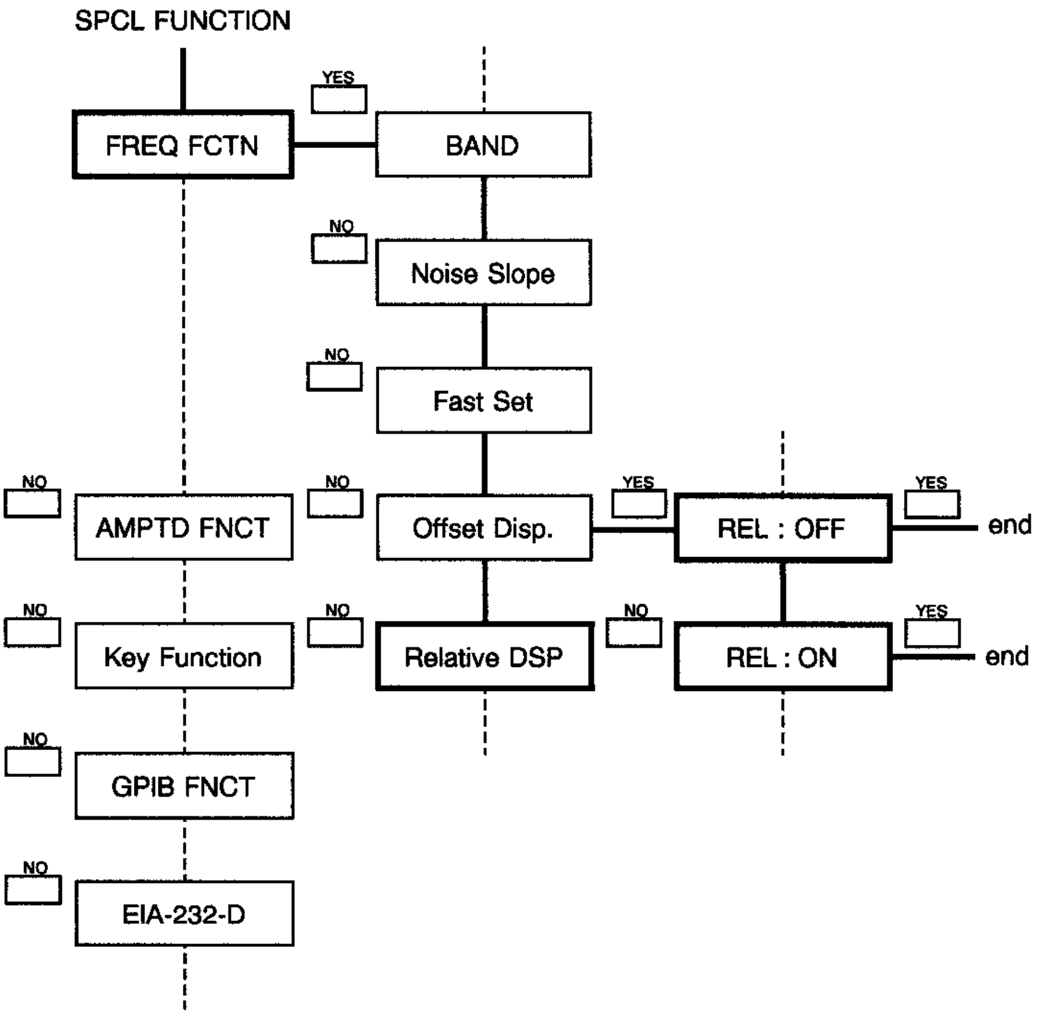
(2) Procedure

To set the RELATIVE DISP function, use the [7 / SPCL] in the function/memory keys.
FUNCTION

(3) Note

The RELATIVE DISP function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for RELATIVE DISP Function



3.3 Amplitude

3.3.1 Description

Table 3.3-1 shows the relationship between electrical characteristics and amplitude ranges. Amplitudes can be set directly in the units of dBm, dBμ, dBμEMF, dBf, V, mV, μV, and nV.

Table 3.3 - 1 Relationship between Electrical Characteristics and Amplitude Ranges (1/2)

Electrical characteristics	Range	Setting conditions
Amplitude range	+16.0 to −140.0dBm (+123.0 to −33.0dBμ) (+129.0 to −27.0dBμEMF) (+136.0 to −20.0dBf) (1.41V to 22.4nV)	Band 1 to Band 5 (Divided band of 100kHz to 2GHz)
	+16.0 to −133.0dBm (+123.0 to −26.0dBμ) (+129.0 to −20.0dBμEMF) (+136.0 to −13.0dBf) (1.41V to 50.1nV)	Band 6(1000MHz to 2000MHz) and HET Band (10MHz to 2000MHz)
	+16.0 to −120.0dBm (+123.0 to −13.0dBμ) (+129.0 to −7.0dBμEMF) (+136.0 to −0.0dBf) (1.41V to 224nV)	Band 7 (2000 to 4000MHz)
	+13.0 to −120.0dBm (+120.0 to −13.0dBμ) (+126.0 to −7.0dBμEMF) (+133.0 to −0.0dBf) (999mV to 224nV)	Band 7 (4000 to 4500MHz)
Specified resolution	0.1dB	

Amplitudes can be entered within the range of +20.0 to −143.0dBm but must be entered within the range specified in the above table ; otherwise, their accuracy will not be guaranteed.

Table 3.3 - 1 Relationship between Electrical Characteristics and Amplitude Ranges (2/2)

Electrical characteristics	Range	Setting conditions
Absolute accuracy (25 ℃ ±10℃) (Excluding analog sweep time)	±1dB	Amplitude ≥ −120dBm
	±2dB	Amplitude : −120 to −133dBm Band 1 to Band 6, HET Band
Amplitude switching time	<50ms	Period from the last command input to output stabilization
Output impedance	50Ω (nominal value)	
Flatness	±0.8dB	100kHz to 4.5GHz Amplitude = +5dBm
	±0.5dB	100kHz to 1.0GHz Amplitude = +5dBm
SWR	<1.5	Amplitude < 0dBm
	<2.0	Amplitude ≤ +5dBm
Reverse current protection	20W, ±25VDC	

(Amplitude Units)

dBm ..... A unit quantity of power expressed logarithmically in terms of its ratio to 1mW (0dBm) in the 50Ω system.
Calculated by the following formula :

$$[dBm] = 10 \cdot \log_{10} (Power\ [mW]))$$

dBμ ..... A unit quantity of voltage expressed logarithmically in terms of its ratio to 1 μV (0 dBu) in the 50Ω system.
Calculated by the following formula :

$$[dB\mu] = 20 \cdot \log_{10} (Voltage\ [\ \mu V])$$

dBμEMF .. A unit quantity of source electromotive force (open end voltage) expressed logarithmically in terms of its ratio to 1μV (0dBμEMF). The "EMF" stands for electromotive force and represents source electromotive force in this context. Calculated by the same formula as the unit of dBμ.

dBf ..... A unit quantity of power expressed logarithmically in terms of its ratio to 1fw (femtowatto : 10^{-15}W) (0dBf).
Calculated by the following formula :

$$[dBf] = 10 \cdot \log_{10} (Power\ [fW]\ )$$

Volts .... A unit quantity of voltage used in the 50Ω system.
Available in four types : V, mV, μV, and nV.

The quantitative relationship between dBm and the other units expressed relative to dBm is shown in the table below :

dBm	dBμ	dBμEMF	dBf	Volts	Volts (EMF)
0	107	113	120	223.0mV	446.7mV

[UNLVLD Lamp]

A lamp marked "UNLVLD" is provided above the amplitude lamps on the front panel. This "UNLVLD" lamp will come on when an output signal fails to reach or exceeds the preset RF value (and may come on when the ALC is off). The "UNLVLD" stands for "UNLEVELED" .

Note that an output level is unstable when the "UNLVLD" lamp comes on.

3.3.2 Amplitude Setting (dBm and dBμ) : AMPTD

(1) Description

There are three means for amplitude setting: ten keys, amplitude adjustment knob, and amplitude step keys on the front panel.
Before using the ten keys, press the AMPTD key to select the RF setting function. Then, the unit keys GHz, MHz, kHz, and Hz keys on the side of the ten keys will function as the units of +dBm, −dBm, +dBμ, and −dBμ, respectively.
Unlike the ten keys, the amplitude adjustment knob and amplitude step keys will always function to set RF digits and do not, therefore, require selection of the RF setting function with the AMPTD key. Each time they are turned or pressed, they will increment or decrement, by one, RF digits set with the amplitude digit setting keys. (When an increment step size is set, however, they will increment and decrement RF digits not by one but by the set step size.)

(2) Example

① Set an amplitude to −107.3dBm.

	FUNCTION	DATA ENTRY
Key operation	AMPTD	1 0 7 . 3 MHz (−dBm) %
GPIB	AP-107.3 DM or LE-107.3 DM	

Indications

−107.3 dBm

Then, an amplitude will be set to −107.3dBm and the unit lamp "dBm" below the amplitude display lamps will come on.

② Set an amplitude to 9.3dBμ.

	FUNCTION	DATA ENTRY
Key operation	AMPTD	9 . 3 kHz (+dBu) s
GPIB	AP9.3DU or LE9.3DU	

Indications

9.3 dBu

Then, an amplitude will be set to 9.3dBμ and the unit lamp "dBμ" below the amplitude display lamps will come on.

3.3.3 Amplitude Setting in dBμEMF (Open End Voltage Unit) and dBf

(1) Description

Ordinarily, the unit keys kHz (+dBu) and Hz (−dBu) function to set an amplitude unit of dBμ for terminal voltage in the 50Ω system. To use the same unit keys to set an amplitude unit of dBμEMF for open end voltage, set a special function AMPTD to switch an amplitude unit mode from the terminal voltage unit (dBm/dBμ) mode to the open end voltage unit (dBμEMF/dBf) mode. Likewise, the unit keys GHz (+dBm) and MHz (−dBm) keys, which ordinarily function to set an amplitude unit of dBm, can also be used to set an amplitude unit of dBf by setting the special function AMPTD.

(2) Procedure

The following paragraphs describe the procedure of setting the amplitude units of dBμEMF and dBf. First, set a special function AMPTD and switch an amplitude unit mode from the terminal voltage unit (dBm/dBμ) mode to the open end voltage unit (dBμEMF/dBf) mode.

(3) Example

Set an amplitude to +20 dBμEMF (when the open end voltage unit (dBμEMF/dBf) mode is currently not on.)

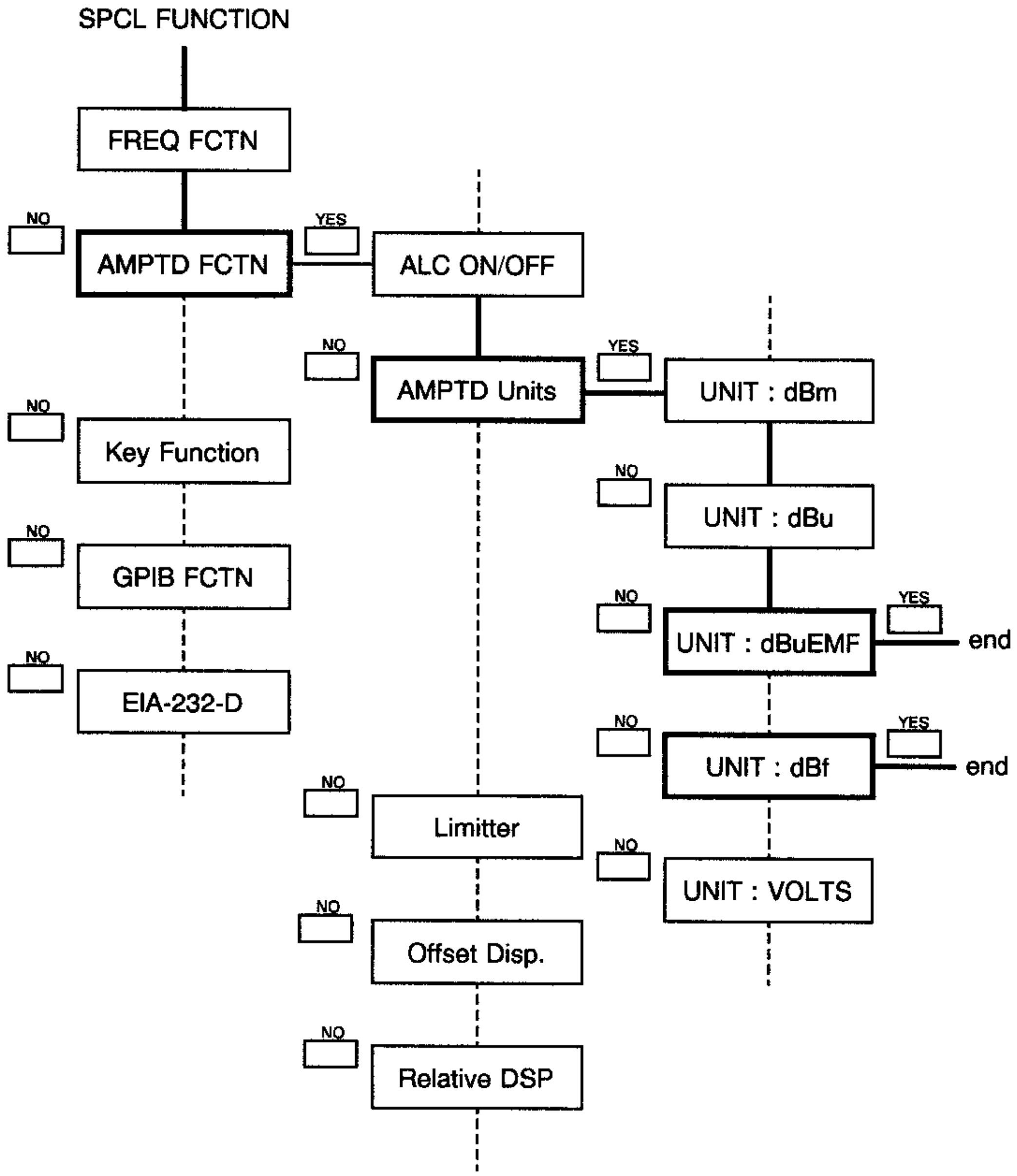
	FUNCTION	DATA ENTRY
Key operation	AMPTD	2 0 kHz (+dBu %)
GPIB	AP20EM or LE20EM	

Indications

20.0 dBμEMF

Then, an amplitude will be set to 20dBμ EMF and the unit lamp "dBμEMF" below the amplitude display lamps will come on.

(4) Operational Map for Amplitude Setting in dBμEMF and f dBf



3.3.4 Amplitude Setting in Voltage Units (V, mV, μV, and nV)

(1) Description

Ordinarily, amplitudes are set in the units of dBm and dBμ but can be set in the voltage units of V, mV, μV, and nV by using a special function AMPTD.

(2) Procedure

The following paragraphs describe the procedure of setting amplitudes in the voltage units. First, set a special function AMPTD and switch an amplitude unit mode from the terminal voltage (dBm/dBμ) to the voltage unit (V, mV, μV, and nV) mode.

(3) Example

Set an amplitude to 2.24mV (when the voltage unit mode is currently on)

	FUNCTION	DATA ENTRY
Key operation	AMPTD	2 · 2 4 MHz (−dBm) %
GPIB	AP 2.24MV or LE 2.24M	

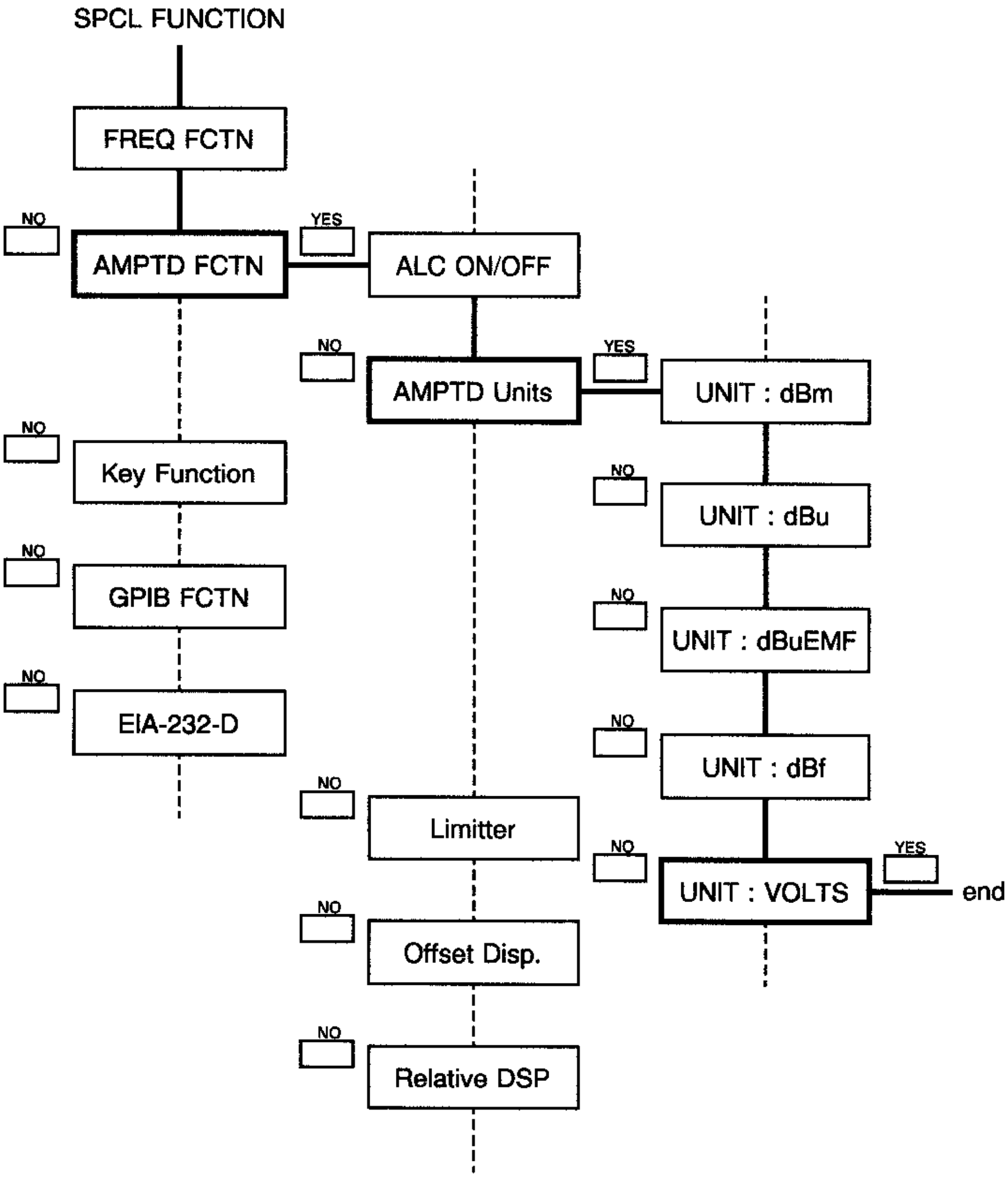
Indications

	2.24
mV	

Then, an amplitude will be set to 2.24mV and the unit lamp "mV" below the amplitude display lamps will come on.

Any amplitude value entered in the voltage units will be internally converted into the terminal voltage unit of dBm. In this conversion process, an error may occur between the entered amplitude value and the amplitude value displayed on the amplitude display lamps.

(4) Operational Map for Amplitude Setting in Voltage Units



3.3.5 Output RF Signal Switch-On/Off : RF ON/OFF

(1) Description

RF signals output from the RF signal output terminal on the front panel can be set to on and off by setting the RF OUTPUT ON/OFF function with the RF OUTPUT ON/OFF key. The RF OUTPUT ON/OFF function switches its state between ON and OFF. It is in the ON state when the lamp of the RF OUTPUT ON/OFF key is on ; it is in the OFF state when the same lamp is off. When it is in the OFF state, the amplitude display lamps are off and the amplitude digit setting keys and the amplitude step keys will be disabled.

(2) Example

Set an output RF signal to off (when it is currently on).

	FUNCTION
Key operation	RF OUTPUT ON/OFF
GPIB	RF or RFOF

Indications

Then, an output RF signal will be set to off, turning off the amplitude display lamps.
(Note that the UNLVLD lamp remain on whether an output RF signal is set to on or off.)

The RF OUTPUT ON/OFF function can be switched between ON and OFF states not only with the RF OUTPUT ON/OFF key but also with dedicated GPIB commands.

Switching the RF OUTPUT ON/OFF function to OFF ··· RFOF
Switching the RF OUTPUT ON/OFF function to ON ··· RFON

3.3.6 Increment Step Size Setting : INC

(1) Description

Ordinarily, the amplitude step keys are used to increment and decrement amplitude digits set with the amplitude digit setting keys by one. When the [SHIFT] and [→] keys are pressed in this order to set an increment step size, however, they can be used to increment and decrement amplitude digits by the set step size.

When an increment step size is set, any amplitude digit set with the amplitude digit keys will be incremented and decremented by the set step size.

Note
The amplitude digit setting keys and amplitude step keys are [↑] and [↓] keys and [←] and [→] keys, respectively, under the amplitude display lamps on the front panel. These digit setting keys and step keys should, therefore, be distinguished from the those under the amplitude dilplay lamps, i.e. the frequency digit setting keys and amplitude step keys.

(2) Example

Set an increment step size for amplitude to 12dB.

	FUNCTION	DATA ENTRY
Key operation	[SHIFT] [→] INC	[1] [2] [+dBm GHz rad]
GPIB	ISB12DB	

Then, an increment step size for amplitude will be set to 12dB, by which amplitude digits will be incremented and decremented when the amplitude step keys [↑] and [↓] are pressed, respectively.

To release an increment step size, set it to 0dB (0V). Then, amplitude digits will be incremented and decremented by one as before an increment step size is set.

3.3.7 Panel Key (Amplitude) Hold Setting : HOLD

(1) Description

Panel key hold is a function that disables the amplitude setting keys, i.e. the amplitude digit setting keys, amplitude digit adjustment knob, and amplitude step keys. This function can be set by pressing the SHIFT and ← keys in this order and used to prohibit erroneous change of any set amplitude digits.

Panel key hold can be released with the same key operation as when it is set : SHIFT and ← .
When PRESET is specified, panel key hold will be released forcibly.

(2) Example

Set panel key hold to disable the amplitude setting keys.

Key operation	DATA ENTRY
	SHIFT ← (HOLD)
GPIB	KHBON or SHKLB

Panel key hold can be set to on and off not only with the SHIFT and ← (HOLD) keys and but also with a dedicated GPIB command.
"KHBOF" or is a dedicated GPIB command for setting panel key hold to off through the GPIB.

3.3.8 ALC Circuit Turn-On/off : ALC ON/OFF

(1) Description

Any RF signal output from the RF signal output terminal on the front panel has its absolute accuracy (−140dBm to +16dBm) guaranteed by an Auto Level Control (ALC) circuit built in the equipment . Unless such absolute accuracy is required, the ALC circuit can be turned off by setting the ALC ON/OFF function to OFF, thereby raising an amplitude by about 2dB to 3dB. In particular, when an amplitude of more than +16dBm is required, the ALC circuit must be turned off. Similarly, when two signal sources are being connected together by such means as a power combiner to measure the distortion characteristics of two signals output from those two signal sources, the ALC circuit can also be turned off, thereby improving the distortion characteristics.

(2) Procedure

To set the ALC ON/OFF function to ON and OFF, use the [7 / SPCL / PRESET] key in the function/memory keys.

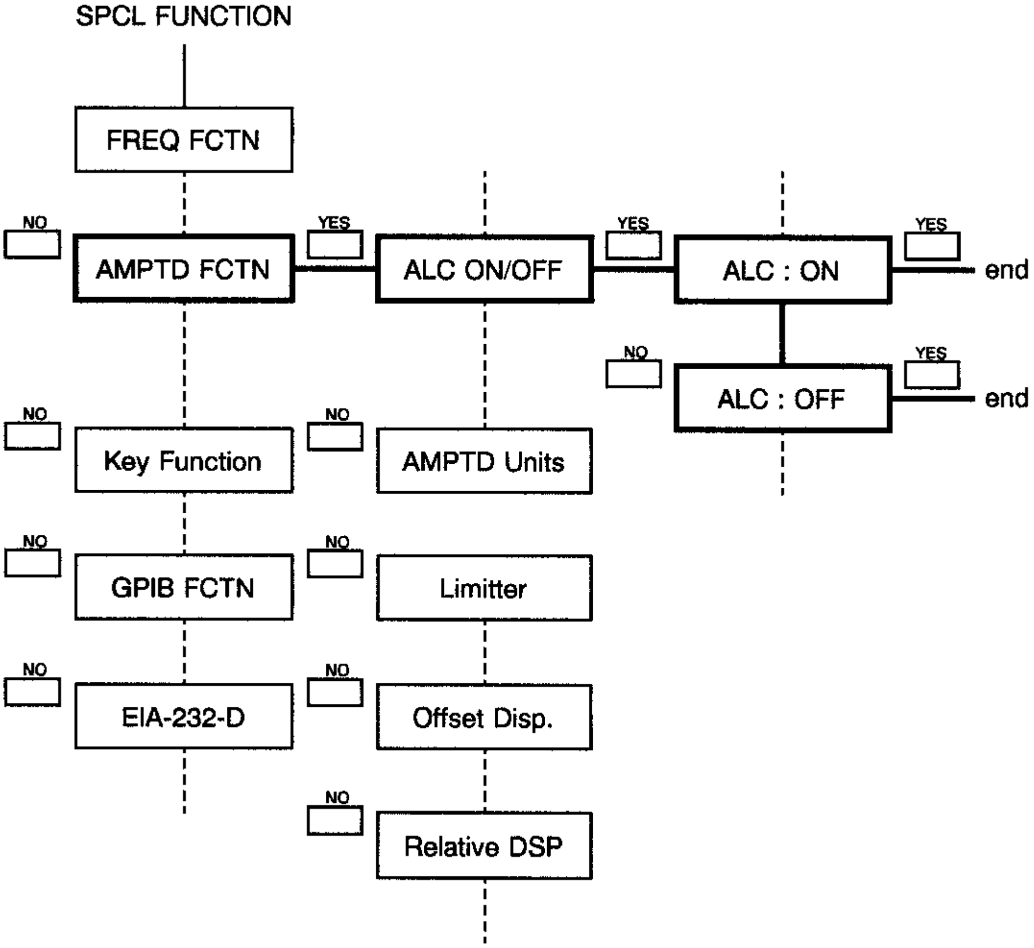
(3) Note

① The above procedure does not guarantee a high performance of the equipment. Before using the ALC ON/OFF function, be sure to confirm, by such means as a power meter and spectrum analyzer, the characteristics of the equipment as the ALC circuit is turned on and off.

② Whether the ALC ON/OFF function is set to ON or OFF, it will be set to ON forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

③ When the [NO] key is pressed to select whether to set the ALC ON/OFF function to ON or OFF (indicated by "ALC: ON" or "ALC: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the ALC ON/OFF function. Therefore, when any function key is pressed after the [NO] key, the ALC ON/OFF function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for ALC ON/OFF Function



3.3.9 Analog Amplitude Sweep Setting : ANALOG L.SWP

(1) Description

The amplitude sweep function is available in two types: the analog amplitude sweep (AA SWP) function and the digital amplitude sweep (DA SWP) function. The AA SWP function changes amplitudes continuously (linearly) while the DA SWP function changes amplitudes discontinuously (in steps). This section describes the AA SWP function. For the DA SWP function, see the next section.

(2) Preparation

The AA SWP function can be set by pressing the [7 SPCL function] key or the following data entry keys :

———AMPTD SWEEP———

START STOP SLOPE

When any of the above data entry keys START, STOP, and SLOPE keys is pressed, the AA SWP function will be set immediately without any additional setting. In the initial state, the AA SWP function will be set while the DA SWP function will be set once it is selected. If the AMPTD key is pressed after the AA SWP or DA SWP function is set, it will be released.

(3) Parameters for the AA SWP function are as follows:

Start level	:	−140dBm to +16dBm (Band 1 to 5)
		−133dBm to +16dBm (Band 6, HET Band)
		−120dBm to +16dBm (Band 7, ≤4GHz)
		−120dBm to +13dBm (Band 7, > 4GHz)
Stop level	:	Start level ±15dB
Provided that	:	−140dBm ≤Stop level ≤ +16dBm (Band 1 to 5)
		−133dBm ≤Stop level ≤ +16dBm (Band 6, HET Band)
		−120dBm ≤Stop level ≤ +16dBm (Band 7, ≤ 4GHz)
		−120dBm ≤Stop level ≤ +13dBm (Band 7, > 4GHz)
Slope	:	±15dBm
Provided that	:	−140dBm ≤Stop level ±Slope ≤ +16dBm (Band 1 to 5)
		−133dBm ≤Stop level ±Slope ≤ +16dBm (Band 7, HET Band)
		−120dBm ≤Stop level ±Slope ≤ +16dBm (Band 7, ≤ 4GHz)
		−120dBm ≤Stop level ±Slope ≤ +13dBm (Band 7, > 4GHz)

Sweep time : 50ms to 100s

Sweep triggers : INT, LINE, SINGLE, and EXT

Sweep modes : Internal sweep mode, external sweep mode, and manual sweep mode

(4) Procedure

To set the AA SWP function after the DA SWP function, press the [0 / A SWP] key. Select a desired sweep type (see (5) Operational Map for Analog Amplitude Sweep). When setting a sweep type displayed in the message window on the front panel, press the [YES] key; otherwise, press the [NO] key. Until the desired sweep type is displayed in the message window, press the [NO] key. When it is displayed, press the [YES] key. The following paragraphs describe the individual amplitude sweep functions.
Note that two frequency sweep functions FULL SWP and SCALING are disabled while the amplitude sweep function is set.

① Automatic Sweep (AUTO SWEEP Function)

Amplitude sweep performed automatically with internal sweep voltage during a sweep time set with the [3 / SWP TIME] key.

Trigger types

Automatic amplitude sweep can be started with the following four types of triggers:

INT. TRIG : Starts automatic amplitude sweep continuously at any time.

LINE TRIG : Starts automatic amplitude sweep synchronously with the AC LINE frequency (50/60 Hz).

EXT. TRIG : Starts automatic amplitude sweep through a trigger signal input from the external trigger input (EXT TRIG IN) terminal on the rear panel.

SINGLE TRIG : Starts automatic amplitude sweep each time the [YES] key is pressed.

② Manual Sweep (MANUAL Function)

Amplitude sweep performed manually by turning the frequency digit adjustment knob. Turning the knob clockwise and counterclockwise causes amplitude sweep in the direction of the start to stop frequencies and the stop to start frequencies, respectively.

③ External Sweep (EXT SWEEP Function)

Amplitude sweep performed with sweep voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. Sweep voltage is available in two ranges of 0V to 8V and −4V to +4V. The lamp voltages for the two voltage ranges can be varied to any desired value.

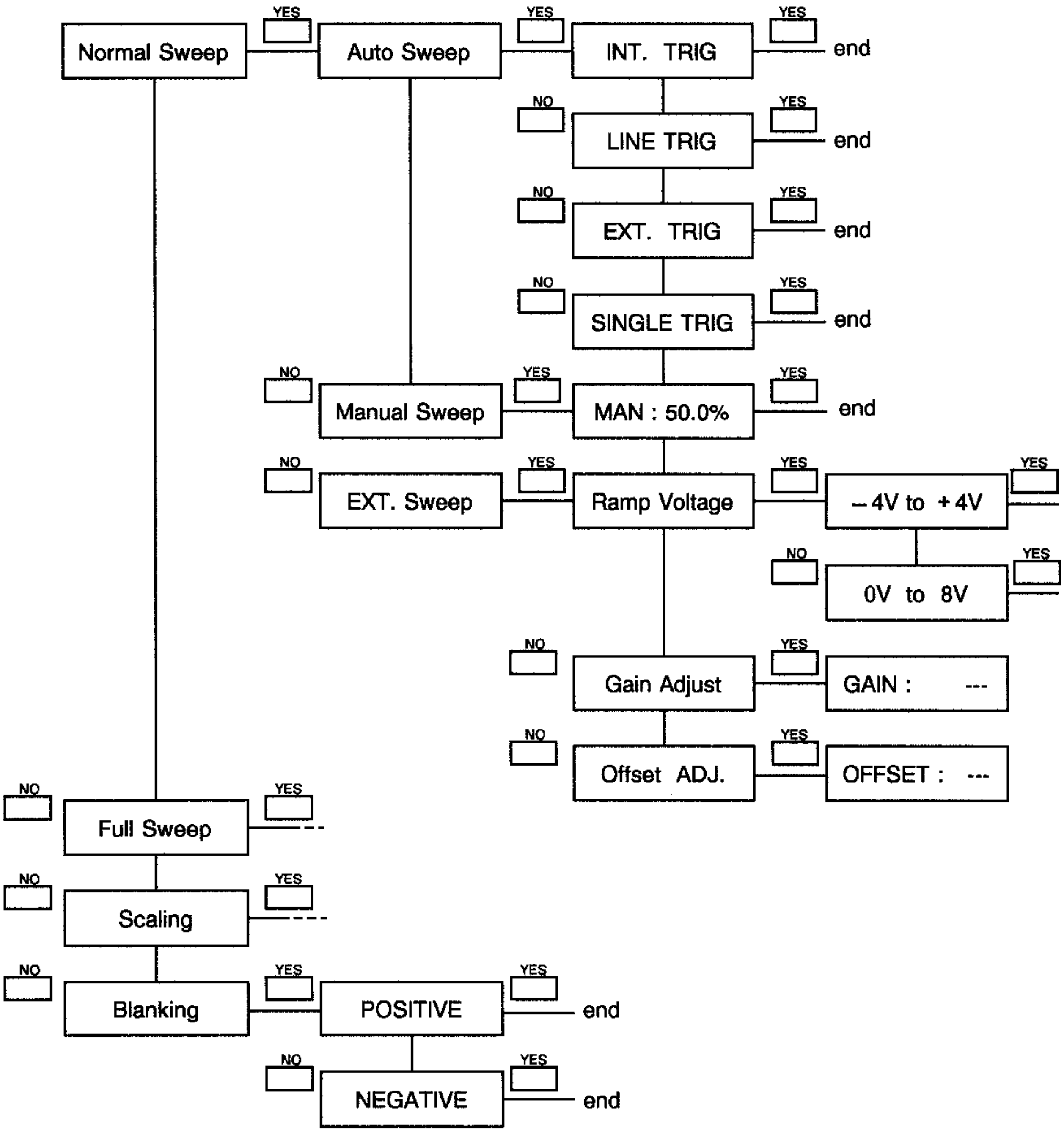
−4V to +4V	:	Inputs sweep voltage ranging from −4V to +4V.
0V to 8V	:	Inputs sweep voltage ranging from 0V to +8V.
Gain	:	Sets the amplitude of any sweep voltage in the stages of 0 to 255. For example, Stage 1 and Stage 255 provide about 2040V and 8V, respectively, for each sweep. Sweep voltage must be input within ±12V.
Offset	:	Sets the start voltage of any sweep voltage in the stages of 0 to 255. For example, Stage 0 and Stage 1 provide 0V and -8V, respectively.

④ Blanking Signal Setting (BLANKING Function)

Sets the polarity of a blanking signal output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel during a period of transit from the stop amplitude back to the start amplitude.

POSITIVE	:	Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to 5V during blanking.
NEGATIVE	:	Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to −5V during blanking.

(5) Operational Map for AA SWP Function



Note that the FULL SWEEP and SCALING functions are valid only when the frequency sweep function is set.

[Start Amplitude Setting] : START (AMPTD SWEEP)

(1) Description

There are three means for setting a start amplitude for amplitude sweep: ten keys, amplitude adjustment knob, and amplitude step keys on the front panel.

Before using the ten keys, press the START key to select the start amplitude setting (START) function. Then, the unit keys GHz, MHz, kHz, and Hz keys on the side of the ten keys will function as the units of +dBm, −dBm, +dBμ, and −dBμ, respectively (these units will be converted into dBμEMF, dBf, and voltage units (V, mV, μV, and nV) when the open end voltage unit (dBμEMF/dBμ) mode and the voltage unit mode are set).

When the START key is pressed, the amplitude adjustment knob and the amplitude step keys will function to set a start amplitude for amplitude sweep. Each time they are turned or pressed, they will increment or decrement, by one, amplitude digits set with the amplitude digit setting keys. (When an increment step size is set, however, they will increment and decrement amplitude digits not by one but by the set step size.)

(2) Example

Set a start amplitude for amplitude sweep to −45.0dBm.

	FUNCTION	DATA ENTRY
Key operation	START	4 5 MHz (−dBm)
GPIB	AA-45DM	

Indications

SWP START
−45.0
dBm

Then, a start amplitude will be set to −45.0dBm.

[Stop Amplitude Setting] : STOP (AMPTD SWEEP)

(1) Description

There are three means for setting a stop amplitude for amplitude sweep: ten keys, amplitude adjustment knob, and amplitude step key on the front panel.
Note that any stop amplitude for analog amplitude sweep must fall within the range of the corresponding start amplitude ±15dB.

(2) Example

Set a stop amplitude for amplitude sweep to −32.0dBm.

	FUNCTION	DATA ENTRY
Key operation	STOP [ ]	[3] [2] [MHz] (−dBm)
GPIB	AB-32DM	

Indications

SWP START
−32.0
dBm

Then, a start amplitude will be set to −32.0dBm.

[Amplitude Slope Setting] : SLOPE (AMPTD SWEEP)

(1) Description

There are three means for setting a slope for amplitude sweep: ten keys, amplitude adjustment knob, and amplitude step keys on the front panel.
Note that any amplitude slope for analog amplitude sweep must fall within the range of the corresponding amplitude slope ±15dB.

(2) Example

Set an slope for amplitude sweep to −10.0dBm.

	FUNCTION	DATA ENTRY
Key operation	SLOPE [ ]	[1] [0] [MHz] (−dBm)
GPIB	AC-10DB	

Indications

SWP	SLOPE	
	−10.0	
	dBm	

Then, a start will be set to −10.0dBm.

[Sweep Time Setting] : SWEEP TIME

(1) Description

Amplitude sweep time can be set with ten keys. Confirm that the lamp of the FUNCTION key is on. (If it is not on, press the FUNCTION key.) Press the one of the function/memory key switches 3 SWP TIME. Then, an amplitude sweep time currently set will be displayed in the message window as follows :

TIME : 500ms

Enter a desired amplitude sweep time value through the ten keys within a range and with resolutions specified in the table below :

Range	Resolution
50ms to 999ms	1ms
1.0s to 9.9s	100ms
10s to 100s	1s

(2) Example

Set an amplitude sweep time to 300ms.

	FUNCTION	DATA ENTRY
Key operation	3 SWP TIME	3 0 0 −dBμ Hz deg ms nV
GPIB	ST300MS	

Indications

TIME : 300ms

Then, an amplitude sweep time will be set to 300ms.
An amplitude sweep time can also be set with the frequency digit adjustment knob and the frequency step keys.

3.3.10 Digital Amplitude Sweep Setting : DIGITAL LEVEL SWEEP

(1) The amplitude sweep function is available in two types: the analog amplitude sweep (AA SWP) function and the digital amplitude sweep (DA SWP) function. The AA SWP function changes amplitudes continuously (linearly) while the DA SWP function changes amplitudes discontinuously (in steps). This section describes the DA SWP function. For the AA SWP function, see the previous section.

(2) Preparation

The AA SWP function can be set by pressing the [7 / SPCL FUNCTION] key or the following data entry keys :

———AMPTD SWEEP———

[START] [STOP] [SLOPE]

When any of the above data entry keys [START], [STOP] . and [SLOPE] keys is pressed, the DA SWP function will be set immediately without any additional setting. In the initial state, the AA SWP function will be set while the DA SWP function will be set once it is selected. If the [AMPTD] key is pressed after the AA SWP or DA SWP function is set, it will be released.

To set the DA SWP function, press any of the [START], [STOP] and [SLOPE] keys and then press one of the function/memory key switches [1], or press the [AMPLITUDE] key to set the amplitude setting function and then press the [1 D SWP / D SWP] key.

(3) Parameters for the DA SWP function are as follows:

Start level	:	−140dBm to +16dBm (Band 1 to 5)
		−133dBm to +16dBm (Band 6, HET Band)
		−120dBm to +16dBm (Band 7, ≤ 4GHz)
		−120dBm to +13dBm (Band 7, > 4GHz)
Stop level	:	Start level ±15dB
Provided that	:	−140dBm to +16dBm (Band 1 to 5)
		−133dBm to +16dBm (Band 6, HET Band)
		−120dBm to +16dBm (Band 7, ≤ 4GHz)
		−120dBm to +13dBm (Band 7, > 4GHz)

Slope : ±15dBm

Provided that : $-140\text{dBm} \leq$ Stop level ±Slope $\leq +16\text{dBm}$ (Band 1 to 5)
$-133\text{dBm} \leq$ Stop level ±Slope $\leq +16\text{dBm}$ (Band 6,HET Band)
$-120\text{dBm} \leq$ Stop level ±Slope $\leq +16\text{dBm}$ (Band 7, $\leq$ 4GHz)
$-120\text{dBm} \leq$ Stop level ±Slope $\leq +13\text{dBm}$ (Band 7, > 4GHz)

Sweep time : 50ms to 100s

Sweep triggers : INT only

Sweep modes : Internal sweep mode, external sweep mode, and manual sweep mode

A start amplitude, stop amplitude, amplitude slope, and sweep time for can be set for the DA SWP function in the same manner as for the AA SWP function.

3.3.11 Amplitude Limiter Setting : LIMITTER

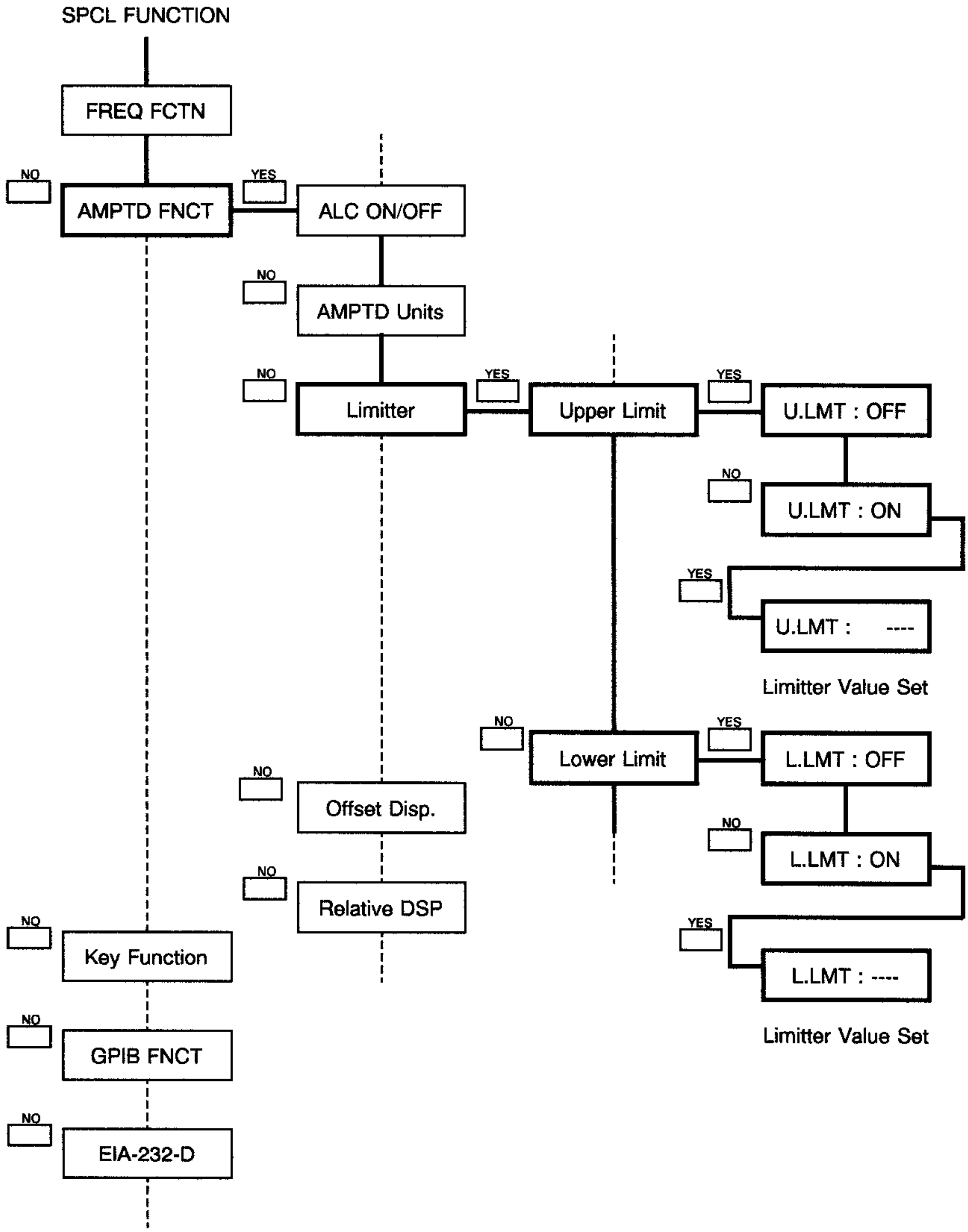
(1) Description

The R4262 provides the LIMITER function that sets both upper and lower limits above and below which no amplitude can be set. This function can be used to operate small to signal devices, test amplifiers and other devices with great input sensitivities, and perform tests with limited test ranges.

(2) Procedure

To set the LIMITER function, use the [7 / SPCL FUNCTION] key in the function/memory keys.

(3) Operational Map for LIMITER Function



3.3.12 Offset Amplitude Display Setting : OFFSET DISP

(1) Description

The offset display function "OFFSET DISP" adds any predetermined value to RF values for display on the frequency display lamps on the front panel. This function is useful when the R4262 is operated in combination with an external attenuator, mixer, and other devices.

(2) Procedure

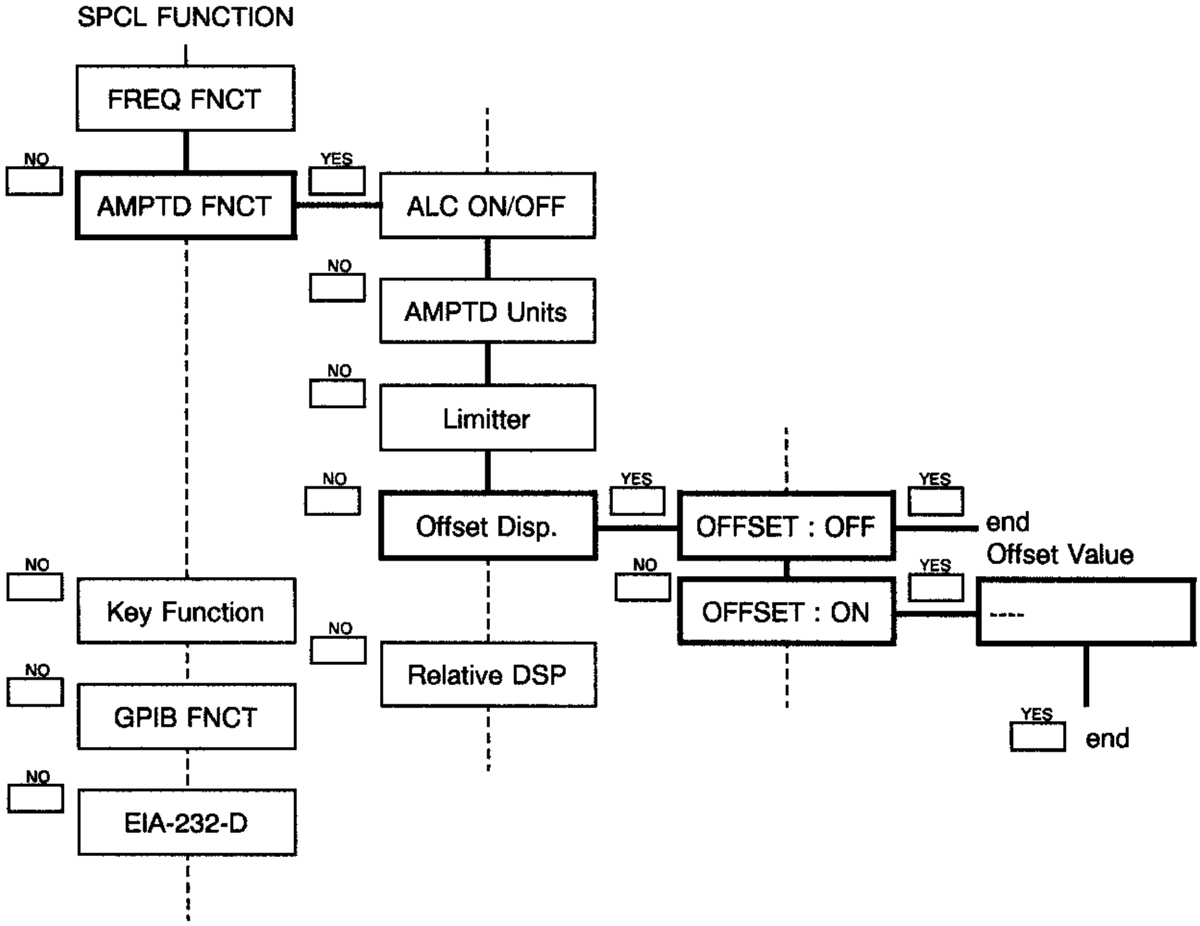
To set the OFFSET DISP function, use the [7 / SPCL FUNCTION] key in the function/memory keys.

To end the OFFSET DISP function, press the [YES] key.

(3) Note

The OFFSET function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for OFFSET DISP Function



3.3.13 Relative Amplitude Display Setting : RELATIVE DSP

(1) Description

The relative display function "RELATIVE DISP" sets a reference amplitude of 0dB and displays the quantity of change in any other amplitude relative to that reference amplitude on the amplitude display lamps on the front panel.

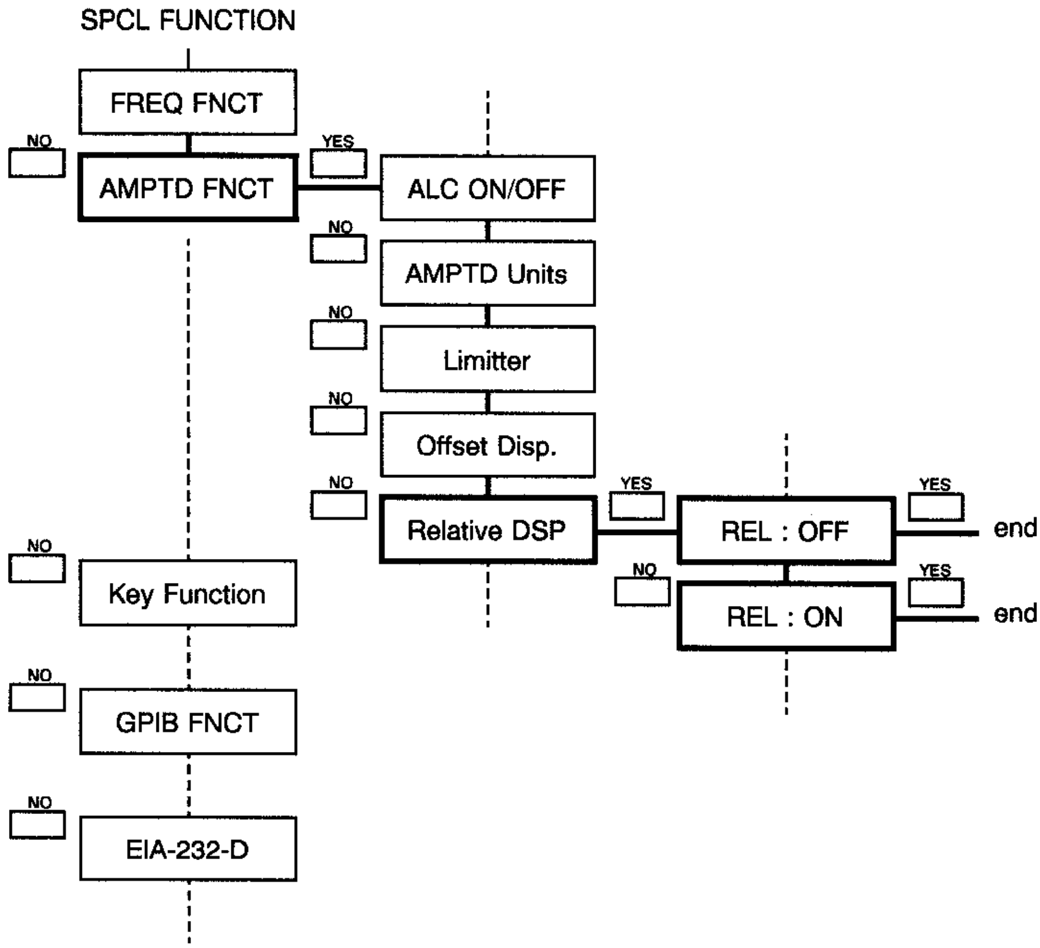
(2) Procedure

To set the RELATIVE DISP function, use the 7 SPCL FUNCTION key in the function/memory keys.

(3) Note

The RELATIVE DISP function will be released forcibly when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

(4) Operational Map for RELATIVE DISP Function



3.4 General Information on Modulation

Description

The R4262 Synthesized Signal Source provides the following modulation functions:

① Amplitude modulation (AM) function

② Frequency modulation (FM) function

③ Phase modulation (øM) function

④ Pulse modulation (PULSE) function

⑤ Binary phase shift keying (BPSK) function

⑥ Phase sweep (øSWP) function

⑦ Phase offset (øOFFSET) function

Also available is the wide-band frequency modulation (Wide FM) function under the FM function.

3.5 Amplitude Modulation (AM)

Table 3.5-1 shows the amplitude modulation characteristics of the R4262.

Table 3.5 - 1 Amplitude Modulation Characteristics (1/2)

Electrical characteristics	Range	Setting conditions
Modulation depth	0 to 99%	Band 1 to Band 5 Amplitude ≤ +7dBm Valid when the INT AM or EXT AC AM function is set
	0 to 95%	Band 6 Amplitude ≤ +7dBm Valid when the INT AM or EXT AC AM function is set
	0 to 90%	Band 1 to Band 6 Amplitude ≤ +7dBm Valid when the EXT DC AM function is set and Band 7 (< 4GHz) Amplitude ≤ +7dBm Valid when the INT AM or EXT AC AM function is set
Specified resolution	0.1%	
Specified AM accuracy	Set accuracy ±6% ±1%	Modulation frequency = 1kHz Modulation depth ≤ 90%
AM distortion	< 1.5% (Modulation depth: 0 to 30%) < 2.0% (Modulation depth: 30 to 70%) < 4.0% (Modulation depth: 70 to 90%)	Band 1 to Band 6 Valid when the INT AM or EXT AC AM function is set Modulation frequency: 1kHz
	< 4.0% (Modulation depth: 0 to 30%) < 6.0% (Modulation depth: 30 to 70%) < 10.0% (Modulation depth: 70 to 90%)	Band1 to Band 6 Valid when the INT AM or EXT AC AM function is set or Band 1 to Band 6 Valid when the EXT DC AM function is set Modulation frequency: 1kHz
AM 3dB bandwidth	20Hz to 50kHz	Band1 to Band 6 Valid when the EXT DC AM function is set
	DC to 1kHz	Band1 to Band 6 Valid when the EXT DC AM function is set
	DC to 20kHz	Band7 Valid when the INT AM, EXT AC AM, or EXT DC AM function is set

Table 3.5 - 1 Amplitude Modulation Characteristics (2/2)

Electrical characteristics	Range	Setting conditions
Parasitic phase maodulation	Demodulation bandwidth : 0.3 to 3kHz	Modulation frequency : 1kHz Modulation depth : 30%
	< 0.2 radian (peak)	Band 1 to 6
	< 0.4 radian (peak)	Band 7

The R4262 performs the AM function by using an AM signal output from its internal low-frequency AM oscillator (internal AM (INT AM) function) or by using an AM signal input from external sources (external AM (EXT AC/DC AM) function). The internal oscillator is available in two types: AM oscillator and FM (or øM) oscillator. A special modulation function allows combined use of the output signals of these two types of internal oscillators for the AM functions. Still another AM signal can be derived from the anxiliary modulation signal input terminal AUX MOD IN on the rear panel.

Note

1. The AM function is disabled when the amplitude sweep function is set. When the Auto Level Control (ALC) circuit is off, the AM function will automatically turn it on (i.e. set the ALC ON/OFF function to ON).
2. To initialize the instrument, press the [SHIFT] and [FUNCTION / PRESET] keys in this order.

3.5.1 AM Turn-On/Off and AM Depth Setting : AM ON/OFF, AM DEPTH

(1) Description

To turn on the AM function, press one of the amplitude digit setting keys [AM] or one of the data entry keys [AM]. To turn off the AM function, press either of two amplitude digit setting keys [ALL OFF] and [MOD OFF]. Pressing the [ALL OFF] key will turn off all the modulation functions currently set. On the contray, pressing the [MOD OFF] key will turn off only the AM function when the AM lamp is on. When the AM lamp is off, press the either of the two [AM] keys before the [MOD OFF] key. The lamp of the [AM] key is on and off when the AM function is on and off, respectively.

To set AM depth with ten keys, also use either of the two [AM] keys. Then, AM frequency and internal AM frequency will be displayed on the modulation display lamps (internal AM frequency will not be displayed when the external AM (EXT AC/DC AM) function is set) and the ten keys will get ready for entering AM depth values. As a unit key for AM depth, use the [-dBm MHz % nV] key.

The modulation depth/deviation adjustment knob can be used to increment or decrement, by one, modulation depth digits set with the modulation depth/deviation digit setting keys [←] and [→]. Turning the knob clockwise and counterclockwise will increment and decrement modulation depth digits, respectively.

(2) Example

Turn on the AM function and set AM depth to 30%.

	FUNCTION	DATA ENTRY
Key operation	AM	3 0 MHz (+dBu / % / mV)
GPIB	AM30PC or AM30%	

Indications

AM	DEPTH
1.00 kHz	30.0 %

Then, the AM function will be turned on and AM depth will be set to 30%.

3.5.2 Setting Internal AM and Internal Modulation Frequency:INT, MOD FREQ

(1) Description

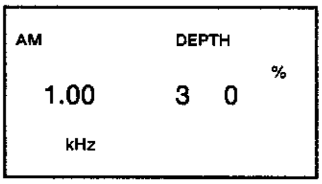
The equipment performs the internal AM (INT AM) function by using its internal low-frequency AM oscillator, which is available in two types : AM oscillator for generating AM signals and FM (or øM) oscillator for generating FM (or øM) signals. Table 3.5-2 shows the characteristics of the internal AM oscillator.

Table 3.5 - 2 Characteristics of Internal Modulation Oscillator

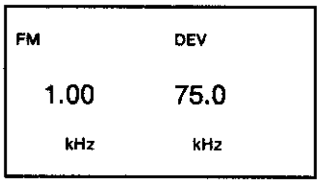
Electrical characteristics	Range	Setting conditions
Oscillating frequency	20Hz to 100kHz	
Frequency resolution	1% of any set value	
Frequency accuracy	Any set value ±3%	
Output amplitude range	$1V_{P-P}$ (under load of 600Ω)	
Output amplitude resolution	$1mV_{P-P}$	
Distotion	< 0.04% < 1% (Output amplitude: $0.2V_{P-P}$)	20Hz to 20kHz >20kHz
Output amplitude accuacy	Any set value ±4%	
Output impedance	600Ω±10%	

(2) Procedure

To start the INT AM funciton, press one of the modulation digit setting keys [INT] when the AM lamp is on, indicating that the AM funciton is set. Then, the lamp of the [INT] key will come on, indicating that the INT AM function has been started. This lamp will not come on when the external AM (EXT AC/DC AM) function is set. When the AM function is set simultaneously with the FM and øM functions, pressing the [INT] key will start any of the INT AM, INT FM, and INT øM functions that is indicated on any of the corresponding modulation display lamps AM, FM, and øM. For example, when the FM lamp is on with both the AM and FM functions set, pressing the [INT] key will start not the INT AM function but the INT FM function (see the figures on the top of the next page).



Pressing the [INT] key will start the INT AM function.



Pressing the [INT] key will start the INT FM function.

Upon starting of the INT AM function, the output frequency of the internal AM oscillator will be displayed on the left modulation display lamps. Nothing will be displayed on the left modulation display lamps when the EXT AC/DC AM function is set.

To set internal AM frequency with the AM frequency setting (AM NOD FREQ) function, use the ten keys or modulation frequency digit adjustment knob. The ten keys can be used to enter any desired AM frequency value after one of the data entry keys [MOD FREQ] is pressed. The modulation frequency adjustment knob, when turned clockwise and counterclockwise, will increment and decrement, by one, modulation frequency digits set with the modulation frequency digit setting keys [←] and [→].

(3) Example

Set internal AM frequency to 10kHz when the AM lamp is currently on.

	FUNCTION	DATA ENTRY
Key operation	[INT] [MOD FREQ]	[1] [0] [kHz] (+dBu, s, uV)
GPIB	MFA10KZ	

Indications

AM	DEPTH
10.0 kHz	30.0 %

Then, internal AM frequency will be set to 10kHz.

3.5.3 External AM Setting : EXT AC/DC

(1) Description

The equipment performs the external AM (EXT AC/DC AM) function with AM signals input from external sources, i.e. the external AN signal input (AM IN) terminal on the front panel and the auxiliary modulation input (AUX MOD IN) terminal on the rear panel. This section describes the EXT AC/DC AM function using AM signals input from the AM IN terminal. For the EXT AC/DC AM function using AM signal input from the AUX IN terminal, see Section 3.5.8 "AM Signal Mixing: SOURCE MIX Function".

(2) Procedure

To start the EXT AC/DC AM function, press the EXT AC or EXT DC key when the AM lamp is on, indicating that the AM function is set. Pressing the EXT AC or EXT DC key causes AC coupling or DC coupling, respectively, of an AM signal input from the AM IN terminal. Then, the lamp of the EXT AC or EXT DC key will come on, respectively. The lamp will not come on when the internal AM (INT AM) function is set. When the AM function is set simultaneously with the FM and øM functions, pressing the EXT AC or EXT DC key will start any of the EXT AC/DC AM, EXT AC/DC FM, and EXT AC/DC øM functions that is indicated on any of the corresponding modulation display lamps AM, FM, and øM. For example, when the FM lamp is on with both the AM and FM functions set, pressing the EXT AC or EXT DC key will start not the EXT AC AM or EXT DC AM function but the EXT AC FM or EXT DC FM function.

AM	DEPTH	
		%
1.00	30.0	
kHz		

↓

Pressing the EXT AC key will start the EXT AC AM function.
Pressing the EXT DC key will start the EXT DC AM function.

FM	DEPTH	
		%
1.00	75.0	
kHz	KHz	

↓

Pressing the EXT AC key will start the EXT AC FM function.
Pressing the EXT DC key will start the EXT DC FM function.

When the EXT AC/DC AM function is set, the output frequency of the internal AM oscillator will be erased from the left modulation display lamps.

Note

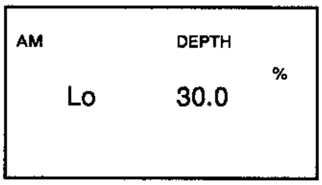
When the EXT AC/DC AM function is set, the INT AM function is disabled.

(3) Difference between External AM Signals for EXT AC AM and EXT DC AM Functions

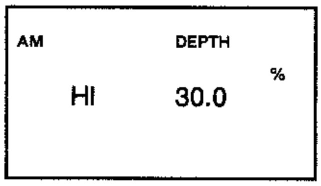
An external AM signal input from the AM IN terminal for the EXT AC AM function (EXT AC AM signal) differs from that for the EXT DC AM function (EXT DC AM signal) as shown in the table below. More specifically, the EXT AC AM signal, when falling within the amplitude range specified in the table below, will be calibrated automatically to a preset modulation depth by the internal Auto Gain Control (AGC) circuit built in the equipment while the EXT DC AM signal will not. Thus, the latter signal must be adjusted manually to fall within the specified amplitude range. The input impedance of the AM IN terminal is 100kΩ.
Amplitude Range of External AM Signals

	EXT AC AM Signal	EXT DC AM Signal
Automatic calibration by internal AGC circuit	Available	Not available
Amplitude range	0.9 to 1.1V_{P-P}	1V_{P-P} ± 1%

When an external AM signal, whether EXT AC AM signal or EXT DC AM signal, exceeds the amplitude range specified in the above table, a message "Hi" or "Lo" will be displayed in the modulation display lamps as follows:



When the lower limit of the specified amplitude range is exceeded



When the upper limit of the specified amplitude range is exceeded

In this event, the amplitude of the eternal AM signal must be adjusted to fall within the specified amplitude so that the message "Hi" or "Lo" may disappear from the modulation display lamps. Note that the above the sample messages apply to an external AM signal input from the AM IN terminal when the AM lamp is on. Therefore, when another lamp, e.g. the FM lamp is on, the message displayed on the modulation display lamps applies to an external FM signal input from the FM IN terminal.

3.5.4 Internal AM Signal Output Setling : AM MOD OUT

(1) Description

An internal AM signal, that is, an AM signal output from its internal low-frequency AM oscillator can be output from the AM signal output (AM MOD OUT) terminal on the front panel by using the AM MOD OUT function.

(2) Procedure

To set the AM MOD OUT function, use the [4 SPCL MOD] key in the function/memory keys.

(3) Note

① The AM MOD OUT function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION PRESET] keys in this order).

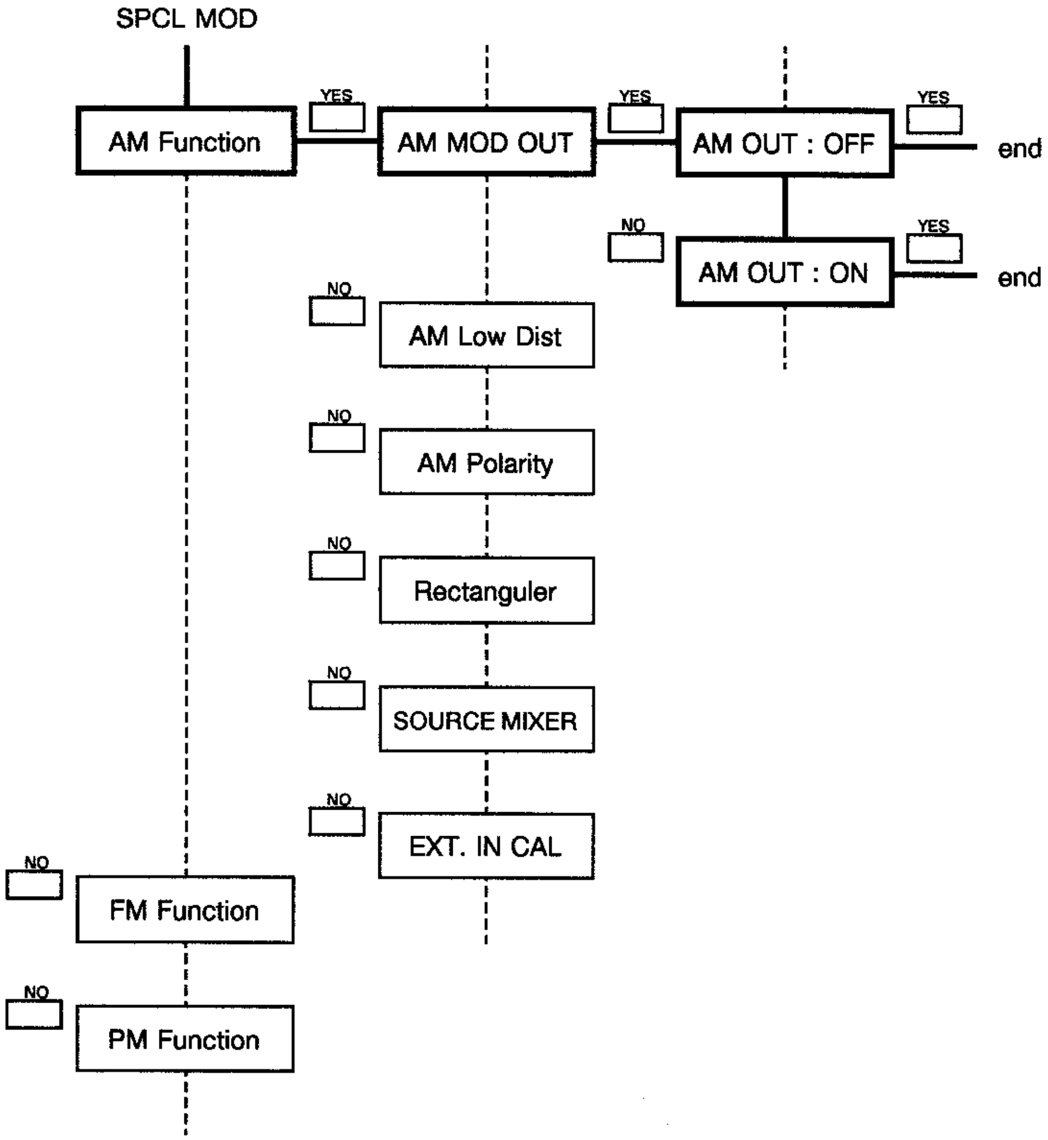
② When the [NO] key is pressed to select whether to set the AM MOD OUT function to ON or OFF (indicated by "AM OUT: ON" or "AM OUT : OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the AM MOD OUT function. Therefore, when any function key is pressed after the [NO] key, the AM MOD OUT function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ The amplitude of an internal AM signal output from the AM MOD OUT terminal by the AM MOD OUT function varies depending on preset AM depth as shown in Table 3.5-3. The output impedance of the AM MOD OUT terminal is 600Ω.

Table 3.5-3 Correspondence between AM Depth and Amplitude of Internal AM Signal Output from AM MOD OUT Terminal

AM depth	Amplitude
100 %	1.0 V_{P-P}
90 %	0.9 V_{P-P}
80 %	0.8 V_{P-P}
70 %	0.7 V_{P-P}
60 %	0.6 V_{P-P}
50 %	0.5 V_{P-P}
40 %	0.4 V_{P-P}
30 %	0.3 V_{P-P}
20 %	0.2 V_{P-P}
10 %	0.1 V_{P-P}
0 %	0.0 V_{P-P}

(4) Operational Map for AM MOD OUT Function



3.5.5 Low-distortion AM Setting : AM LOW DIST

(1) Description

The external AM setting function accompanied by AC coupling of an AM signal, that is, the EXT AC AM function will cause distortion of the AM signal frequency of less than 20Hz under the influence of the Auto Gain Control (AGC) circuit built in the equipment.The low-distortion AM setting (AM LOW DIST) function reduces such distortion for even that low AM signal frequency.

(2) Procedure

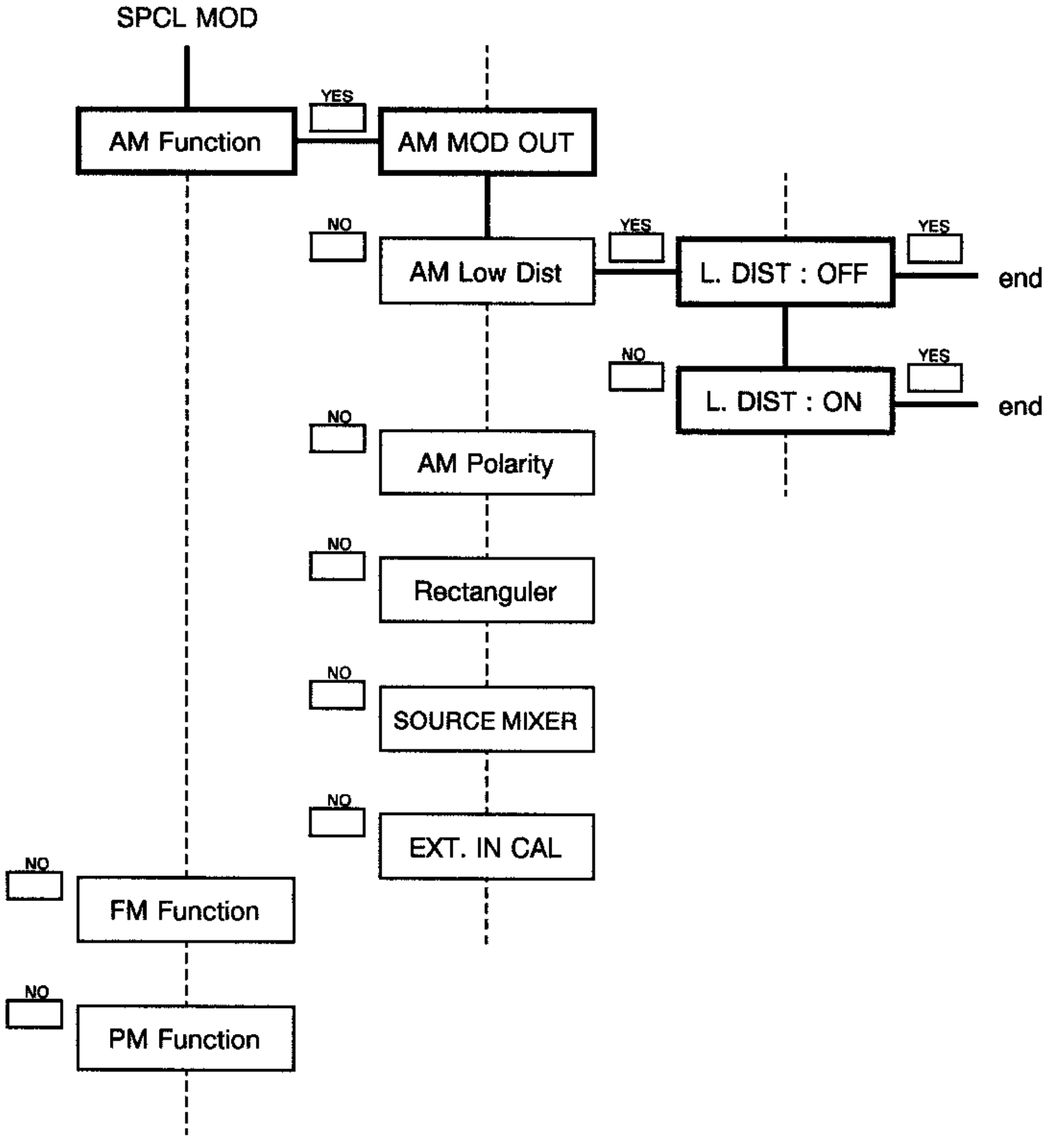
To set the AM LOW DIST function, use the [4 / SPCL MOD] key.

(3) Note

① The AM LOW DIST function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the AM LOW DIST function to ON or OFF (indicated by "L. DIST: ON" or "L. DIST : OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed complete the AM LOW DIST function. Therefore, when any function key is pressed after the [NO] key, the AM LOW DIST function will be Completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for AM LOW DIST Function



3.5.6 AM Signal Phase Polarity Conversion Setting : AM POLARITY

(1) Description

The R4262 allows conversion of the phase polarity of a mixed AM signal consisting of AM signals that are output from its internal AM external and internal FM oscillator and input from the external AM signal input (AM IN) terminal on the front panel and auxiliary modulation input (AUX MOD IN) terminal on the rear panel (AM POLARITY function). (Note that the AM POLARITY function does not affect FM and øM signals.)

(2) Procedure

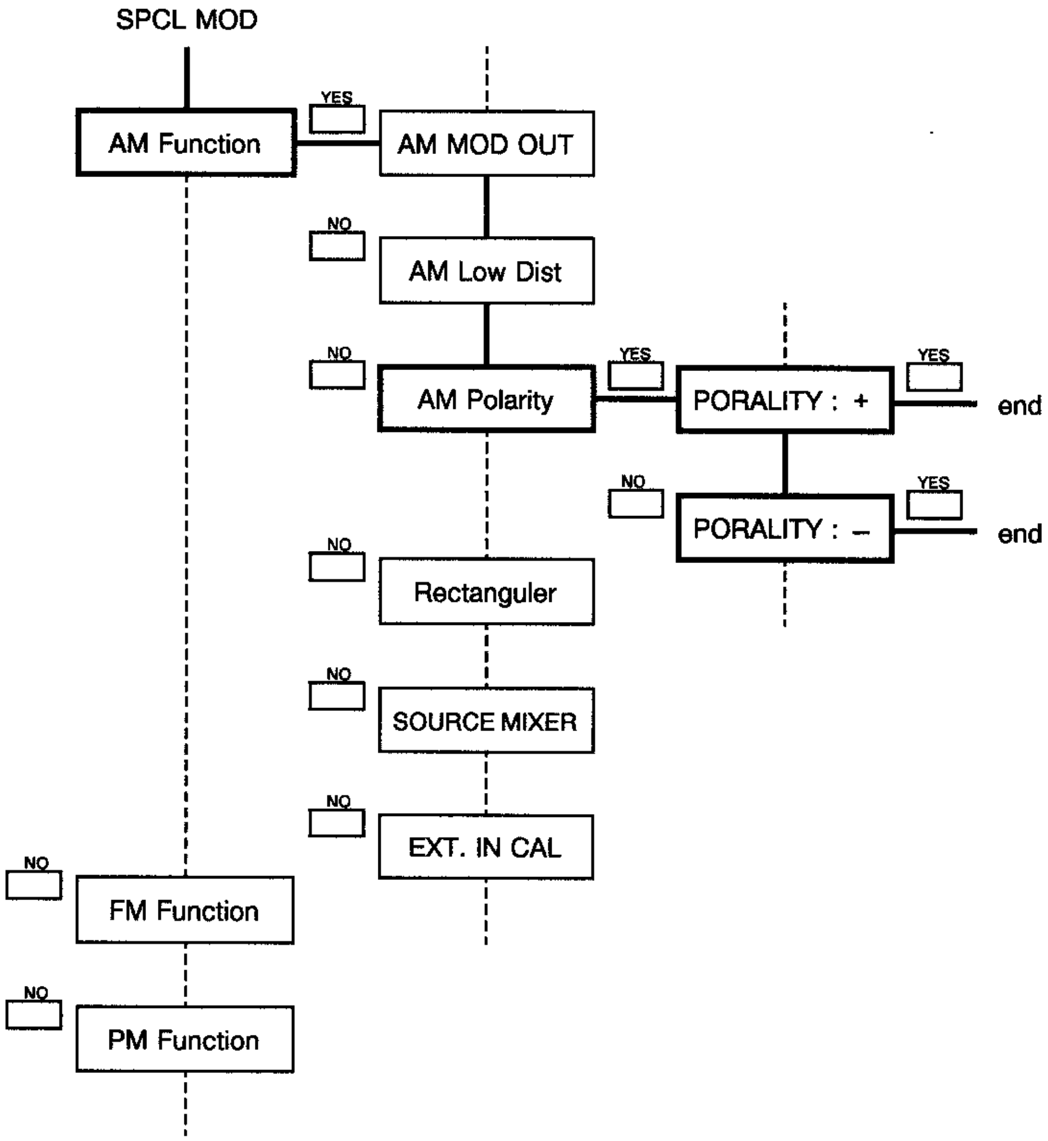
To set the AM POLARITY function, use the 4 SPCL MOD key.

(3) Note

① The AM POLARITY function will be set to the positive (+) polarity forcibly when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

② When the NO key is pressed to select whether to set the AM POLARITY function to the positive (+) or negative (-) polarity (indicated by "POLARITY: +" or " POLARITY: -", respectively, displayed in the message window), it will automatically be set to the selected state even if the YES key is not pressed to complete the AM POLARITY function. Therefore, when any function key is pressed after the NO key, the AM POLARITY function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for AM POLARITY Function



3.5.7 Rectangular Wave Output Setting : RECTANGULAR

(1) Description

The rectangular wave output (RECTANGULAR) function causes the internal AM oscillator built in the equipment to generate a rectangular wave of low frequency ranging from 20 Hz to 10kHz for output from the external AM signal input (AM IN) terminal on the front panel.

(2) Procedure

To set the RECTANGULAR POLARITY function, use the [4 / SPCL MOD] key.

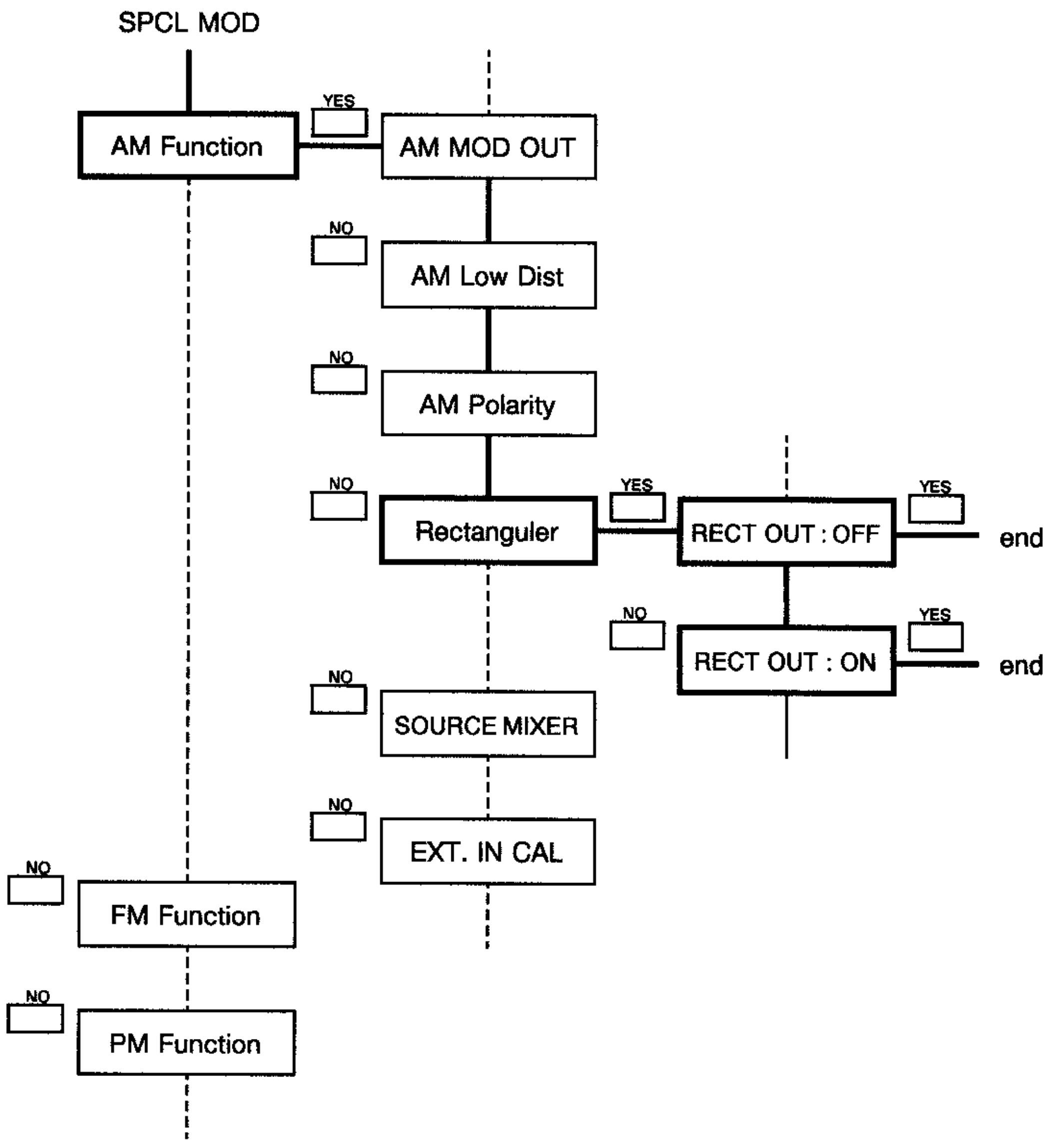
(3) Note

① The RECTANGULAR function will be set to OFF forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the RECTANGULAR function to the ON or OFF (indicated by "RECT OUT: ON" or "RECT OUT: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the RECTANGULAR function. Therefore, when any function key is pressed after the [NO] key, the RECTANGULAR function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ The RECTANGULAR function cannot be used simultaneously with any other AM function.

(4) Operational Map for RECTANGULAR Function



3.5.8 AM Signal Mixing Setting : SOURCE MIXER

(1) Description

Ordinarily, an AM signal is derived separately from the internal AM oscillator built in the equipment or the external AM signal input (AM IN) terminal on the front panel. When the AM signal mixing (SOURCE MIXER) function is set, an AM signal can be derived separately from the internal AM oscillator and internal FM oscillator that are built in the equipment and the anxiliary modulation input (AUX MOD IN) terminal on the rear panel, or AM signals output from these three different sources can be mixed together.

(2) Procedure

To set the SOURCE MIXER function, use the 4 [SPCL MOD] key.

(3) Note

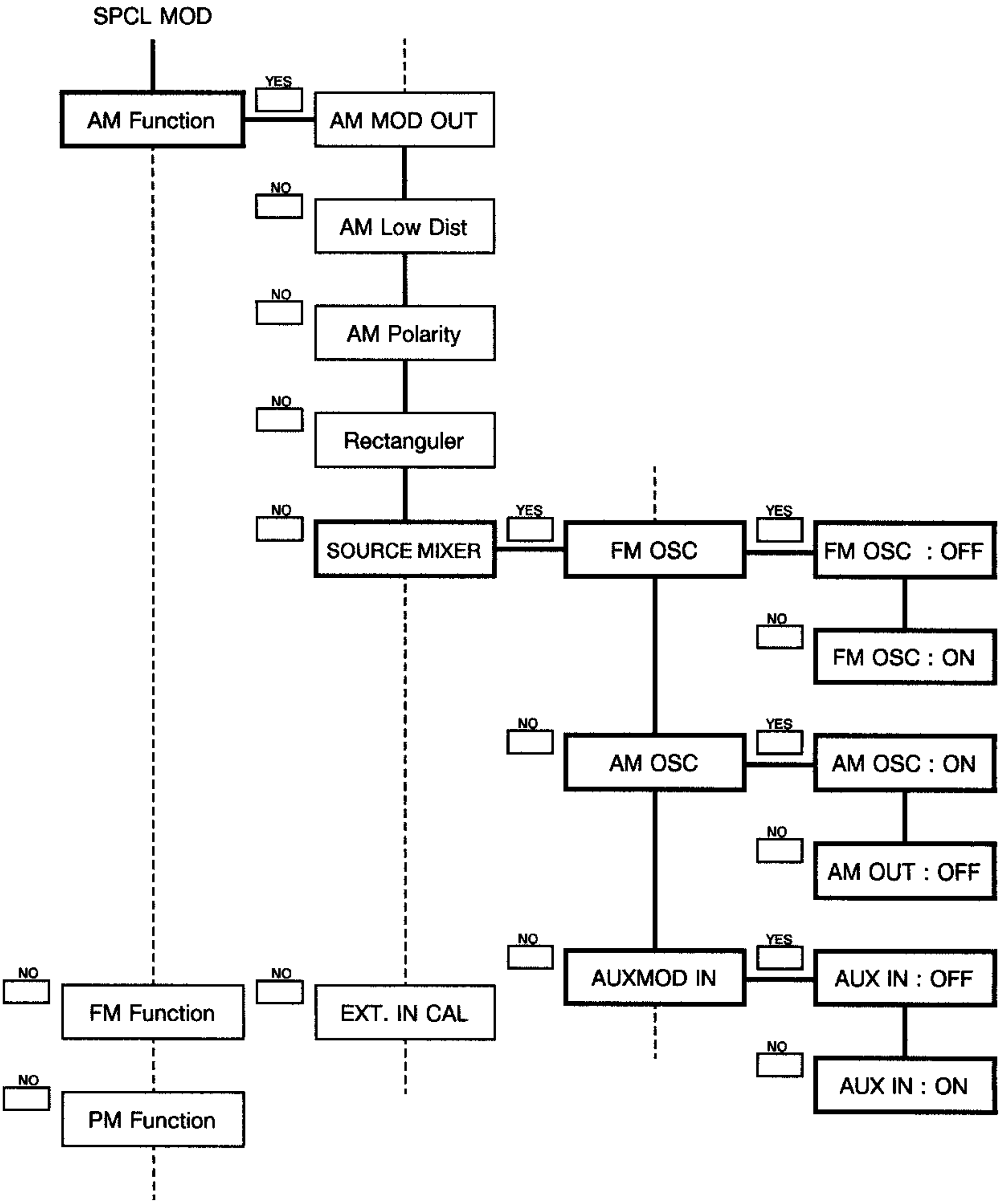
① The SOURCE MIXER function will be set to the "FM OSC : OFF", "AM OSC : ON", or "AUX IN: OFF" state forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the SOURCE MIXER function to ON or OFF (indicated by either "FM OSC : ON", "AM OSC : ON", "AUX IN : ON", or "FM OSC : OFF", "AM OSC: OFF", "AUX IN: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the SOURCE MIXER function.

Therefore, when any function key is pressed after the [NO] key, the SOURCE MIXER function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ When the SOURCE MIXER function is used to mix two or three AM signals, the total of the modulation depths of the individual AM signals must not exceed 100%.

(4) Operational Map for SOURCE MIXER Function



3.5.9 External AM Signal Calibration Setting: EXT. IN CAL

(1) Description

When one of the external AM functions, EXT AC AM function, is set, an external AM signal input from the AM IN terminal (EXT AC AM signal), when falling within the amplitude range of 0.9 to 1.1 Vp-p, will be calibrated automatically to a preset modulation depth with an accuracy of ±6% ±1% by the internal Auto Gain Control (AGC) circuit built in the equipment. This function implemented by the AGC circuit is called the external AM signal calibration (EXT IN CAL) function and will be abled whenever the EXT AC AM function is set. However, this function can be disabled by key operation described in (2) procedure. When an EXT AC AM signal exceeding the above specified amplituitude range is being used, this function should rather be disabled.

(2) Procedure

To set the EXT IN CAL function, use the [4 / SPCL MOD] key.

(3) Note

① The EXT IN CAL function will be set to the following states forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order):

EXT AC .. EIAC ON
EXT DC .. EIAC OFF

The EXT IN CAL function will be set to the following states when switching is made between the internal AM (INT AM) function and the external AM (EXT AC/DC AM) function:

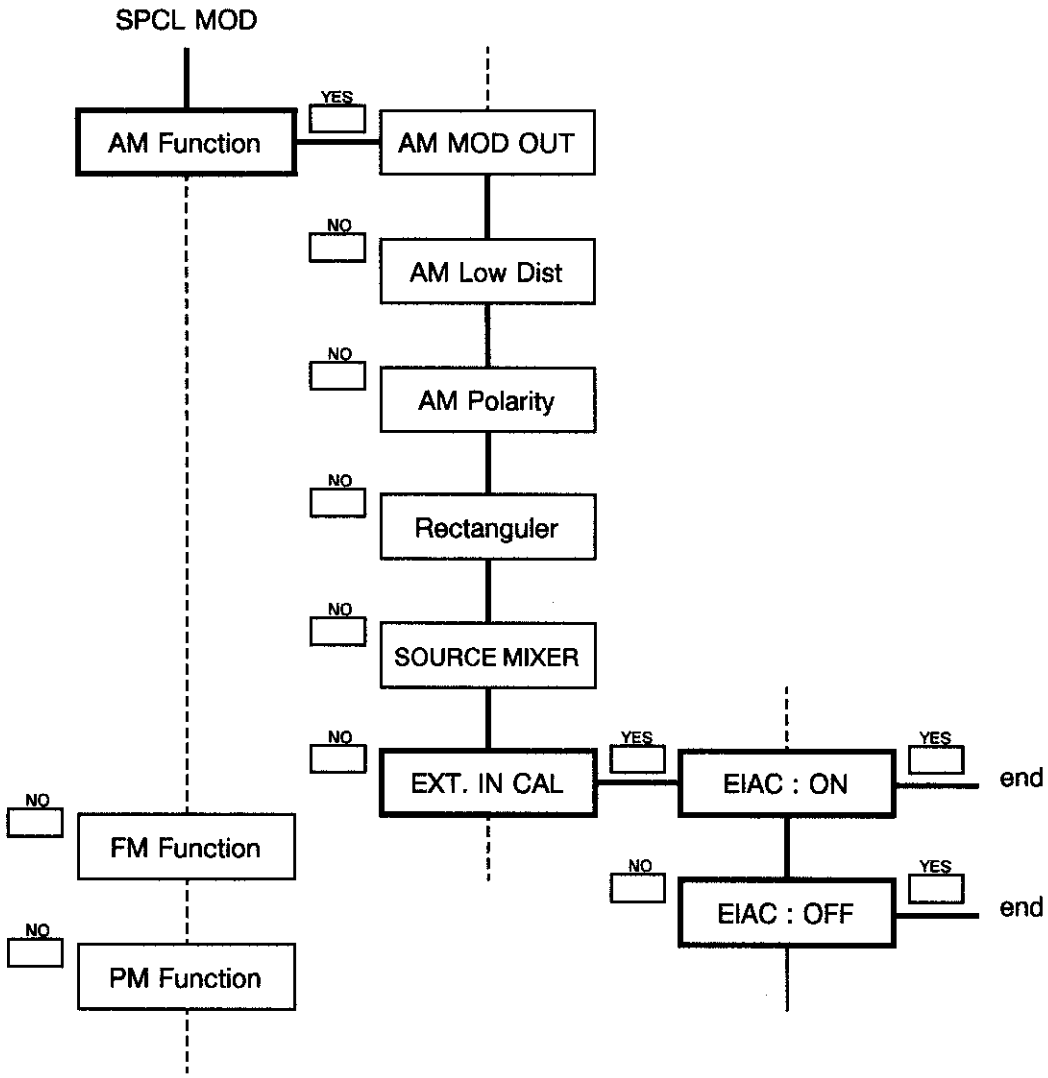
INT ..... EIAC ON
EXT AC .. EIAC ON
EXT DC .. EIAC OFF

② When the [NO] key is pressed to select whether to set the EXT IN CAL function to the ON or OFF (indicated by "EIAC: ON" or "EIAC: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the EXT IN CAL function.

Therefore, when any function key is pressed after the [NO] key, the EXT IN CAL function will be comPleted in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ The EXT IN CAL function cannot be used simultaneously with any other AM function.

(4) Operational Map for EXT IN CAL Function



3.6 Frequency Modulation (FM)

Table 3.6-1 shows the frequency modulation characteristics of the R4262.

Table 3.6 - 1 Frequency modulation Characteritics (1/2)

Electrical characteristics	Range	Setting conditions
Maximum modulation deviation	(Modulation frequency = 1kHz)	
	800kHz	Band 7, HET
	400kHz	Band 6
	200kHz	Band 5, 1, Iex
	100kHz	Band 4
	50kHz	Band 3
	25kHz	Band 2
Specified resolution	1kHz (DEV. 800. to 201kHz) 100Hz (DEV. 200 to 20.1kHz) 10Hz (DEV. 20 to 0kHz)	Band 7, HET
	1kHz (DEV. 400 to 101kHz) 100Hz (DEV. 100 to 10.1kHz) 10Hz (DEV. 10 to 0kHz)	Band 6
	1kHz (DEV. 200 to 51kHz) 100Hz (DEV. 50 to 5.1kHz) 10Hz (DEV. 5 to 0kHz)	Band 5, 1, Iex
	1kHz (DEV. 100 to 26kHz) 100Hz (DEV. 25.9 to 2.6kHz) 10Hz (DEV. 2.59 to 0kHz)	Band 4
	1kHz (DEV. 50 to 13kHz) 100Hz (DEV. 12.9 to 1.3kHz) 10Hz (DEV. 1.29 to 0kHz)	Band 3
	1kHz (DEV. 25 to 7kHz) 100Hz (DEV. 6.9 to 0.7kHz) 10Hz (DEV. 0.69 to 0kHz)	Band 2
Specified FM accuracy	Set value ±7% ±10Hz	Modulation frequency = 1kHz Modulation deviation ≤ 400kHz
FM distortion	Modulation frequency = 20Hz to 20kHz	When the EXT DC FM function is set
	1%	Maximum modulation deviation (DEV)
	0.3%	1/2 of maximum modulation deviation (DEV)
	0.2%	1/10 of maximum modulation deviation (DEV)

Table 3.6 - 1 Frequency Modulation Characteristics (2/2)

Electrical characteristics	Range	Setting conditions
FM 3 dB Bandwidth	DC to 200kHz 20Hz to 200kHz 20Hz to 100kHz	When the EXT DC FM function is set When the EXT AC FM function is set When the INT FM function is set
Parasitic AM	1%	Modulation frequency = 1kHz Modulation depth = 75kHz
Carrier friequency offset	(DEV. < 1/10 of maximum modulation deviation) < 4kHz < 2kHz < 1kHz	When the EXT DC FM function is set Band 7, HET Band Band 6 Band 1 to Band 5

The R4262 performs the FM functions by using an FM signal output from its internal low to frequency FM oscillator (internal FM (INT FM) function) or by using an FM signal input from external sources (external FM (EXT AC/DC FM) function). The internal oscillator is available in two types: FM oscillator and AM oscillator. The SOURCE MIXER function allows combined use of the output signals of these two types of internal oscillators for the FM functions. Still another FM signal can be derived from the auxiliary modulation signal input terminal AUX MOD IN on the rear panel.

Note

The FM function is disabled when the analog frequency sweep function is set.

3.6.1 FM Turn-On/Off and FM Depth Setting : FM ON/OFF, FM DEVIATION

(1) Description

To turn on the FM function, press one of the frequency digit setting keys [FM] or one of the data entry keys [ON FM]. To turn off the FM function, press either of two frequency digit setting keys [ALL OFF] and [MOD OFF]. Pressing the [ALL OFF] key will turn off all the modulation functions currently set. On the contrary, pressing the [MOD OFF] key will turn off only the FM function when the FM lamp is on. When the FM lamp is off, press either the [FM] or [FM] key before the [MOD OFF] key. The lamp of the [FM] key is on and off when the FM function is on and off, respectively.

To set FM depth with ten keys, also use the [FM] key. Then, FM frequency and internal FM frequency will be displayed on the modulation display lamps (internal FM frequency will not be displayed when the external FM (EXT AC/DC FM) function is set) and the ten keys will get ready for entering FM depth values. As a unit key for FM depth, use the [−dBm MHz] % mV key.

The modulation depth/deviation adjustment knob can be used to increment or decrement, by one, modulation depth digits set with the modulation depth/deviation digit setting keys [←] and [→]. Turning the knob clockwise and counterclockwise will increment and decrement modulation depth digits, respectively.

(2) Example

Turn on the FM function and set FM deviation to 75kHz.

	FUNCTION	DATA ENTRY
Key operation	[FM]	[7] [5] [+dBu kHz s uV]
GPIB	FM75KZ	

Indications

FM	DEV
1.00 kHz	75.0 kHz

Then, the FM function will be turned on and FM deviation will be set to 75kHz.

Pressing the MOD OFF key will the FM function that is turned on last or that is currently displayed in the modulation display lamps.

3.6.2 Setting Internal FM and Internal Modulation Frequency : INT, MOD FREQ

(1) Description

The equipment performs the internal FM (INT FM) function by using its internal low to frequency FM oscillator, which is available in two types: FM oscillator for generating FM signals and FM oscillator for generating FM signals. Table 3.6-2 shows the characteristics of the internal FM oscillator.

Table 3.6 - 2 Characteristics of Internal Modulation Oscillator

Electrical characteristics	Range	Setting conditions
Oscillating frequency	20Hz to 100kHz	
Frequency resolution	1% of any set value	
Frequency accuracy	Any set value ±3%	
Output frequency range	$1V_{P\text{-}P}$ (under load od 600Ω)	
Output frequency resolution	$1mV_{P\text{-}P}$	
Distorion	< 0.04% < 1% (Output frequency : $0.2V_{P\text{-}P}$	20Hz to 20kHz
Output frequency accuracy	Any set value ±4%	
Output impedance	600Ω ± 10%	

(2) Procedure

To start the INT FM function, press one of the modulation digit setting keys [INT] when the FM lamp is on, indicating that the FM function is set. Then, the lamp of the [INT] key will come on, indicating that the INT FM function has been started. This lamp will not come on when the external FM (EXT AC/DC FM) function is set. When the FM function is set simultaneously with the AM function, pressing the [INT] key will start any of the INT FM and INT AM functions that is indicated on any of the corresponding modulation display lamps FM and AM. For example, when the FM lamp is on with both the FM and AM functions set, pressing the [INT] key will start not the INT FM function but the INT AM function (see the following figures).

AM	DEPTH
	%
1.00	30.0
kHz	

Pressing the [INT] key will start the INT FM function.

FM	DEV
1.00	75.0
kHz	kHz

Pressing the [INT] key will start the INT FM function.

Upon starting of the INT FM function, the output frequency of the internal FM oscillator will be displayed on the left modulation display lamps. Nothing will be displayed on the left modulation display lamps when the EXT AC/DC FM function is set.

To set internal FM frequency with the FM frequency setting (FM NOD FREQ) function, use the ten keys or modulation frequency digit adjustment knob. The ten keys can be used to enter any desired FM frequency value after one of the data entry keys [MOD FREQ] or [INT] key is pressed. The modulation frequency adjustment knob, when turned clockwise and counterclockwise, will increment and decrement, by one, modulation frequency digits set with the modulation frequency digit setting keys [←] and [→].

(3) Example

Set internal FM frequency to 1kHz when the FM lamp is currently on.

	FUNCTION	DATA ENTRY
Key operation	INT [ ]	[1] [+dBu kHz s uV]
	MOD FREQ [ ]	
GPIB	MFB1KZ	

Indications

FM	DEV
1.00	30.0
kHz	kHz

Then, internal FM frequency will be set to 1kHz.

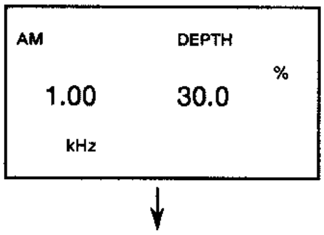
3.6.3 External FM Setting : EXT AC/DC

(1) Description

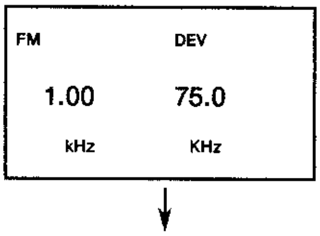
The equipment performs the external FM (EXT AC/DC FM) function with FM signals input from external sources, i.e. the external FM signal input (FM IN) terminal on the front panel and the auxiliary modulation input (AUX MOD IN) terminal on the rear panel. This section describes the EXT AC/DC FM function using FM signals input from the FM IN terminal. For the EXT AC/DC FM function using FM signal input from the AUX IN terminal, see Section 3.6.9 "FM Signal Mixing: SOURCE MIX Function".

(2) Procedure

To start the EXT AC/DC FM function, press the EXT AC or EXT DC key when the FM lamp is on, indicating that the FM function is set. Pressing the EXT AC or EXT DC key causes AC coupling or DC coupling, respectively, of an FM signal input from the FM IN terminal. Then, the lamp of the EXT AC or EXT DC key will come on, respectively. The lamp will will not come on when the internal FM (INT FM) function is set. When the FM function is set simultaneously with the FM and øM functions, pressing the EXT AC or EXT DC key will start any of the EXT AC/DC FM, EXT AC/DC FM, and EXT AC/DC øM functions that is indicated on any of the corresponding modulation display lamps FM, FM, and øM. For example, when the FM lamp is on with both the FM and FM functions set, pressing the EXT AC or EXT DC key will start not the EXT AC FM or EXT DC FM function but the EXT AC FM or EXT DC FM function.



Pressing the EXT AC key will start the EXT AC FM function.
Pressing the EXT DC key will start the EXT DC FM function.



Pressing the EXT AC key will start the EXT AC FM function.
Pressing the EXT DC key will start the EXT DC FM function.

When the EXT AC/DC FM function is set, the output frequency of the internal FM oscillator will be erased from the left modulation display lamps. When the EXT AC/DC FM function is set, the INT FM function is disabled.

(3) Difference between External FM Signals for EXT AC FM and EXT DC FM Functions

An external FM signal input from the FM IN terminal for the EXT AC FM function (EXT AC FM signal) differs from that for the EXT DC FM function (EXT DC FM signal) as shown in the table below. More specifically, the EXT AC FM singnal, when falling within the amplitude range specified in the table below, will be calibrated automatically to a preset modulation depth by the internal Auto Gain Control (AGC) circuit built in the equipment while the EXT DC FM signal will not. Thus, the latter signal must be adjusted manually to fall within the amplitude range of $1V_{P\text{-}P}$ $\pm 1\%$. The input impedance of the FM IN terminal is 100kΩ.

Amplitude Range of External FM Signals

	EXT AC AM Signal	EXT DC AM Signal
Automatic calibration by internal AGC circuit	Available	Not available
Amplitude range	0.9 to 1.1V_{P-P}	1V_{P-P} ± 1%

When an external FM signal, whether EXT AC FM signal or EXT DC FM signal, exceeds the amplitude range specified in the above table, a message "Hi" or "Lo" will be displayed in the modulation display lamps as follows :

FM DEV
Lo 30.0
kHz

When the lower limit of the specified amplitude range is exceeded

FM DEV
HI 30.0
kHz

When the lower limit of the specified amplitude range is exceeded

In this event, the amplitude of the eternal FM signal must be adjusted to fall within the specified range so that the message "Hi" or "Lo" may disappear from the modulation display lamps. Note that the above the sample messages apply to an external FM signal input from the FM IN terminal when the FM lamp is on. Therefore, when another lamp, e.g. the AM lamp is on, the message displayed on the modulation display lamps applies to an external AM signal input from the AM IN terminal.

3.6.4 Internal FM Signal Output : FM MOD OUT

(1) Description

An internal FM signal, that is, an FM signal output from the internal low-frequency FM oscillator built in the equipment can be output from the FM signal output (FM MOD OUT) terminal on the front panel by using the FM MOD OUT function.

(2) Procedure

To set the FM MOD OUT function, use the [4 / SPCL MOD] key.

(3) Note

① The FM MOD OUT function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the FM MOD OUT function to ON or OFF (indicated by "FM OUT: ON" or "FM OUT: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the FM MOD OUT function.

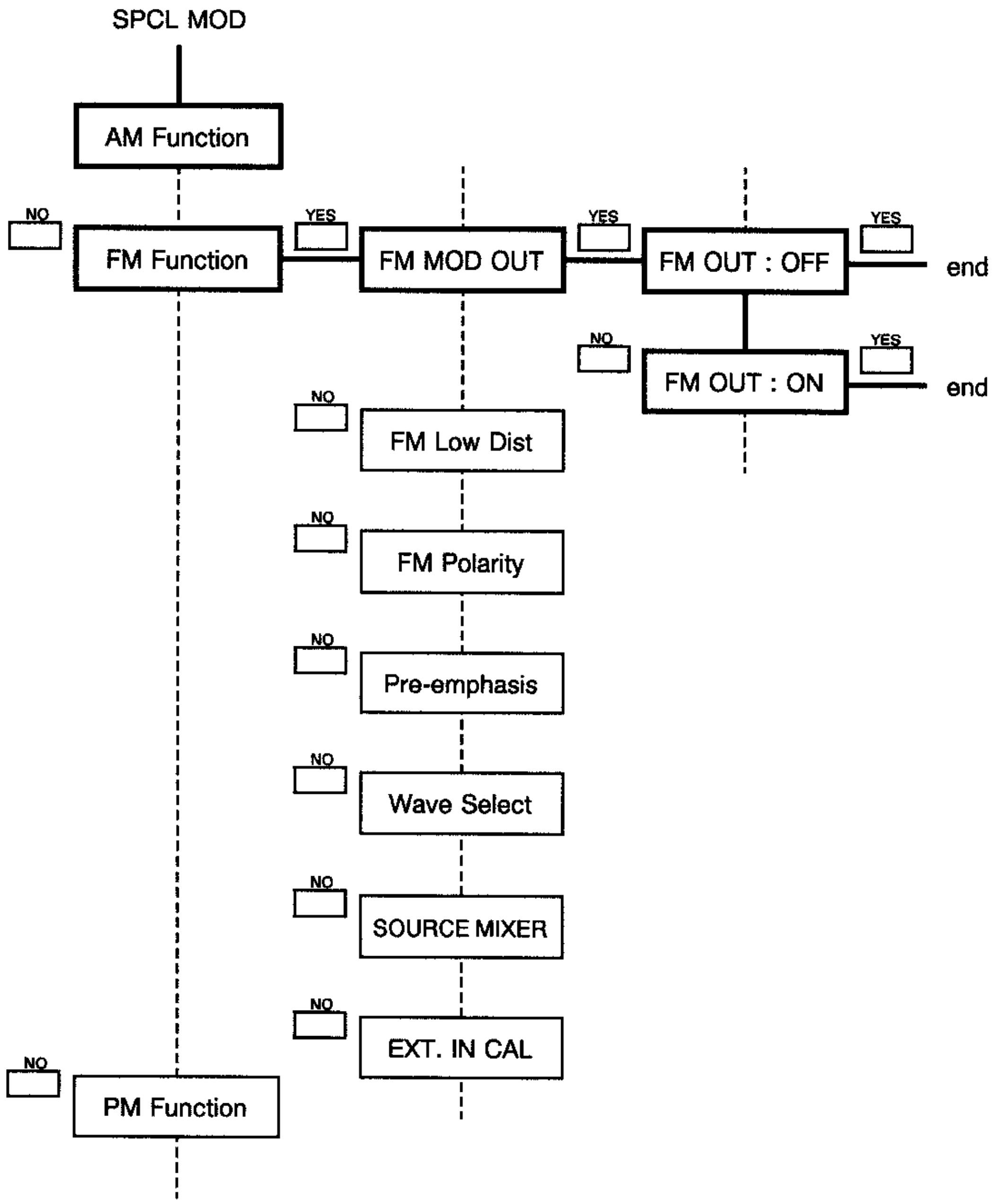
Therefore, when any function key is pressed after the [NO] key, the FM MOD OUT function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ The frequency of an internal FM signal output from the FM MOD OUT terminal by the FM MOD OUT function varies depending on preset FM depth. The output impedance of the FM MOD OUT terminal is 600Ω.

Table 3.6 - 3 Correspondence between FM Depth and Frequency of Internal FM Signal Output from FM MOD OUT Terminal

BAND	2	3	4	1, Iex, 5	6	7	Output voltage
DEV	25kHz	50kHz	100kHz	200kHz	400kHz	800kHz	$1.00V_{P-P}$
	2.5kHz	5kHz	10kHz	20kHz	40kHz	80kHz	$1.00V_{P-P}$
	0.25kHz	0.5kHz	1kHz	2kHz	4kHz	8kHz	$1.00V_{P-P}$

(4) Operational Map for FM MOD OUT Function



3.6.5 Low-distortion FM Setting : FM LOW DIST

(1) Description

The FM functions with low modulation deviation will cause distortion of the FM signal frequency under the influence of the Auto Gain Control (AGC) circuit built in the equipment. The low-distortion FM setting (FM LOW DIST) function reduces such distortion.

(2) Procedure

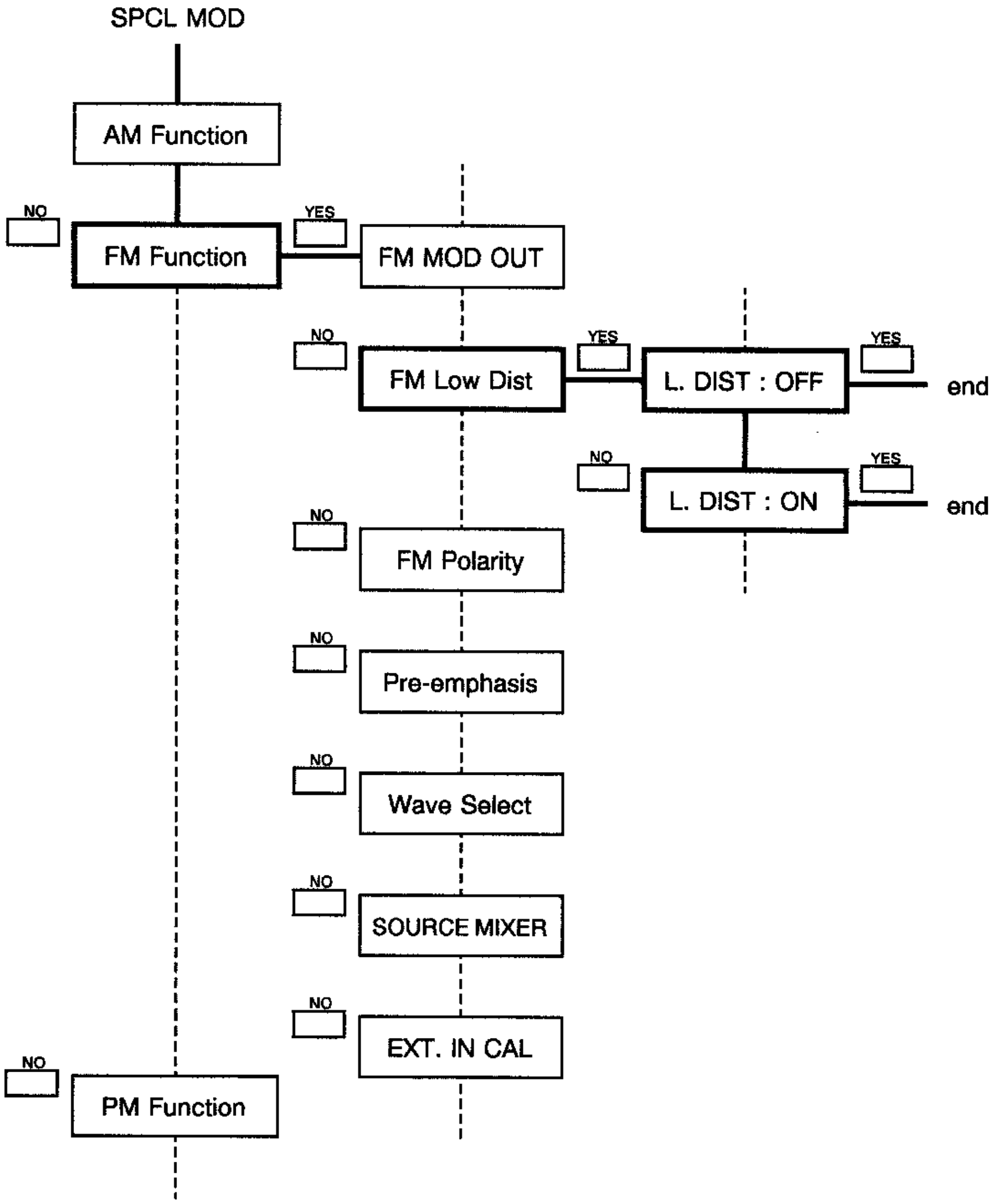
To set the FM LOW DIST function, use the [4 / SPLC MOD] key.

(3) Note

① The FM LOW DIST function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the FM LOW DIST function to ON or OFF (indicated by "L. DIST: ON" or "L. DIST: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the FM LOW DIST function. Therefore, when any function key is pressed after the [NO] key, the FM LOW DIST function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for FM LOW DIST Function



3.6.6 FM Signal Phase Polarity Conversion : FM POLARITY

(1) Description

The R4262 allows conversion of the phase polarity of a mixed FM signal consisting of FM signals that are output from the internal FM oscillator and internal AM oscillator that are built in the equipment and input from the external FM signal input (FM IN) terminal on the front panel and auxiliary modulation input (AUX MOD IN) terminal on the rear panel (FM POLARITY function). (Note that the FM POLARITY function does not affect an AM signal.)

(2) Procedure

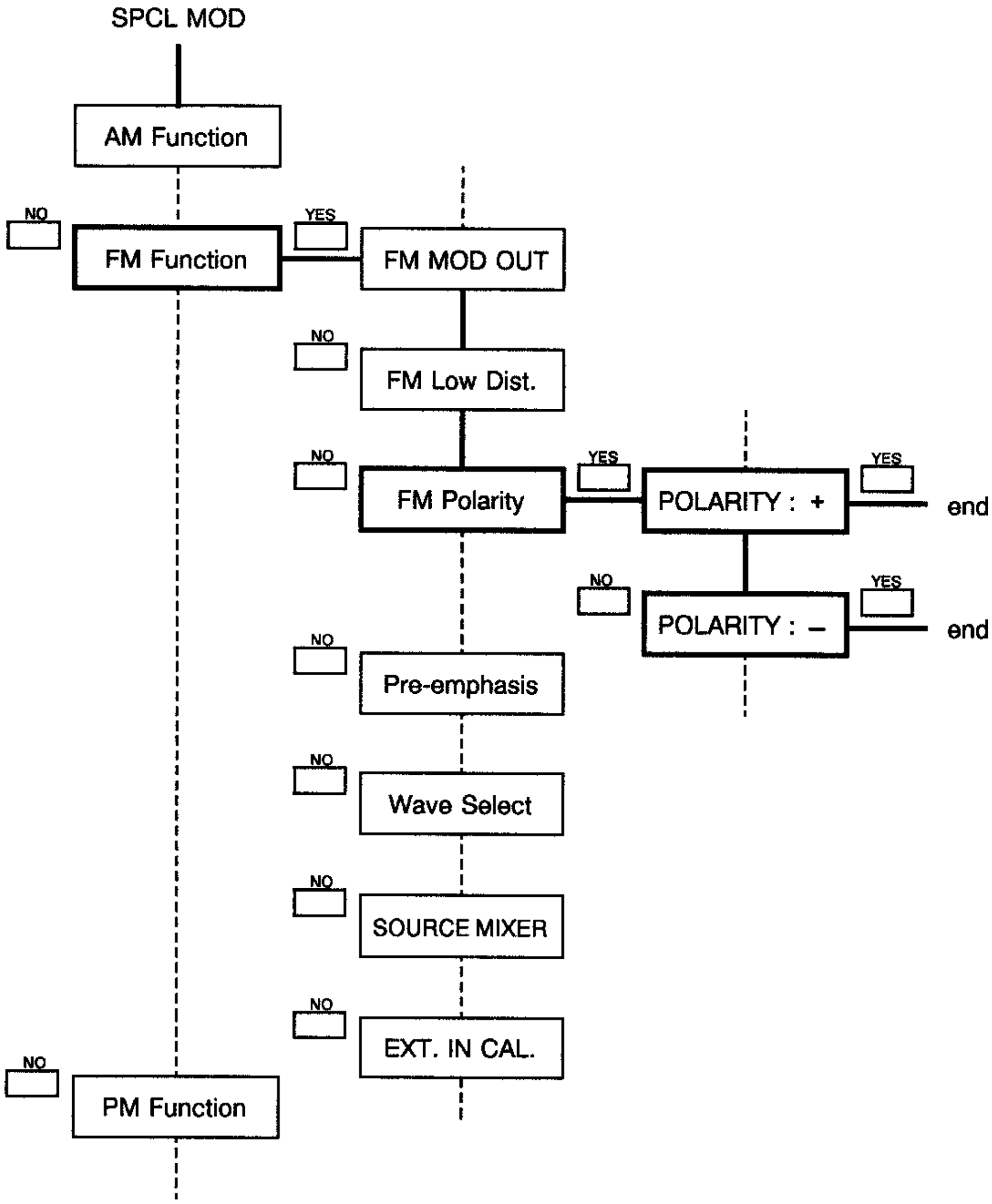
To set the FM POLARITY function, use the [4 / SPCL MOD] key.

(3) Note

① The FM POLARITY function will be set to the positive (+)polarity forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the FM POLARITY function to the positive (+) or negative (−) polarity (indicated by "POLARITY: + " or "POLARITY: −" , respectively, displayed in the message window), it will automatically by set to the selected state even if the [YES] key is not pressed to complete the FM POLARITY function. Therefore, when any function key is pressed after the [NO] key, the FM POLARITY function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for FM POLARITY Function



3.6.7 Pre-emphasis Setting : PRE-EMPHASIS

(1) Description

The R4262 allows setting of pre-emphasis that emphasizes the high-band frequency of an FM signal (PRE-EMPHASIS function). The PRE-EMPHASIS function is available in the three types listed below, which can be selected to serve a desired purpose. Figure 3.6-1 shows the frequency characteristics of pre-emphasis.

① 50μs ··· FM broadcast
② 75μs ··· Television
③ 750μs ··· Radiocommunication
④ Pre-emphasis off

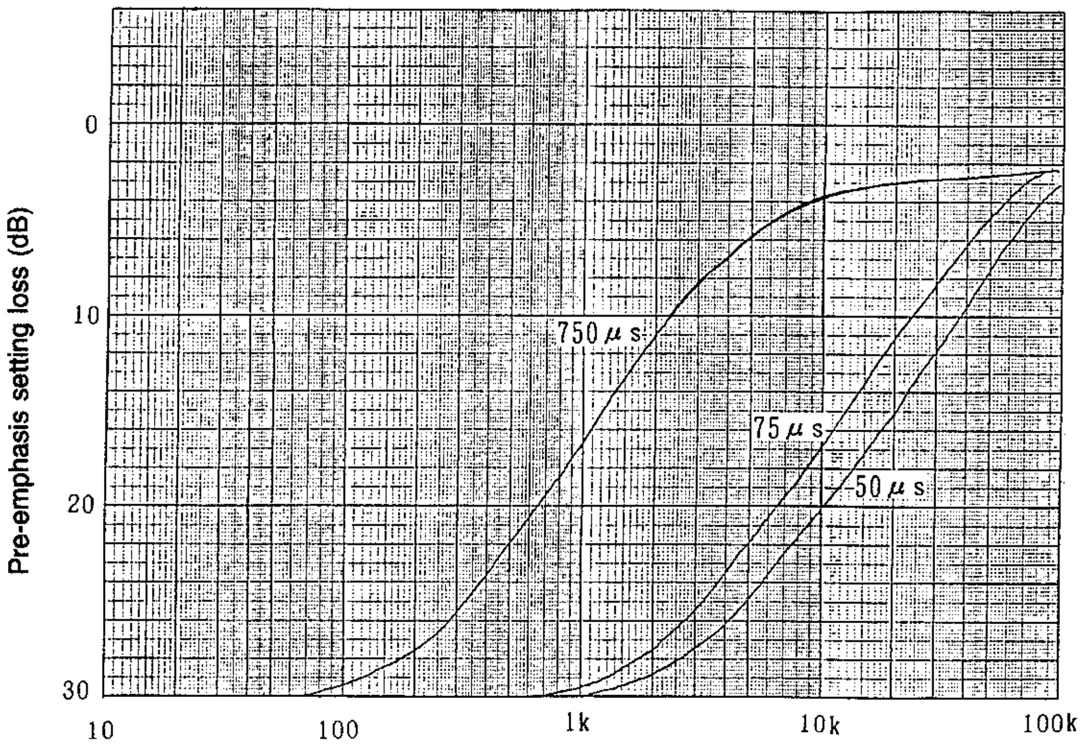


Figure 3.6-1 Frequency Characteristics of Pre-emphasis

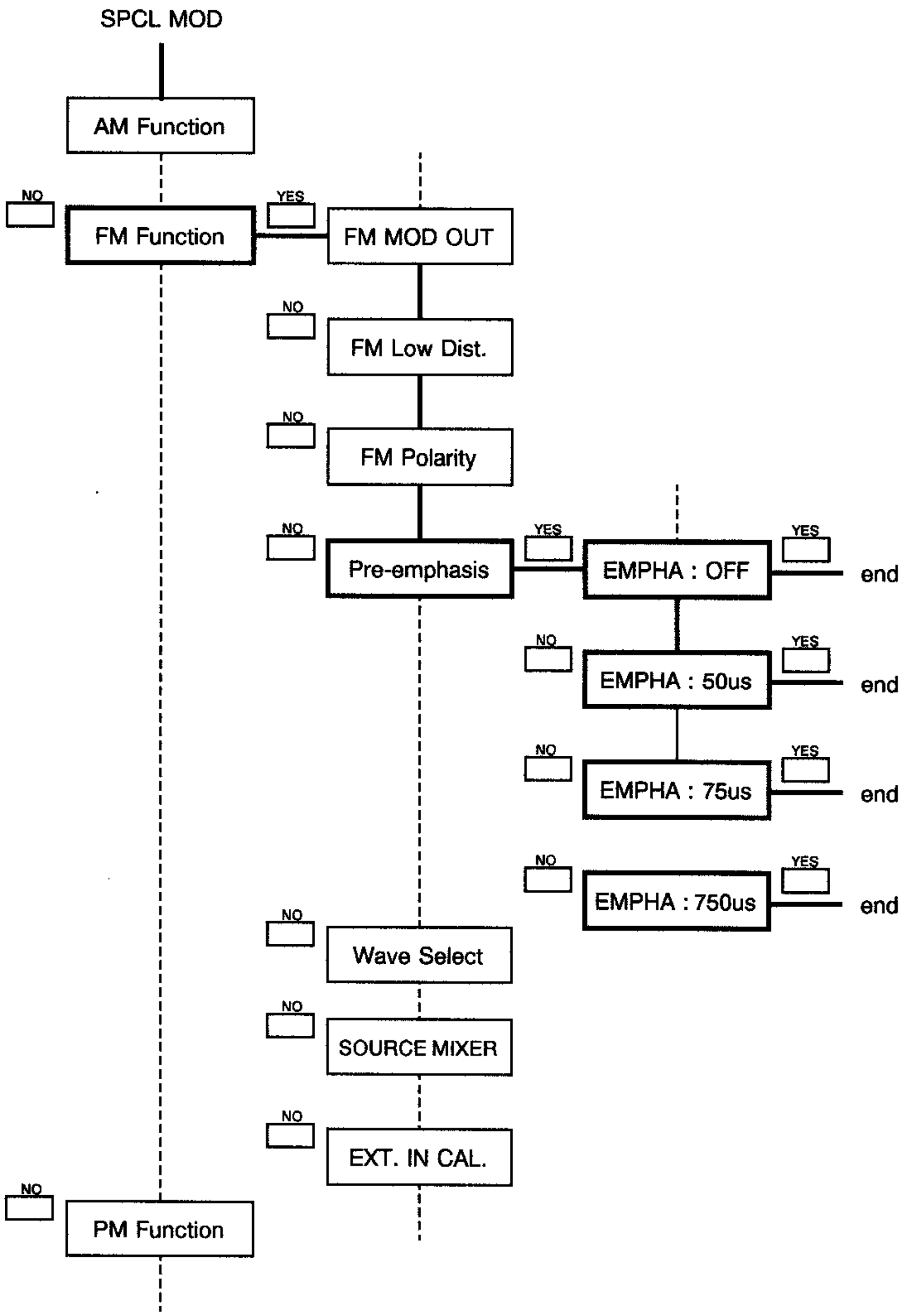
(2) Procedure

To set the PRE-EMPHASIS function, use the [4 / SPCL MOD] key.

(3) Note

① The PRE-EMPHASIS function will be set to OFF forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for PRE-EMPHASIS Function



3.6.8 Internal Sine-wave/Triangular-wave FM Signal Selection : WAVE SELECT

(1) Description

Ordinarily, the internal FM oscillator built in the equipment generates a sine-wave FN signal. If necessary, it can be SET to generate a triangular-wave FM signal with the sine-wave/triangular-wave FM signal selection (WAVE SELECT) function.

(2) Procedure

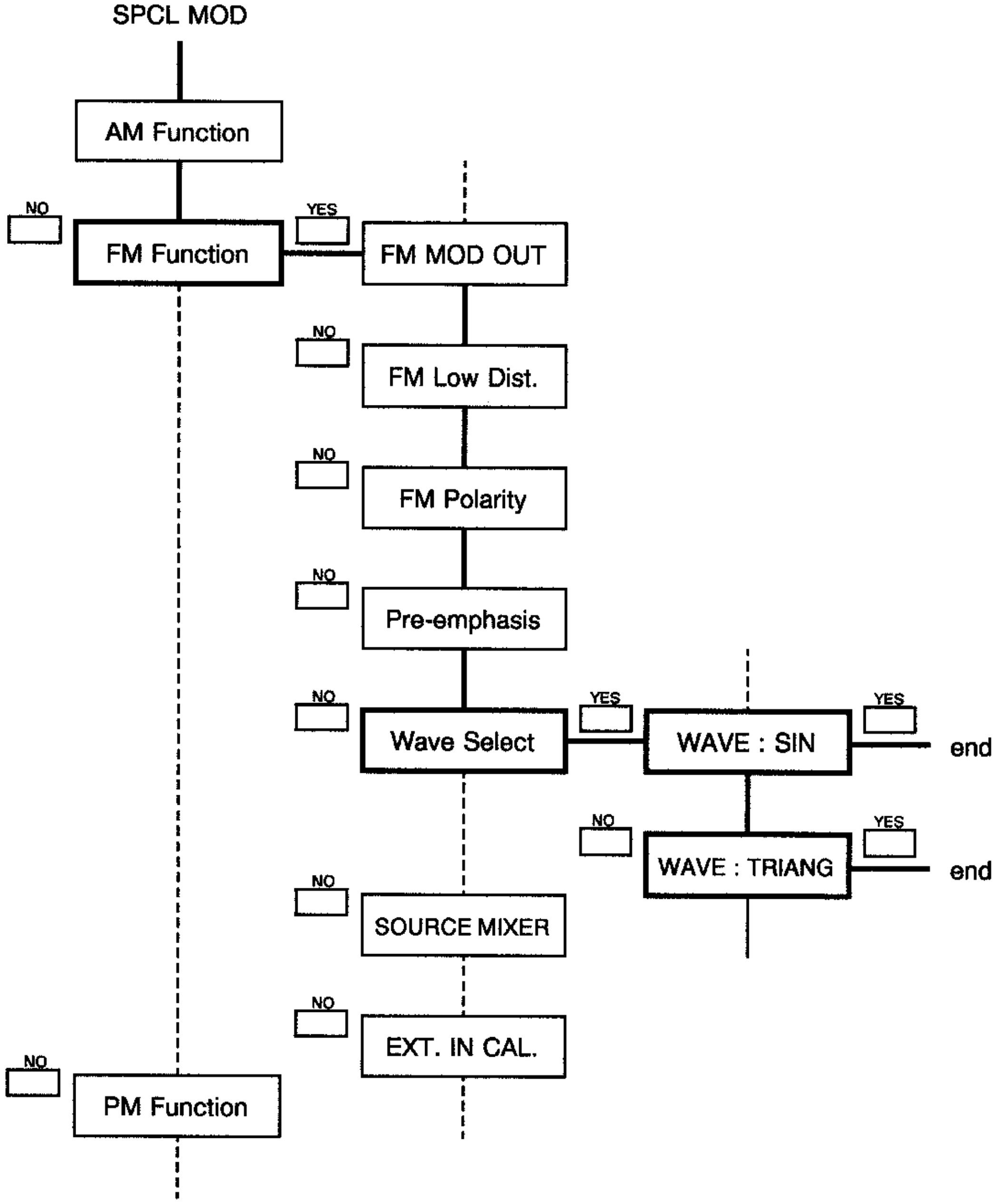
To set the WAVE SELECT function, use the [4 / SPCL MOD] key.

(3) Note

① The WAVE SELECT function will be set to generate a sine-wave FM signal forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the WAVE SELECT function to generate a sine-wave or triangular-wave FM signal (indicated by "WAVE: SINE" or "WAVE: TRIANG", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the WAVE SELECT function. Therefore, when any function key is pressed after the [NO] key, the WAVE SELECT function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for WAVE SELECT Function



3.6.9 FM Signal Mixing : SOURCE MIXER

(1) Description

Ordinarily, an FM signal is derived separately from the internal FM oscillator built in the equipment or the external FM signal input (FM IN) terminal on the front panel. When the FM signal mixing (SOURCE MIXER) function is set, an FM signal can be derived separately from the internal FM oscillator and internal AM oscillator built in the equipment and the auxiliary modulation input (AUX MOD IN) terminal on the rear panel, or FM signals output from these three different sources can be mixed together.

(2) Procedure

To set the SOURCE MIXER function, use the [4 / SPCL MOD] key.

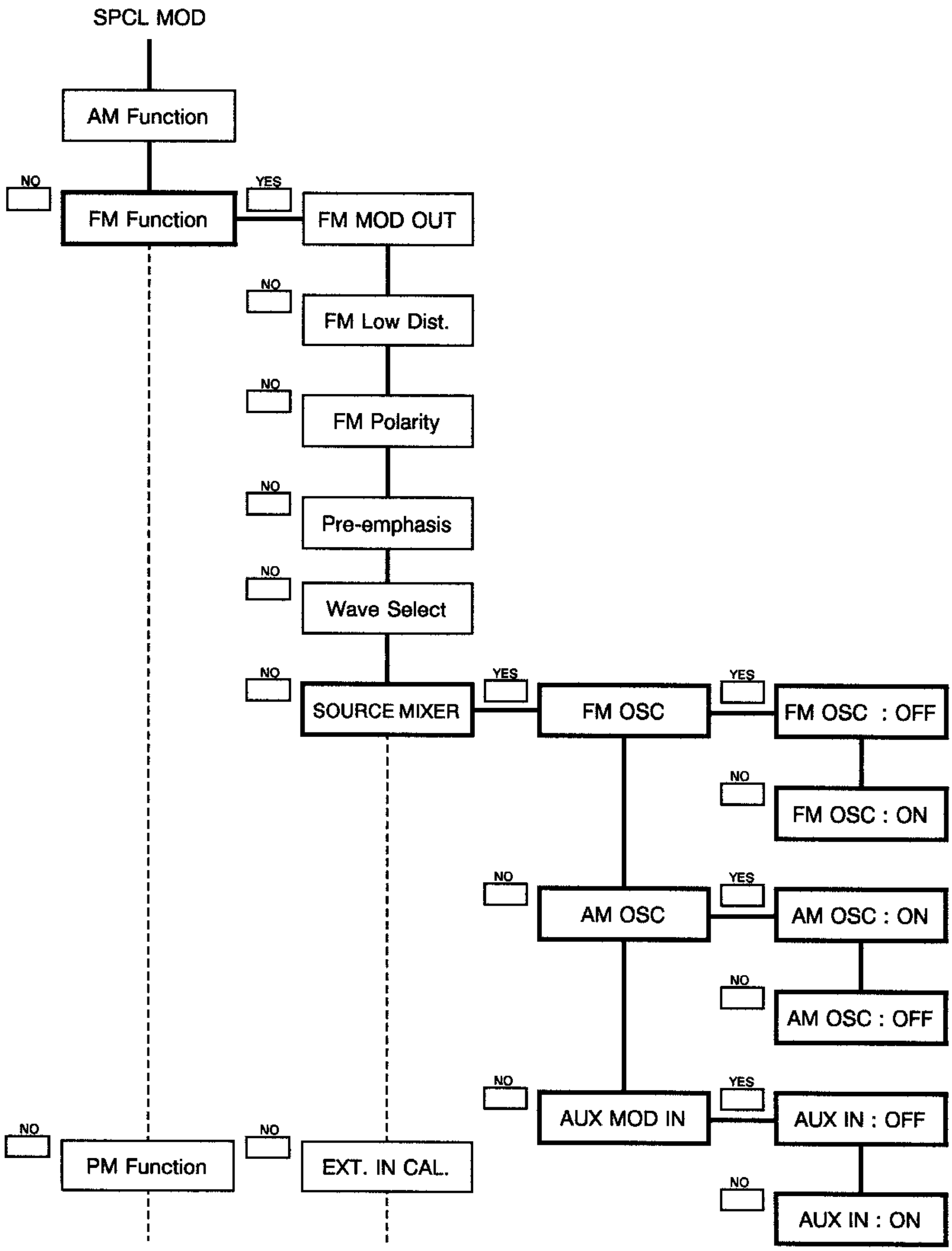
(3) Note

① The SOURCE MIXER function will be set to the "FM OSC : ON" , "AM OSC : OFF" , or "AUX IN : OFF" state forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the SORUCE MIXER function to ON or OFF (indicated by either "FM OSC: ON", "AM OSC: ON", "AUX IN: ON", or "FM OSC: OFF", "AM OSC: OFF", "AUX IN: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the SOURCE MIXER function. Therefore, when any function key is pressed after the [YES] key, the SOURCE MIXER function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ When the SOURCE MIXER function is used to mix two or three FM signals, the total of the modulation deviations of the individual FM signals must not exceed the maximum modulation deviation.

(4) Operational Map for SOURCE MIXER Function



3.6.10 External FM Signal Calibration : EXT.IN CAL.

(1) Description

When one of the external FM functions, EXT AC FM function, is set, an external FM signal input from the FM IN terminal (EXT AC FM signal), when falling within the frequency range of 0.9 to 1.1 $V_{P\text{-}P}$, will be calibrated antomatically to a preset modulation depth with an accuracy of ±7% ±10Hz by the internal Auto Gain Control (AGC) circuit built in the equipment. This function implemented by the AGC circuit is called the external FM signal calibration (EXT. IN CAL.) function and will be abled whenever the EXT AC FM function is set. However, this function can be disabled by key operation described in (2) Procedure. When an EXT AC FM signal exceeding the above specified frequency range is being used, this function should rather be disabled.

(2) Procedure

To set the EXT IN CAL function, use the [4 / SPCL MOD] key.

(3) Note

① The EXT IN CAL function will be set to the following states forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order):

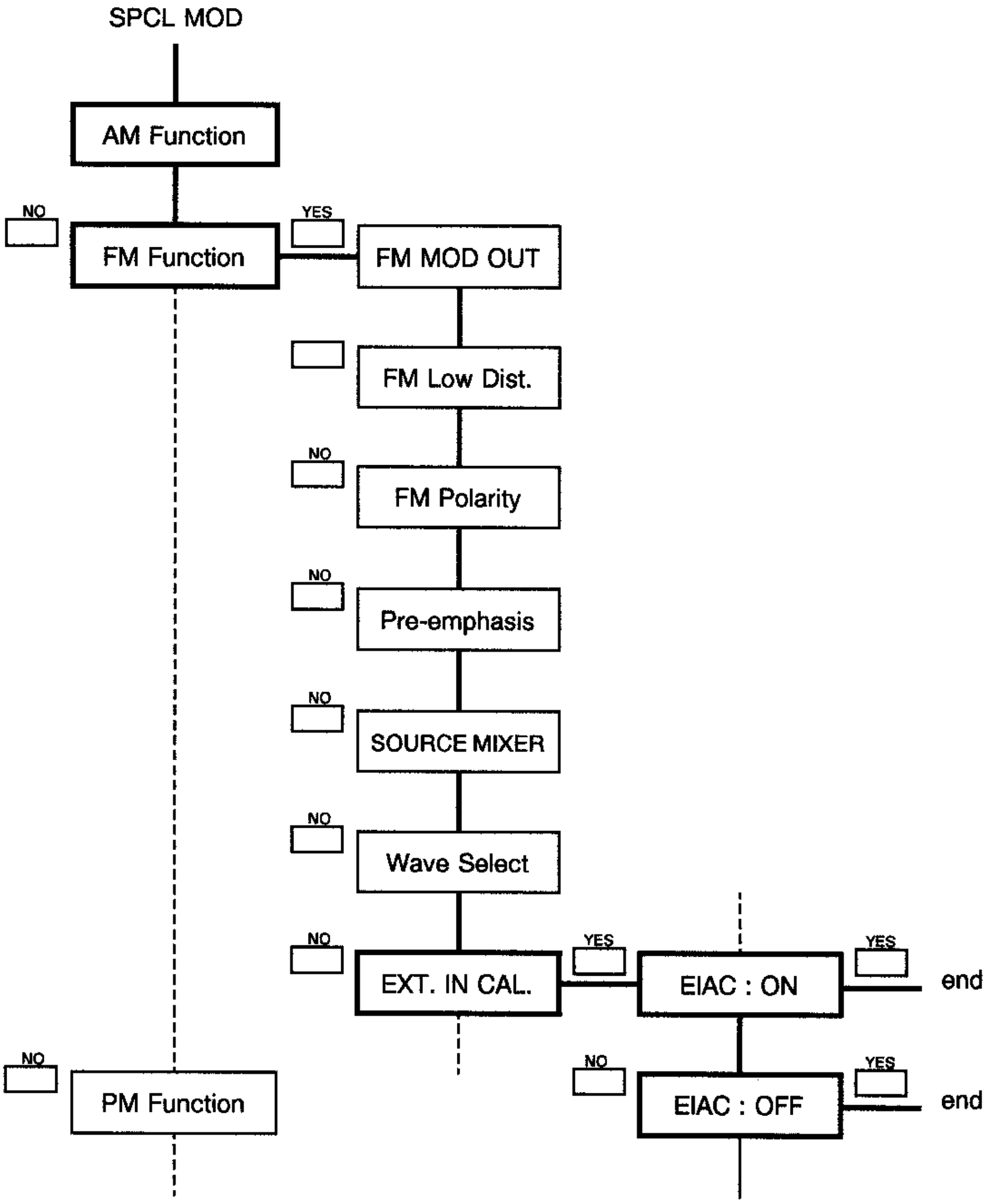
EXT AC . . EIAC ON
EXT DC . . EIAC OFF

The EXT IN CAL function will be set to the following states when switching is made between the internal FM (INT FM) function and the external FM (EXT AC/DC FM) function:

INT . . . . . EIAC ON
EXT AC . . EIAC ON
EXT DC . . EIAC OFF

② When the [NO] key is pressed to select whether to set the EXT IN CAL function to the ON or OFF (indicated by "EIAC : ON" or "EIAC : OFF", respectively, displayed in the message window), it will antomatically be set to the selected state even if the [YES] key is not pressed to complete the EXT IN CAL function. Therefore, when any function key is pressed after the [NO] key, the EXT IN CAL function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for EXT IN CAL Function



3.6.11 Wide-band FM Setting : WIDE FM

(1) Description

The wide-band FM setting (WIDE FM) function allows setting of wide-band FM with the maximum deviation of over 800kHz. The WIDE BAND function has three modes: WIDE FM 1, WIDE FM 2, and WIDE FM 3, each of which allows the maximum modulation deviation of 28MHzp-p. A wide-band FM signal cannot be input from the internal FM oscillator built in the equipment but can only be input from an external source, i.e. the wide-band FM signal input (WIDE FM IN) terminal to the front panel.

Table 3.6-3 shows the characteristics of the WIDE FM function.

Table 3.6 - 3 Characteristics of WIDE FM Function

Electrical characteristics	Range	Setting conditions
WIDE FM 1 Maximum modulation deviation *1 Modulation frequency Input impedance	 > 28MHz$_{P-P}$ 20Hz to 300kHz (3dB bandwidth) Approx. 10kΩ	 Uses 10kHz rectangular-wave modulation signals in Band 7 and HET Band. Valid when the CW mode is set.
WIDE FM 2 Maximum modulation deviation *2 Modulation frequency Input impedance	 > 28MHz$_{P-P}$ 20Hz to 1MHz (3dB bandwidth) Approx. 50kΩ	 Uses 10kHz rectangular-wave modulation signals in Band 7 and HET Band. Valid when the CW mode is set.
WIDE FM 3 Maximum modulation seviation	(Analog wide-band frequency sweep) > 28MHz$_{P-P}$	 Uses 10kHz rectangular-wave modulation signals in Band 7 and HET Band.
Modulation frequency Input impedance	DC to 300kHz (3dB bandwidth) DC to 1MHz (3dB bandwidth) Approx. 10kΩ Approx. 50kΩ	WIDE FM 1 + WIDE FM 3 WIDE FM 2 + WIDE FM 3 WIDE FM 1 + WIDE FM 3 WIDE FM 2 + WIDE FM 3
Combination of R4262 with TR45101 Maximum modulation deviation *2 Modulation frequency	 >20MHz$_{P-P}$ 20Hz to 8.5MHz DC to 8.5MHz	 Uses 10kHz rectangular-wave modulation signals in Band 7 and HET Band. Valid when the CW mode is set. WIDE FM 2 + WIDE FM 3

*1: Measured when the wide-band FM signal amplitude ranges from 2.5 to 3V$_{P-P}$.
*2: Measured when the wide-band FM signal amplitude ranges from 5 to 6V$_{P-P}$.

The WIDE FM 3 mode allows the low-band frequency of a wide-band FM signal in the WIDE FM 1 and 2 modes to be modulated when the signal is direct current (DC). When the equipment is set to the WIDE FM 3 mode, it will automatically enter the analog wide-band frequency sweep accordingly but will not make no sweep or panel display because it sets a sweep span to 0Hz.

The WIDE FM 1 and 2 modes are also abled when the analog frequency sweep mode is set.

(2) Procedure

① WIDE FM 1 Mode Setting

To set the WIDE FM 1 mode to on, press the SHIFT and INT (WIDE FM1) keys in this order.

To set the WIDE FM 1 mode to off, press the ALL OFF key.

② WIDE FM 2 Mode Setting

To set the WIDE FM 2 mode to on, press the SHIFT and EXT AC (WIDE FM2) keys in this order.

To set the WIDE FM 2 mode to off, press the ALL OFF key.

③ WIDE FM 3 Mode Setting

To set the WIDE FM 3 mode to on, first turn on the WIDE FM 1 or 2 mode and then press the SHIFT and EXT DC (WIDE FM3) keys in this order. Depending on whether the WIDE FM 3 mode is set to on after the WIDE FM 1 or 2 mode, the 3dB bandwidth and the input impedance of the WIDE FM IN terminal will differ as follows:

When the WIDE FM 3 mode is set to on after the WIDE FM 1 mode:

3dB bandwidth : DC to 300kHz
Input impedance : 10kΩ

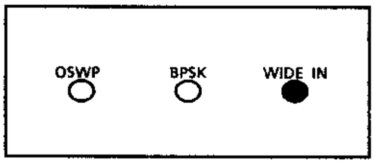
When the WIDE FM 3 mode is set to on after the WIDE FM 2 mode:

3dB bandwidth : DC to 1MHz
Input impedance : 50 Ω

When the WIDE FM 1 or 2 mode is set to on after the WIDE FM 3 mode, the WIDE FM 3 mode will be replaced by the WIDE FM 1 or 2 mode, respectively. To set the WIDE FM 3 mode to off, press the ALL OFF key.

(3) Note

① When any of the WIDE FM 1, 2, and 3 modes is on, the WIDE FM lamp on the bottom left of the front panel as shown in the figure below :



Conversely, when the WIDE FM lamp is off, all the WIDE FM 1, 2, and 3 modes are off.

② The maximum modulation deviation of the WIDE FM function differs depending on which freqency band is used as shown in the table below :

	Band					
	HET, 7	6	1, 5	4	3	2
Maximum modulation deviation (MHz_{P-P})	28	14	7	3.5	1.75	0.875

③ The WIDE FM function will be set to off when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

3.7 Phase Modulation (øM)

The R4262 performs the øM functions by using an øM signal output from its internal low-frequency øM oscillator (internal øM (INT øM) function) or by using an øM signal input from external sources (external øM (EXT AC/DC øM) function). The internal oscillator is available in two types : øM (FM) oscillator and AM oscillator. The SOURCE MIXER function allows combined use of the output signals of these two types of internal oscillators for the øM functions. Still another øM signal can be derived from the auxiliary modulation signal input terminal AUX MOD IN on the rear panel.

Note

1. The øM function is disabled when the analog frequency sweep function is set.
2. To initialize the equipment, press the SHIFT and FUNCTION (PRESET) keys in this order.

Table 3.7-1 shows the phase modulation characteristics of the R4262.

Table 3.7 - 1 Phase Modulation Characteristics (1/2)

Electrical characteristics	Range	Setting conditions
Maximum modulation deviation	(Modulation frequency = 1kHz) When the unit of "rad" is set When the unit of "deg" is set	
	300 rad 150deg	Band 7, HET
	150 rad ———	Band 6
	75 rad ———	Band 5, 1, lex
	37.5 rad ———	Band 4
	18.7 rad ———	Band 3
	9.3 rad ———	Band 2
Specified resolution	Resolution (Specified DEV)	
	0.1 rad (300 to 32.1rad) 0.01 rad (32.00 to 3.21rad) 0.001rad (3.200 to 0rad) 0.1 deg (150 to 15.1deg) 0.01 deg (15.00 to 1.51deg) 0.001deg (1.500 to 0deg)	Band 7, HET
	0.1 rad (150 to 16.1rad) 0.01 rad (16.00 to 1.61rad) 0.001rad (1.600 to 0rad)	Band 6
	0.1 rad (75 to 8.1rad) 0.01 rad (8.00 to 0.81rad) 0.001rad (0.800 to 0rad)	Band 1, lex 5

Table 3.7 - 1 Phase Modulation Characteristics (2/2)

Electrical characteristics	Range	Setting conditions
Specified resolution (Continued)	Resolution (Specified DEV) 0.1 rad (300 to32.1rad) 0.01 rad (32.00 to 3.21rad) 0.001rad (3.200 to 0rad)	Band 4
	0.1 rad (300 to32.1rad) 0.01 rad (32.00 to 3.21rad) 0.001rad (3.200 to 0rad)	Band 3
	0.1 rad (300 to32.1rad) 0.01 rad (32.00 to 3.21ra) 0.001rad (3.200 to 0rad)	Band 2
Specified accuracy	Set value ±10%	Modulation frequency = 1kHz
øM distortion	Demodulation frequency bandwidth = 20Hz to 20kHz <2%	When the unit of "rad" is set Modulation frequency = 1kHz Modulation deviation = 5rad
øM 3dB bandwidth	20Hz to 2.66kHz DC to 320kHz	When the EXT DC øM function and the unit of "rad" are set When the EXT DC øM function and the unit of"deg" are set

3.7.1 øM Turn-On/off and øM Depth Setting : øM ON/OFF, øM DEVIATION

(1) Description

To turn on the øM function, press one of the frequency digit setting keys [øM] or one of the data entry keys øM [FM]. To turn off the øM function, press either of two frequency digit setting keys ALL OFF [ ] and MOD OFF [ ]. Pressing the ALL OFF [ ] key will turn off all the modulation functions currently set. On the contrary, pressing the MOD OFF [ ] key will turn off only the øM function when the øM lamp is on. When the øM lamp is off, press either [øM] or øM [FM] key before the MOD OFF [ ] key. The lamp of the [øM] or øM [FM] key is on and off when the øM function is on and off, respectively.

To set øM depth with ten keys, also use either the [øM] or øM [FM] key. Then, øM frequency and internal øM frequency will be displayed on the modulation display lamps (internal øM frequency will not be displayed when the external øM (EXT AC/DC øM) function is set) and the ten keys will get ready for entering øM depth values. As a unit key for øM depth, use the −dBm [MHz] %mV key.

The modulation depth/deviation adjustment knob can be used to increment or decrement, by one, modulation depth digits set with the modulation depth/deviation digit setting keys [←] and [→] . Turning the knob clockwise and counterclockwise will increment and decrement modulation depth digits, respectively.

(2) Example

Turn on the øM function and set øM deviation to 32 rad.

	FUNCTION	DATA ENTRY
Key operation	[øM]	[3] [2] [GHz] (+dBu, rad, V)
GPIB	PM32RD	

Indications

øM	DEV
1.00 kHz	32.0 rad

Then, the øM function will be turned on and øM deviation will be set to 32 rad.

3.7.2 Setting Internal øM and Internal Modulation Frequency : INT, MOD FREQ

(1) Description

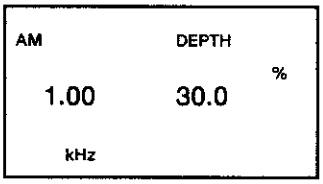
The equipment performs the internal øM (INT øM) function by using its internal low-frequency øM oscillator, which is available in two types: øM oscillator for generating øM signals and øM oscillator for generating øM signals. Table 3.7-2 shows the characteristics of the internal øM oscillator.

Table 3.7 - 2 Characteristics of Internal Modulation Oscillator

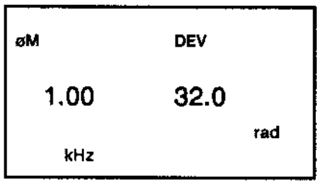
Electrical characteristics	Range	Setting conditions
Oscillating frequency	20Hz to 100kHz	
Frequency resolution	1% of any set value	
Frequency accuracy	Any set value ±3%	
Output frequency band	$1V_{P-P}$ (under load of 600Ω)	
Output frequency resolution	$1mV_{P-P}$	
Distortion	< 0.04% < 1% (Output frequency : $0.2V_{P-P}$)	20Hz to 20kHz >20kHz
Output frequency accuracy	Any set value ±4%	
Output impedance	600Ω ± 10%	

(2) Procedure

To start the INT øM function, press one of the modulation digit setting keys INT when the øM lamp is on, indicating that the øM function is set. Then, the lamp of the INT key will come on, indicating that the INT øM function has been started. This lamp will not come on when the external øM (EXT AC/DC øM) function is set. When the øM function is set simultaneously with the AM function, pressing the INT key will start any of the INT øM and INT AM functions that is indicated on any of the corresponding modulation display lamps øM and AM. For example, when the øM lamp is on with both the øM and AM functions set, pressing the INT key will start not the INTøM function but the INT AM function (see the figures on the top of the next page).



Pressing the INT key will start the INT AM function.



Pressing the INT key will start the INT øM function.

Upon starting of the INT øM function, the output frequency of the internal øM oscillator will be displayed on the left modulation display lamps. Nothing will be displayed on the left modulation display lamps when the EXT AC/DC øM function is set.

To set internal øM frequency with the øM frequency setting (øM MOD FREQ) function, use the ten keys or modulation frequency digit adjustment knob. The ten keys can be used to enter any desired øM frequency value after one of the data entry keys [MOD FREQ] or [INT] key is pressed. The modulation frequency adjustment knob, when turned clockwise and counterclockwise, will increment and decrement, by one, modulation frequency digits set with the modulation frequency digit setting keys [←] and [→] .

(3) Example

Set internal øM frequency to 1kHz when the øM lamp is currently on.

	FUNCTION	DATA ENTRY
Key operation	[INT]	[1] [kHz] (+dBu, s, uV)
	[MOD FREQ]	
GPIB	MFC1KZ	

Indications

øM	DEV
1.00 kHz	32.0 rad

Then, internal øM frequency will be set to 1kHz.

3.7.3 External øM Setting : EXT AC/DC

(1) Description

The equipment performs the external øM (EXT AC/DC øM) function with øM signals input from external sources, i.e. the external øM signal input (FM IN) terminal on the front panel and the auxiliary modulation input (AUX MOD IN) terminal on the rear panel. This section describes the EXT AC/DC øM function using øM signals input from the FM IN terminal. For the EXT AC/DC øM function using øM signal input from the AUX IN terminal, see Section 3.7.7 " øM signal Mixing: SOURCE MIX Function".

(2) Procedure

To start the EXT AC/DC øM function, press the [EXT AC] or [EXT DC] key when the øM lamp is on, indicating that the øM function is set. Pressing the [EXT AC] or [EXT DC] key causes AC coupling or DC coupling, respectively, of an øM signal input from the FM IN terminal. Then, the lamp of the [EXT AC] or [EXT DC] key will come on, respectively. The lamp will will not come on when the internal øM (INT OM) function is set. When the øM function is set simultaneously with the øM and øM functions, pressing the [EXT AC] or [EXT DC] key will start any of the EXT AC/DC øM, EXT AC/DC øM, and EXT AC/DC øM functions that is indicated on any of the corresponding modulation display lamps øM, øM, and øM. For example, when the AM lamp is on with both the øM and AM functions set, pressing the [EXT AC] or [EXT DC] key will start not the EXT AC øM or EXT DC øM function but the EXT AC AM or EXT DC AM function.

AM	DEPTH
1.00	30.0 %
kHz	

Pressing the [EXT AC] key will start the EXT AC AM function.
Pressing the [EXT DC] key will start the EXT DC AM function.

øM	DEV
1.00	32.0 rad
kHz	

Pressing the [EXT AC] key will start the EXT AC øM function.
Pressing the [EXT DC] key will start the EXT DC øM function.

(3) Note

① When the EXT AC/DC øM function is set, the output frequency of the internal øM oscillator will be erased from the left modulation display lamps.

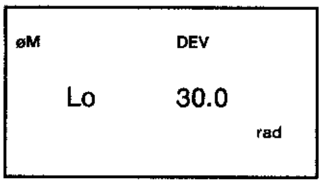
When the EXT AC/DC øM function is set, the INT øM function is disabled.

② An external øM signal input from the FM IN terminal for the EXT AC øM function (EXT AC øM signal) differs from that for the EXT DC øM function (EXT DC øM signal) as shown in the table below. More specifically, the EXT AC øM signal, when falling within the amplitude range specified in the table below, will be calibrated automatically to a preset modulation depth by the internal Auto Gain Control (AGC) circuit built in the equipment while the EXT DC øM signal will not. Thus, the latter signal must be adjusted manually to fall within the specified amplitude range.

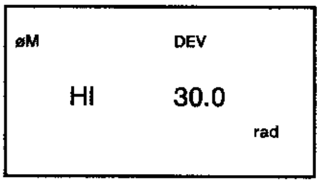
Amplitude Range of External øM Signals

	EXT AC øM Signal	EXT DC øM Signal
Automatic calibration by internal AGC circuit	Available	Not available
Amplitude range	0.9 to 1.1V_{P-P}	1V_{P-P} ± 1%

When an external øM signal, whether EXT AC øM signal or EXT DC øM signal, exceeds the frequnency band specified in the above table, a message "Hi" or "Lo" will be displayed in the modulation display lamps as follows:



When the lower limit of the specified frequency band is exceeded



When the upper limit of the specified frequency band is exceeded

In this event, the frequency of the eternal øM signal must be adjusted to fall within the specified frequency so that the message "Hi" or "Lo" may disappear from the modulation display lamps. Note that the above the sample messages apply to an external øM signal input from the FM IN terminal when the øM lamp is on. Therefore, when another lamp, e. g. the AM lamp is on, the message displayed on the modulation display lamps applies to an external AM signal input from the AM IN terminal.

3.7.4 Internal øM Signal Output : Setting PM MOD OUT

(1) Description

An internal low-frequency FM oscillator will function as an internal low-frequency øM oscillator. An internal øM signal, that is, an øM signal output from that FM oscillator can be output from the FM signal output (FM MOD OUT) terminal on the front panel by using the øM MOD OUT function.

(2) Procedure

To set the øM MOD OUT function, use the [4 / SPCL MOD] key.

(3) Note

① The øM MOD OUT function will be released forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the øM MOD OUT function to ON or OFF (indicated by " øM OUT : ON" or " øM OUT: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the øM MOD OUT function.

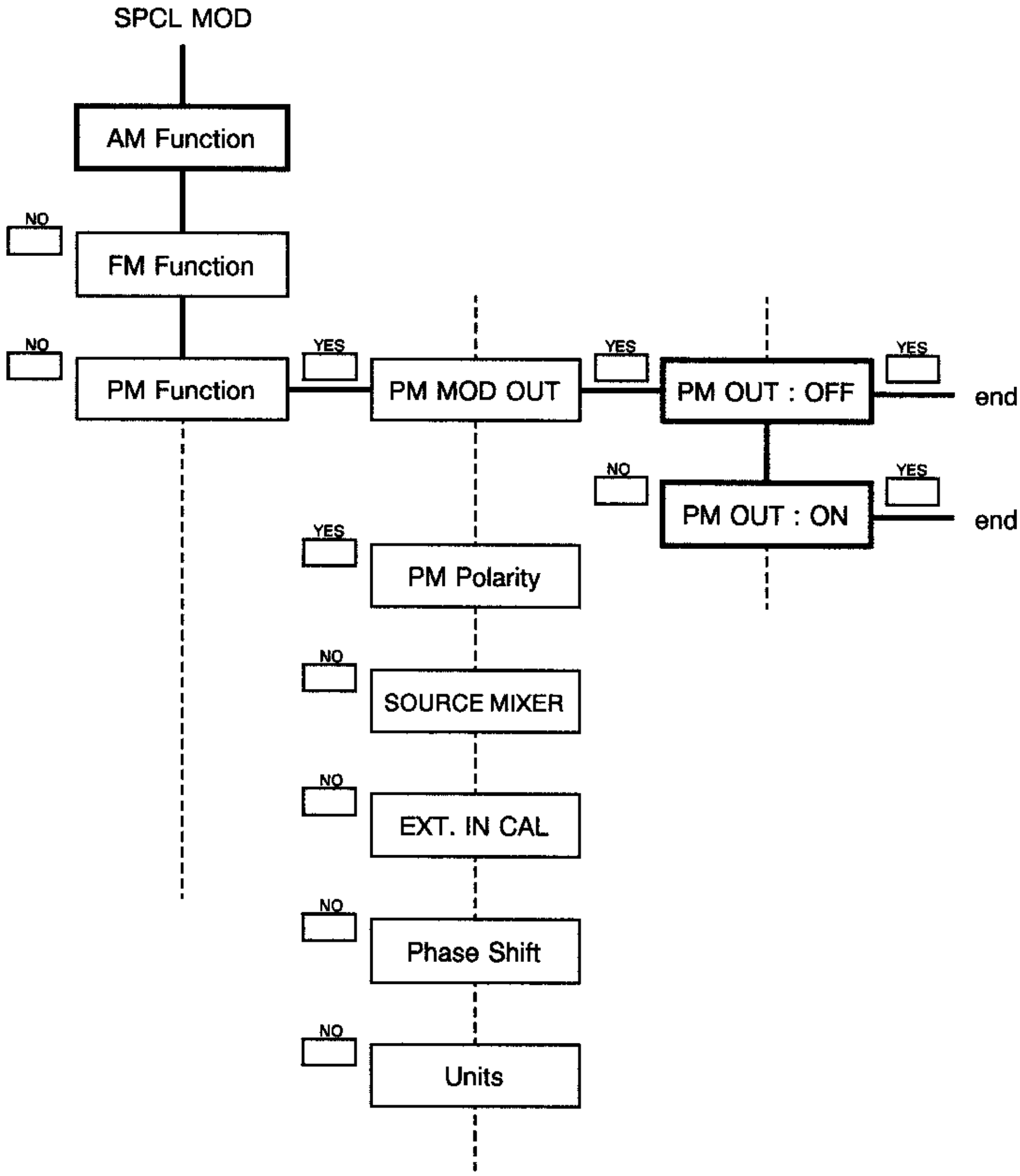
Therefore, when any function key is pressed after the [NO] key, the øM MOD OUT function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ The frequency of an internal øM signal output from the FM MOD OUT terminal by the øM MOD OUT function varies depending on preset øM depth as shown in Table 3.7-3. The output impedance of the FM MOD OUT terminal is 600Ω.

Table 3.7 - 3 Correspondence between øM Depth and Frequency of Internal øM Signal Output from FM MOD OUT Terminal

BAND	2	3	4	1, lex, 5	6	7, HET	Output voltage
DEV	10.0rad to 1.1rad	20.0rad to 2.1 rad	40.0rad to 4.1rad	80.0rad to 8.1rad	160.0rad to 16.1rad	320.0rad to 32.1rad	2.5mV_{P-P} /rad
	1.00rad to 0.11rad	2.00rad to 0.21rad	4.00rad to 0.41rad	8.00rad to 0.81rad	16.00rad to 1.61rad	32.00rad to 3.21rad	25mV_{P-P} /rad
	0.100rad to 0rad	0.200 rad to 0rad	0.400rad to 0rad	0.800rad to 0rad	1.600rad to 0rad	3.200rad to 0rad	250mV_{P-P} /rad

(4) Operational Map for øM MOD OUT Function



3.7.5 Setting øM Signal Phase Polarity Conversion : PM POLARITY

(1) Description

The R4262 allows conversion of the phase polarity of a mixed øM signal consisting of øM signals that are output from the internal øM oscillator and internal AM oscillator and input from the external øM signal input (FM IN) terminal on the front panel and auxiliary modulation input (AUX MOD IN) terminal on the rear panel (øM POLARITY function). (Note that the øM POLARITY) function does not affect an AM signal.)

(2) Procedure

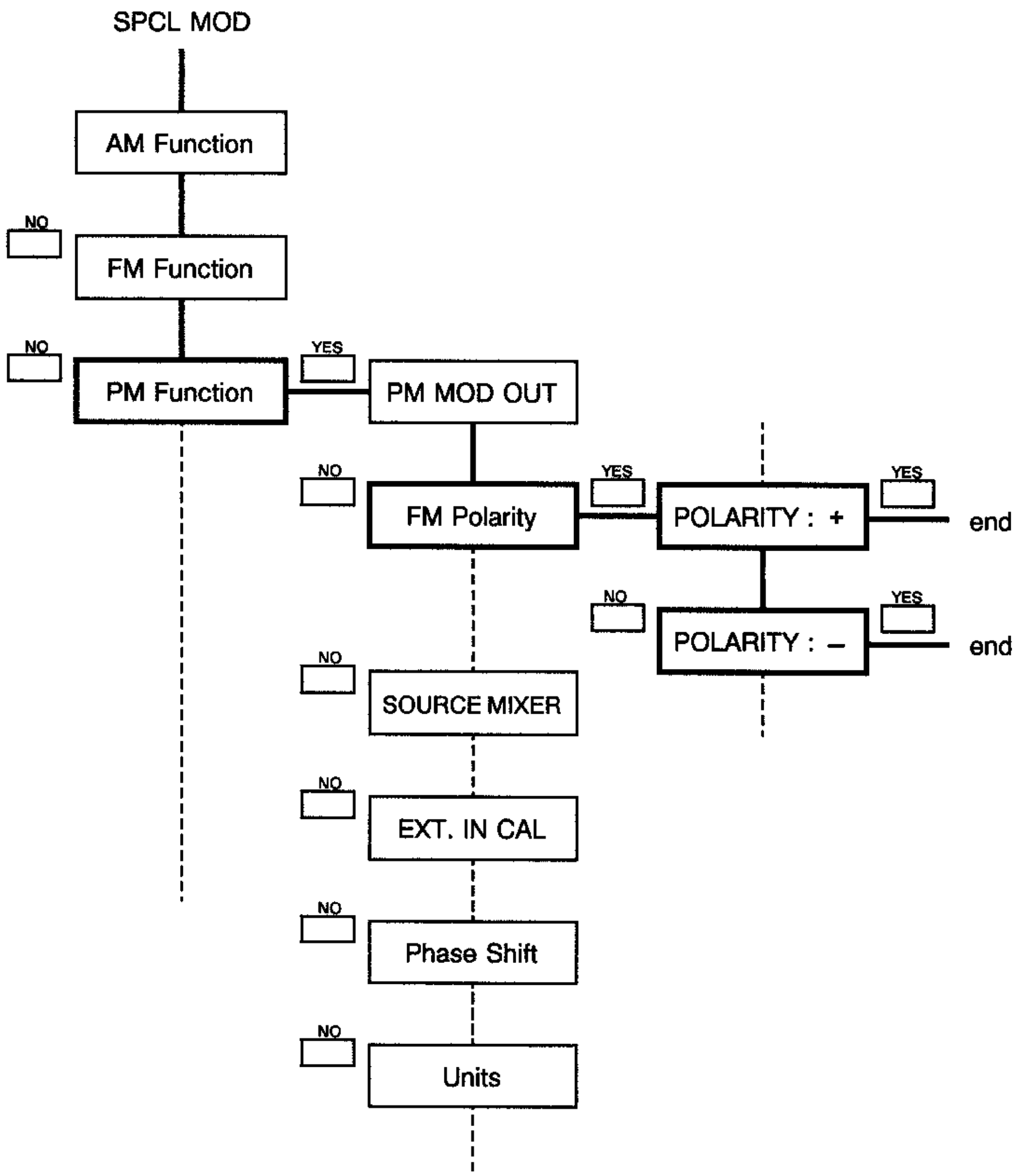
To set the øM POLARITY function, use the [4 / SPCL MOD] key.

(3) Note

① The øM POLARITY function will be set to the positive (+) polarity forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the øM POLARITY function to the positive (+) or negative (–) polarity (indicated by "POLARITY: +" or "POLARITY: –", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the øM POLARITY function. Therefore, when any function key is pressed after the [NO] key, the øM POLARITY function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for øM POLARITY Function



3.7.6 Setting øM Singal Mixing : SOURCE MIXER

(1) Description

Ordinarily, an øM signal is derived separately from the internal øM oscillator built in the equipment or the external øM signal input (øM IN) terminal on the front panel. When the øM signal mixing (SOURCE MIXER) function is set, an øM signal can be derived separately from the internal øM oscillator and internal AM oscillator that are built in the equipment and the auxiliary modulation input (AUX MOD IN) terminal on the rear panel, or øM signals output from these three different sources can be mixed together.

(2) Procedure

To set the SOURCE MIXER function, use the [4 / SPCL MOD] key.

Setting Modulation Conditions for AM Signal Mixing

When the internal AM oscillator built in the equipment is turned on, a message "AM OSC: ON" will be displayed in the message display window.

AM OSC : ON

In this event, the modulation digit setting keys, modulation digit adjustment knob, and two of the data entry keys [MOD FREQ] and [AM] will function to set the amplitude or frequency of an AM signal output from the AM oscillator. The amplitude of the output AM signal ranges from a minimum of 0 to a maximum of 4000 corresponding to the maximum modulation deviation of an FM signal output from the internal FM oscillator.

[AM] key and modulation digit adjustment knob	Set the amplitude of an AM signal output from the internal AM oscillator.
[MOD FREQ] key and modulation digit setting keys	Set the frequency of an AM signal output from the internal AM oscillator.

A modulation signal derived from the AUX MOD IN terminal will reach a modulation depth of 100 % at its amplitude of 1Vp-p (when both the internal AM and FM oscillators are off).

(3) Note

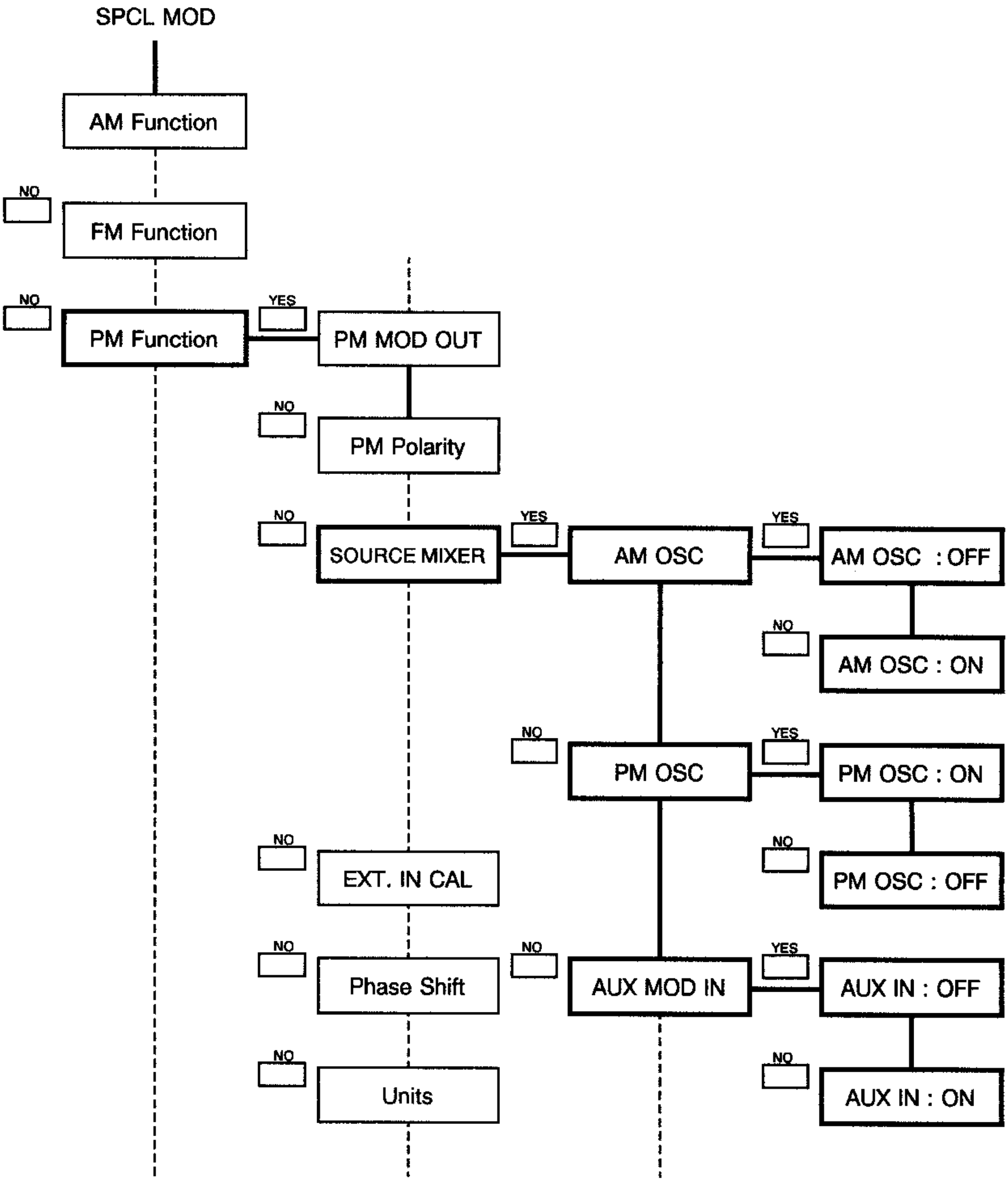
① The SOURCE MIXER function will be set to the "AM OSC : OFF," " øM OSC : ON ", or "AUX IN : OFF" state forcibly when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

② When the NO key is pressed to select whether to set the SOURCE MIXER function to ON or OFF (indicated by either "PM OSC: ON", "AM OSC: ON", "AUX IN: ON", or "PM OSC: OFF", "AM OSC: OFF", "AUX IN: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the YES key is not pressed to complete the SOURCE MIXER function.

Therefore, when any function key is pressed after the NO key, the SOURCE MIXER function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

③ When the SOURCE MIXER function is used to mix two or three øM signals, the total of the modulation deviations of the individual øM signals must not exceed the maximum modulation deviation.

(4) Operational Map for SOURCE MIXER Function



3.7.7 External øM Signal Calibration : EXT.IN CAL.

(1) Description

When one of the external øM functions, EXT AC øM function, is set, an external øM signal input from the øM IN terminal (EXT AC øM signal), when falling within the frequency band of 0.9 to 1.1 $V_{P\text{-}P}$, will be calibrated automatically to a preset modulation depth with an accuracy of ±7%±10Hz by the internal Auto Gain Control (AGC) circuit built in the equipment. This function implemented by the AGC circuit is called the external øM signal calibration (EXT IN CAL) function and will be abled whenever the EXT AC øM function is set. However, this function can be disabled by key operation described in (2) Procedure. When an EXT AC øM signal exceeding the above specified frequency band is being used, this function should rather be disabled.

(2) Procedure

To set the EXT IN CAL function, use the [4 / SPCL MOD] key.

(3) Note

① The EXT IN CAL function will be set to the following states forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order):

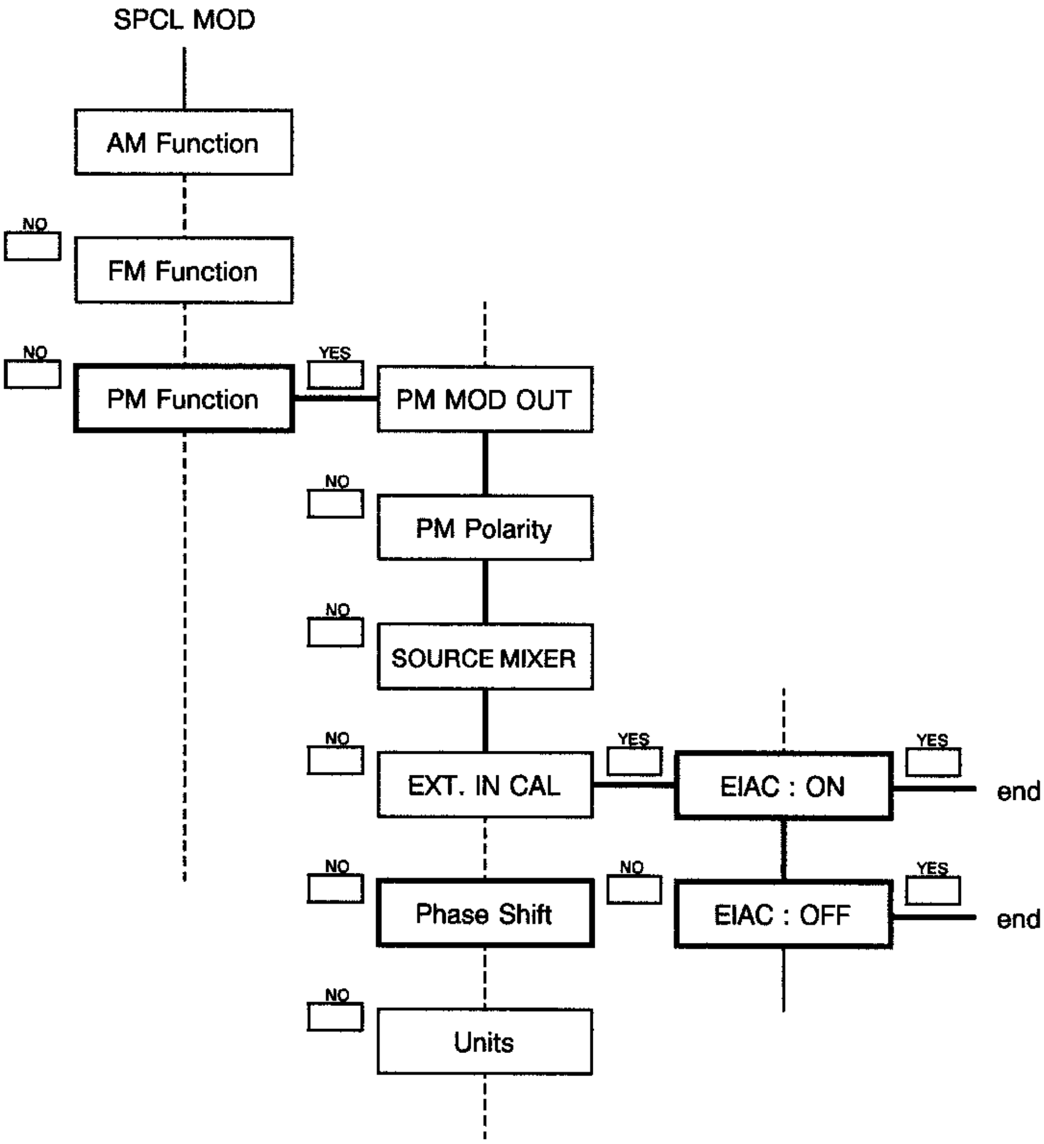
EXT AC ... EIAC ON
EXT DC ... EIAC OFF

The EXT IN CAL function will be set to the following states when switching is made between the internal øM (INT øM) function and the external øM (EXT AC/DC øM) function:

INT ...... EIAC ON
EXT AC ... EIAC ON
EXT DC ... EIAC OFF

② When the [NO] key is pressed to select whether to set the EXT IN CAL function to the ON or OFF (indicated by "EIAC: ON" or "EIAC: OFF", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the EXT IN CAL function. Therefore, when any function key is pressed after the [NO] key, the EXT IN CAL function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for EXT IN CAL Function



3.7.8 Phase Shifting : PHASE SHIFT

(1) Description

The R4262 allows shifting of a carrier wave phase (the phase shifting (PHASE SHIFT) function). The PHASE SHIFT function can be used to compare the phases of any two signals, perform downconversion, repress carrier waves, and other applications.

The PHASE SHIFT function can shift a carrier wave phase either in five fixed degrees (listed below) and in variable degrees ranging from 0 to 600 (listed in Table 3.7-4). The phase unit of "degree" is abbreviated simply as "deg" below.

① −180deg
② −90deg
③ 0deg .... Fixed
④ +90deg
⑤ +180deg
⑥ 0 to 600deg .... Variable (Depending on which band is selected)

Table 3.7 - 4 Characteristics of PHASE SHIFT Function (1/2)

Electrical characteristics	Range	Setting conditions
Maximum phase shift range	600deg 300deg 150deg 75deg 37deg 18deg	Band 7, HET Band 6 Band 1, Iex, 5 Band 4 Band 3 Band 2
Specified resolution	Resolution (Phase shift range) 1 deg (600 to 151deg) 0.1 deg (150.0 to 15.1deg) 0.01deg (15.0 to 0deg)	Band 7
	1 deg (300 to 76deg) 0.1 deg (75.0 to 7.6deg) 0.01deg (7.50 to 0deg)	Band 6
	1 deg (150 to 38deg) 0.1 deg (37.5 to 3.8deg) 0.01deg (3.75 to 0deg)	Band 1, Iex, 5
	1 deg (75 to 19deg) 0.1 deg (18.7 to 1.9deg) 0.01deg (1.87 to 0deg)	Band 4

Table 3.7 - 4 Characteristics of PHASE SHIFT Function (2/2)

Electrical characteristics	Range	Setting conditions
Specified resolution	Resolution (Phase shift range) 1 deg (37 to 9deg) 0.1 deg (8.9 to 0.9deg) 0.01deg (0.89 to 0deg)	Band 3
	1 deg (18 to 5deg) 0.1 deg (4.4 to 0.5deg) 0.01deg (0.44 to 0deg)	Band 2

(2) Procedure

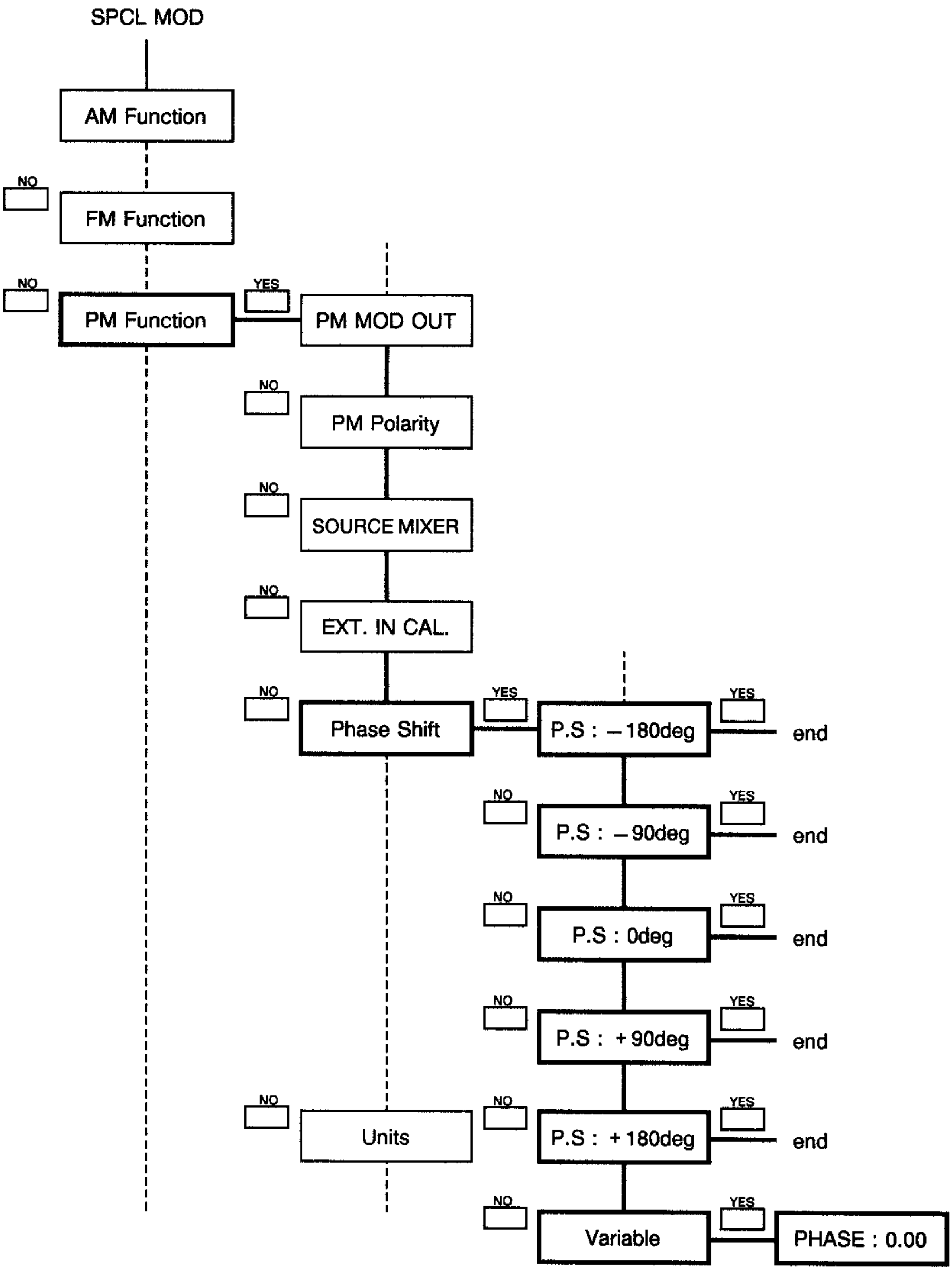
To set the PHASE SHIFT function, use the [4 / SPCL MOD] key.

(3) Note

① The PHASE SHIFT function will be set to a phase shift degree of 0 forcibly when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② To set the PHASE SHIFT function to off, select a phase shift degree of 0 to display "P.S: 0 deg" in the message window.

(4) Operational Map for PHASE SHIFT Function



3.7.9 Modulation Deviation Unit (rad/deg) Selection : UNITS

(1) Description

The R4262 allows setting of phase modulation deviation in two units of angles: degree and radian, which are abbreviated simply as "deg" and "rad", respectively. This is the modulation deviation unit selection (UNITS) function. The relationship between these two units is expressed by the equation : 180deg= pi rad, where the pi is the ratio of the circumference of a circle to its diameter.

Phase modulation deviation will be smaller when set in degrees than in radians and can be set in degrees only within Band 7 (2000MHz to 4500MHz) and HET Band (10mHz to 2000MHz).

(2) Procedure

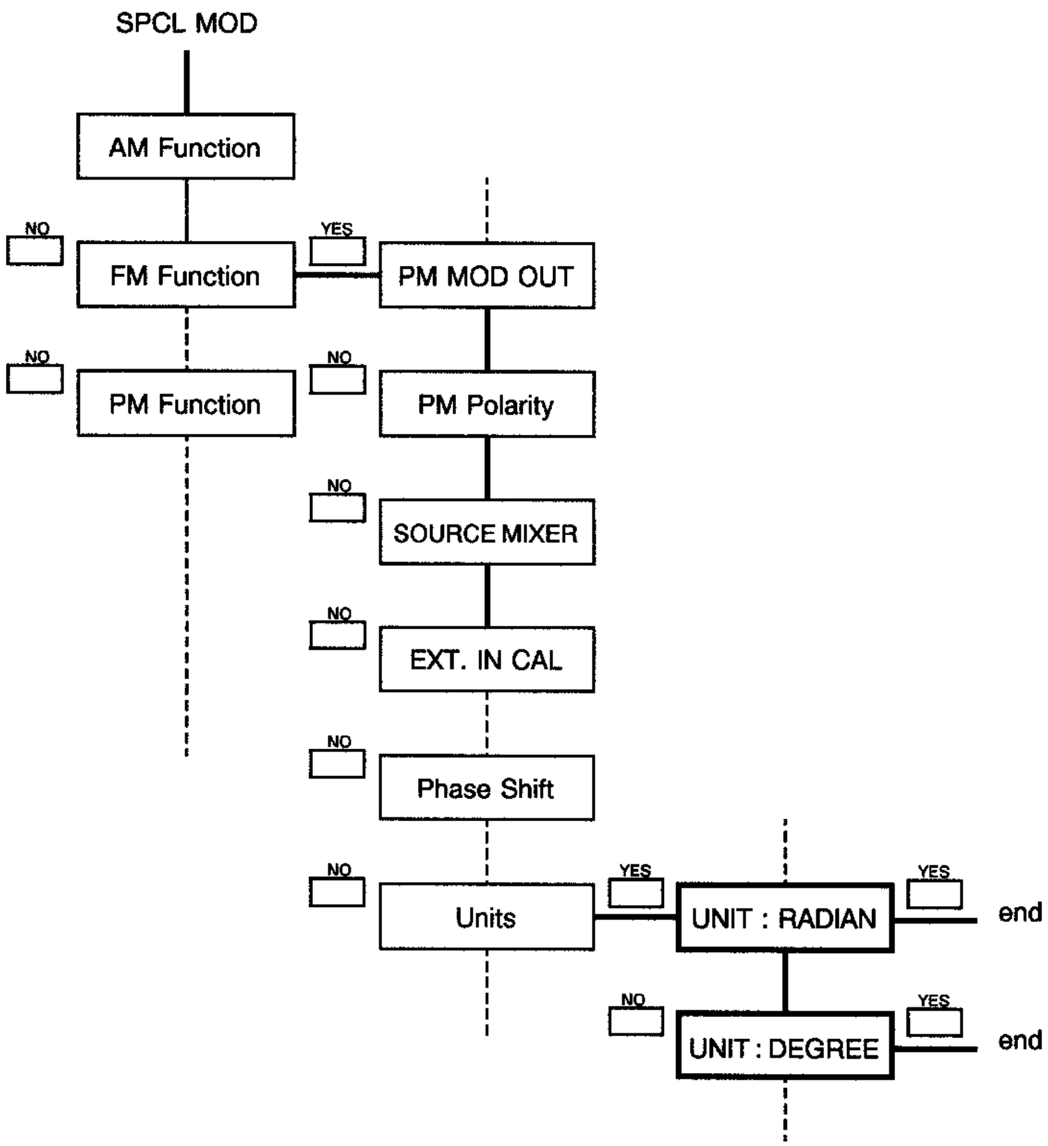
To set the UNITS function, use the 4 SPCL MOD key.

(3) Note

① The UNIT function will be set forcibly to select the unit of rad when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

② When the NO key is pressed to select whether to set the UNITS function to the "UNIT: RADIAN" or "UNIT : DEGREE" state, it will automatically be set to the selected state even if the YES key is not pressed to complete the UNITS function. Therefore, when any function key is pressed after the NO key, the UNITS function will be completed in the state indicated by the message window to cxecute the function corresponding to the pressed function key.

(4) Operational Map for UNITS Function



3.8 Pulse Modulation : PULSE

(1) Description

Table 3.8-1 shows the characteristics of the pulse modulation (PULSE) function.

Table 3.8 - 1 Characteristics of Pulse Modulation Function

Electrical characteristics	Range	Setting conditions
On-off ratio	>35dB >50dB	Band HET Band 7
Rise time/fall time	<2.5μs Time interval during which a pulse increases from 10 to 90 % or decreases from 90 to 10 % of its maximum amplitude.	
Minimum pulse width	5μs	
Repetitive frequency	30Hz to 50kHz	
Input threshold level	1.5V (Nominal value)	

(2) Turn-on Procedure

To turn on the PULSE function, press the PULSE key on the front panel. Then, its lamp will come on, indicatiog that the PULSE PULSE function has been turned on. Conversely, when the lamp is off, the PULSE function is also off.

A pulse modulation signal is input from the pulse modulation signal input (PULSE IN) terminal on the front panel. Its voltage amplitude ranges from 0V to +5V and its threshold voltage is 1.5V.

(3) Note

① Internal pulse modulation cannot be performed with the internal amplitude, frequency, or phase modulation oscillators built in the equipment.

② The PULSE function cannot be performed when the amplitude modulation (AM) function or amplitude sweep (A SWP) function is set.

(4) Turn-off Procedure

To turn off the PULSE function, use the [MOD OFF] or [ALL OFF] key on the front panel. When using the [MOD OFF] key, next press the [PULSE] key to specify turn-off the PULSE function.

When only the [ALL OFF] key is pressed, all the modulation functions will be turned off regardless of whether the PULSE function is currently on or not.

[PULSE] [MOD OFF] ...... Turns off only the pulse modulation function.
[ALL OFF] .... Turns off all the modulation functions.

(5) Example

Turn on the PULSE function.

	FUNCTION
Key operation	[PULSE]
GPIB	PL or PLON

The PULSE function can also be turned on and off with the GPIB codes PL or PLON, and PLOF, respectively.

3.9 Binary Phase Shift Keying : BPSK

(1) Description

The binaly phase shift keying (BPSK) function modulates two phases (+90°and −90°) with two TTL-level input signals. (Uses in degrees within Band 7 or HET Band.) Table 3.9-1 shows the characteristics of the BPSK function.

Table 3.9 - 1 Characteristics of BPSK Function

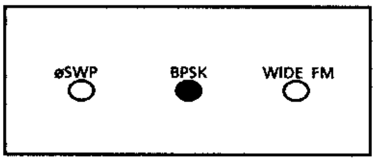
Electrical characteristics	Range	Setting conditions
Modulation rate	DC to 100kbps	Band 7, HET
Carrier null	>30dB	During modulation using a 100kHz rectangular-wave modulation signal
Input modulation signal	TTL level (0V to 5V: V_H > 2.4V, V_L < 0.4V)	

(2) Turn-on Procedure

To turn on the BPSK function, press the SHIFT and FM (BPSK) keys in this order.

SHIFT FM (BPSK) ...... Turns on the BPSK function.

Then, the BPSK lamp on the left bottom of the front panel will come on, indicating that the BPSK function has been turned on. Conversely, when the lamp is off, the BPSK function is also off.



A BPSK modulation signal is input from the external FM signal input (FM IN) terminal on the front panel. Its TTL-level voltage amplitude ranges from 0V to +5V.

(3) Turn-off Procedure

To turn off the BPSK function, use the MOD FREQ or ALL OFF key on the front panel.

MOD FREQ .... Turns off only the BPSK function.

ALL OFF .... Turns off all the modulation functions.

(4) Note

① The BPSK function cannot be performed with the internal amplitude, frequency, or phase modulation oscillator built in the equipment.

② The BPSK function cannot be performed when the frequency modulation (FM) function, phase modulation (øM) function, or frequency sweep (F SWP) function is set.

(5) Example

Turn on the BPSK function.

	FUNCTION
Key operation	SHIFT [ ] [FM] BPSK
GPIB	SHFM or BPON

The BPSK function can also be turned on with the GPIB code SHFM or BPON, and can be turned off with the GPIB code BPOF.

3.10 Phase Sweep

3.10.1 Phase Sweep Setting : øSWP

(1) Description

The R4262 allows sweep of the phase of a carrier wave with its frequency fixed. This is the phase sweep (øSWP) function. Table 3.10-1 shows the characteristics of the øSWP function.

Table 3.10 - 1 Characteristics of BPSK Function

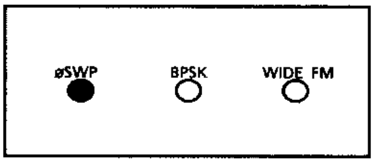
Electrical characteristics	Range	Setting conditions
Maximum span	600deg	Band 7, HET
	300deg	Band 6
	150deg	Band 1, lex, 5
	75deg	Band 4
	37deg	Band 3
	18deg	Band 2
Specified resolution		
	Resolution Span setting range	
	1 deg 600 to 151deg	
	0.1 deg 150.0 to 15.1deg	Band 7, HET
	0.01deg 15.0 to 0deg	
	1 deg 300 to 76deg	
	0.1 deg 75.0 to 7.6deg	Band 6
	0.01deg 7.50 to 0deg	
	1 deg 150 to 38deg	
	0.1 deg 37.5 to 3.8deg	Band 1, lex, 5
	0.01deg 3.75 to 0deg	
	1 defg 75 to 19deg	
	0.1 deg 18.7 to 1.9deg	Band 4
	0.01deg 1.87 to 0deg	
	1 deg 37 to 9deg	
	0.1 deg 8.9 to 0.9deg	Band 3
	0.01deg 0.89 to 0deg	
Specified resolution		
	Resolution Span setting range	
	1 deg 18 to 5deg	
	0.1 deg 4.4 to 0.5deg	Band 2
	0.01deg 0.44 to 0deg	
Sweep mode		
	AUTO (INF. , EXT. , LINE)	
	SINGLE, MANUAL	
Sweep time		
	Approx. 50ms to 100s	

(2) Turn-on Procedure

To turn on the øSWP function, press the SHIFT and øM (øSWP) keys in this order.

SHIFT øM (øSWP) . . . Turns on the øSWP function.

Then, the øSWP lamp on the left bottom of the front panel will come on, indicating that the øSWP function has been turned on. Conversely, when the lamp is off, the øSWP function is also off.



(3) Turn-off Procedure

To turn off the øSWP function, press the MOD OFF or ALL OFF key.

MOD OFF . . . . Turns off only the øSWP function.

ALL OFF . . . . Turns off all the modulation functions.

(4) Note

The øSPW function cannot be performed when the frequency modulation (FM) function, phase modulation (øM) function, binary phase shift keying (BPSK) function, or frequency sweep (FSWP) function is set.

(5) Phase Sweep Parameters

Phase offset : Start phase for phase sweep. Must not exceed the maximum phase span and will vary depending on which radiofrequency (RF) band is selected (see Table 3.10-1).

Phase span : Sweep span. Varies depending on which RF band is selected (see Table 3.10-1).

Sweep time : 50ms to 100s

Sweep trigger : INT, LINE, SINGLE and EXT

Sweep mode : Internal sweep mode, external sweep mode, and manual sweep mode

To set sweep time, sweep trigger, etc., press the [3 SWP TIME] and [0 A SWP], respectively (when the lamp of the [FUNCTION PRESET] key is on).

Select a desired sweep type (see (10) Operational Map for øSWP Function). When setting a sweep type displayed in the message window on the front panel, press the [YES] key; otherwise, press the [NO] key. Until the desired sweep type is displayed in the message window, press the [NO] key. When it is displayed, press the [YES] key. The following paragraphs describe the individual phase sweep types. Note that two sweep types FULL SWEEP and SCALING are disabled while the phase sweep function is set.

(6) Automatic Sweep (AUTO SWEEP Function)

Phase sweep performed automatically with internal sweep voltage during a sweep time set with the [3 SWP TIME] key.

Automatic sweep can be started with the following four types of triggers:

INT. TRIG : Starts antomatic sweep continuously at any time.

LINE TRIG : Starts automatic sweep synchronously with the AC LINE frequency (50/60Hz).

EXT. TRIG : Starts automatic sweep through a trigger signal input from the external trigger input terminal on the rear panel.

SINGLE TRIG : Starts automatic sweep each time the [YES] key is pressed.

(7) Manual Sweep (MANUAL Function)

Phase sweep performed manually by turning the frequency digit adjustment knob. Turning the knob clockwise and counterclockwise causes amplitude sweep in the direction of the start to stop frequencies and the stop to start frequencies, respectively.

(8) External Sweep (EXT. SWEEP Function)

Phase sweep performed with sweep voltage input from the sweep voltage input/output voltage on the rear panel. Sweep voltage is available in two ranges of 0V to 8V and −4V to +4V. The ramp voltages for the two voltage ranges can be varied to any desired value.

−4V to +4V: Inputs sweep voltage ranging from −4V to +4V.

0V to 8V : Inputs sweep voltage ranging from 0V to +8V.

Gain : Sets the amplitude of any sweep voltage in the stages of 0 to 255. For example, Stage 1 and Stage 255 provide about 2040V and 8V, respectively, for each sweep. Sweep voltage must be input within ±12V.

Offset : Sets the start voltage of any sweep voltage in the stages of 0 to 255. For example, Stage 0 and Stage 1 provide 0V and −8V, respectively.

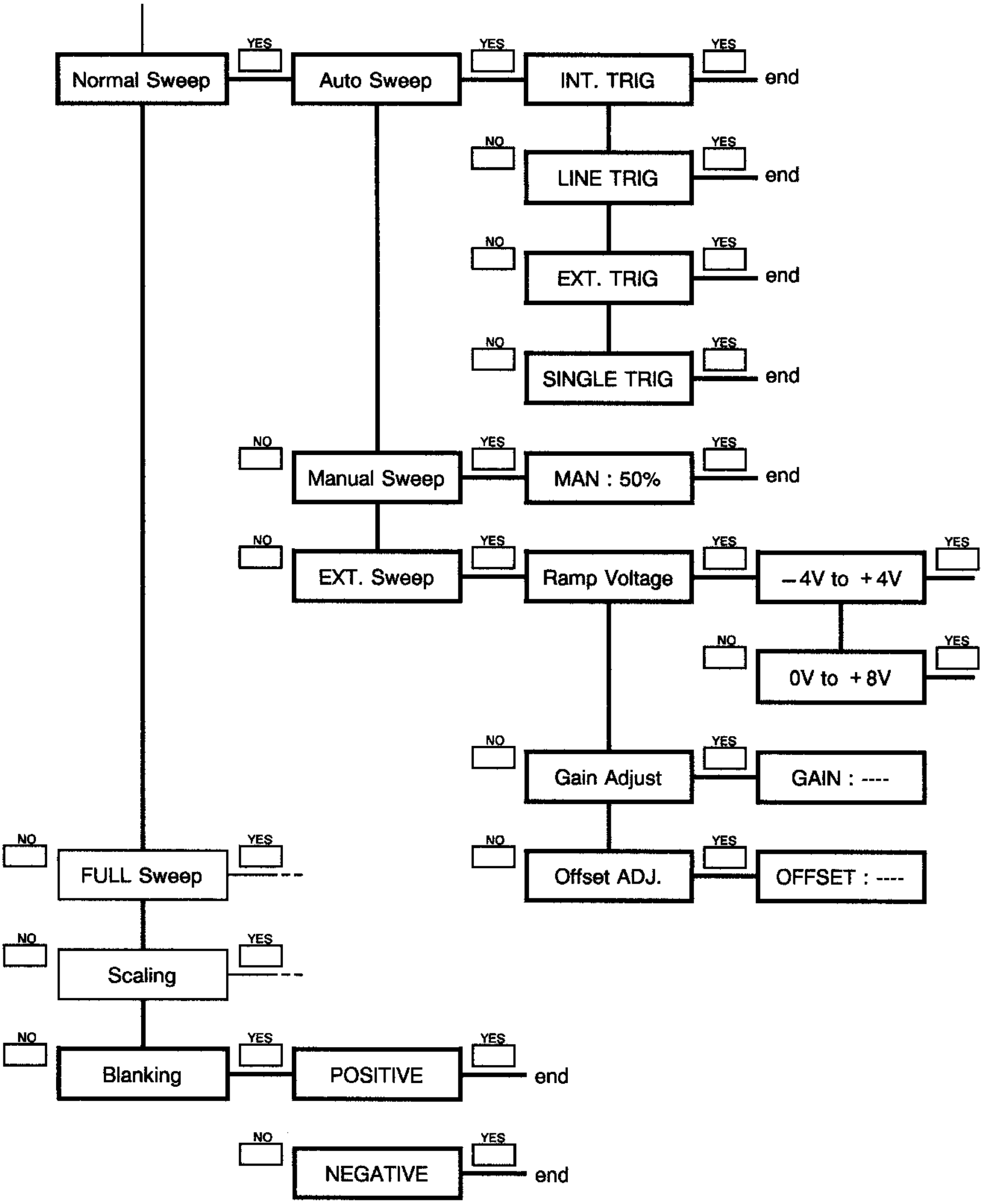
(9) Blanking Signal Setting (BLANKING Function)

Sets the polarity of a blanking signal output from the sweep blanking signal output terminal on the rear panel during a period of transit from the stop amplitude back to the start amplitude.

POSITIVE : Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to 5V during blanking.

NEGATIVE : Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to −5V during blanking.

(10) Operational Map for øSWP Function



3.10.2 Phase Sweep Offset Setting : OFFSET

(1) Description

There are two means for setting phase sweep offset: the ten keys and the modulation frequency digit adjustment knob.

Before using the ten keys, press the SHIFT and øM SWP keys in this order to select the phase offset setting (OFFSET) function (in the same manner as when setting the phase sweep setting (øSWP) function). Then, enter a desired value of phase sweep offset through the ten keys. As the unit key for phase sweep offset, use the -dBu ms nV deg key, (which will function as the unit of deg only).

The modulation frequency digit adjustment knob will function to be set phase sweep offset whenever the modulation display lamps indicate phase sweep.

(2) Example

Set phase sweep offset to 100 deg.

	FUNCTION	DATA ENTRY
Key operation	SHIFT øM SWP	1 0 0 -dBu ms nV deg
GPIB	PSA100DE	

Indications

øSWP	SPAN
100	00.0 deg

Then, phase offset sweep will be set to 100deg.

3.10.3 Phase Sweep Span Setting : SPAN

(1) Description

There are two means for setting phase sweep span: the ten keys and the modulation depth/modulation deviation digit adjustment knob.

Before using the ten keys, press the [MOD FREQ] key to select the phase sweep span setting (SPAN) function (when the modulation display lamps indicate phase sweep). Then, enter a desired value of phase sweep span through ten keys. As the unit key for phase sweep offset, use the [Hz] (-dBm, ms, nV, deg) key, (which will function as the unit of deg only).

The modulation depth/deviation digit adjustment knob will function to be set phase sweep span whenever the modulation display lamps indicate phase sweep.

(2) Example

Set phase sweep span to 50deg.

	FUNCTION	DATA ENTRY
Key operation	[MOD FREQ]	[5] [0] [Hz] (-dBm, ms, nV, deg)
GPIB	PSB50DE	

Indications

ØSWP	SPAN
50	50 deg

Then, phase sweep span will be set to 50deg.

3.10.4 Phase Sweep Time Setting : SWEEP TIME

(1) Description

Phase sweep time can be set with the ten keys. Confirm that the lamp of the FUNCTION/PRESET key is on, (If it is not on, press the FUNCTION/PRESET key.) press one of the function/memory keys 3/SWP TIME. Then, a phase sweep time currently set will be displayed in the message window as shown in the example below :

TIME : 500ms

Now, use the ten keys to enter a desired phase sweep time value with the range and resolution specified in the table below:

Range	Resolution
50ms to 999ms	1ms
1.0s to 9.9s	100ms
10s to 100s	1s

(2) Example

Set phase sweep time to 300ms.

	FUNCTION	DATA ENTRY
Key operation	3 / SWP TIME	3 0 0 Hz (-dBm / deg) ms / nV
GPIB	ST300MS	

Indications

TIME : 300ms

Then, phase sweep time will be set to 300ms.

3.11 Analog Frequency Sweep

3.11.1 Analog Frequency Sweep Function

(1) Description

The frequency sweep function is available in three types: the analog wide-band frequency sweep (A SWP) function, digital frequency sweep (D SWP) function, and analog narrow-band frequency sweep (±ΔF SWP) function. The A SWP function changes output frequencies continuously (linearly) while the D SWP function changes output frequencies discontinuously (in steps).

The ±ΔF SWP function provides the same frequency accuracy and stability as the DC FM function. This section describes the A SWP function. For the D SWP and ±ΔF SWP functions, see 3.12 and 3.13, respectively.

(2) Preparation

The A SWP function can be set by pressing the [7 / SPCL FUNCTION] key and the following data entry keys:

—— FREQ SWEEP ——

[START] [STOP] [CENTER] [SPAN]

When any of the above data entry keys [START], [STOP], [CENTER] and [SLOPE] are pressed, the frequency sweep function will be set immediately without any additional manual operation. In the initial state, the A SWP function will be set while the D SWP and ±ΔF SWP functions will be set once they are selected. If the [FREQUENCY] key is pressed after any of the frequency sweep functions is set, it will be released.

(3) Parameters for the A SWP function are as follows:

Start frequency : Fast frequency in the frequency band to be swept

100kHz to 120MHz
10MHz to 2000MHz
2000MHz to 4500MHz

Stop frequency : Last frequency in the frequency band to be swept

100kHz to 120MHz
10MHz to 2000MHz
2000MHz to 4500MHz

> **Note**
>
> When start and stop frequencies are set to less then 10MHz, the corresponding stop and start frequnencies must be set to less than 120MHz so that the resulting frequency band may range from 100kHz to 120MHz.
> When a frequency value of 2000MHz is to be crossed, the full-band frequency sweep (FULL SWEEP) function must be used (see 3.11.11 Full-band Frequency Sweep Setting: FULL SWEEP Function).

Center frequency	:	Middle frequency in the frequency band to be swept 100kHz to 120MHz 10MHz to 2000MHz 2000MHz to 4500MHz
Span	:	Width (band) of frequencies to be swept 0kHz to 2500MHz (when the ordinary frequency sweep functions are used) 0kHz to 4490MHz (when the full-band frequency sweep function is used)
Sweep time	:	Approx. 50ms to 100s
Sweep triggers	:	INT, LINE, SINGLE, and EXT
Sweep modes	:	Internal sweep mode, external sweep mode, and manual sweep mode

(4) Procedure

To set the A SWP function, press one of the function/memory keys [0 / A SWP] when the lamp of the [FUNCTION / PRESET] key is on.

To set the A SWP function after the D SWP function, press the [0 / A SWP] key. Select a desired sweep type (see (5) Operational Map for A SWP function). When setting a sweep type displayed in the message window on the front panel, press the [YES] key; otherwise, press the [NO] key. (Continue to press the [NO] key until the desired sweep type is displayed in the message window, whereupon, press the [YES] key.

> **Note**
>
> To initialize the equipment, press the [SHIFT] and [FUNCTION / PRESET] keys in this order.

The following paragraphs describe the individual analog wide-band frequency sweep functions :

① Automatic Sweep (AUTO SWEEP) Function

Analog wide-band frequency sweep performed automatically with internal sweep voltage during a sweep time set with the [3 / SWP TIME] key.

Automatic frequency sweep can be started with the following four types of triggers:

INT. TRIG : Starts automatic frequency sweep continuously at any time.

LINE TRIG : Starts antomatic frequency sweep synchronously with the AC LINE frequency (50/60Hz).

EXT. TRIG : Starts antomatic frequency sweep through a trigger signal input from the external trigger input (EXT TRIG IN) terminal on the rear panel.

SINGLE TRIG : Starts automatic frequency sweep each time the [YES] key is pressed.

② Manual Sweep (MANUAL) Function

Analog wide-band frequency sweep performed manually by turning the frequency digit adjustment knob. Turning the knob clockwise and counterclockwise causes frequency sweep in the direction of the start to stop frequencies and the stop to start frequencies, respectively.

③ External Sweep (EXT SWEEP) Function

Analog wide-band frequency sweep performed with sweep voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. Sweep voltage is available in two ranges of 0V to 8V and −4V to +4V. The ramp voltages or the two voltage ranges can be varied to any desired value.

−4V to +4V : Inputs sweep voltage ranging from −4V to +4V.

0V to 8V : Inputs sweep voltage ranging from 0V to +8V.

Gain : Sets the amplitude of any sweep voltage in the stages of 0 to 255. For example, Stage 1 and Stage 255 provide about 2040V and 8V, respectively, for each sweep. Sweep voltage must be input within ± 12V.

Offset : Sets the start voltage of any sweep voltage in the stages of 0 to 255. For example, Stage 0 and Stage 255 provide 0V and −8V, respectively.

④ Full-band Frequency Range (FULL SWEEP Function)

When a frequency value of 2000MHz is to be crossed, the full-band frequency sweep (FULL SWEEP) function must be used. The FULL SWEEP function allows sweep of a frequency band as wide as 10MHz to 4500MHz but only with the single trigger. At the crossing point of 2000MHz, waiting time required for frequency band switching will be added to frequency sweep time.

⑤ Scaling (SCALING Function)

The scaling (SCALING) function calibrates analog wide-band sweep frequencies (start frequency, stop frequency, center frequency, and span) to an accuracy of ±1% at the points of start and stop frequencies in accordance with a reference frequency set by the internal synthesizer built in the equipment.

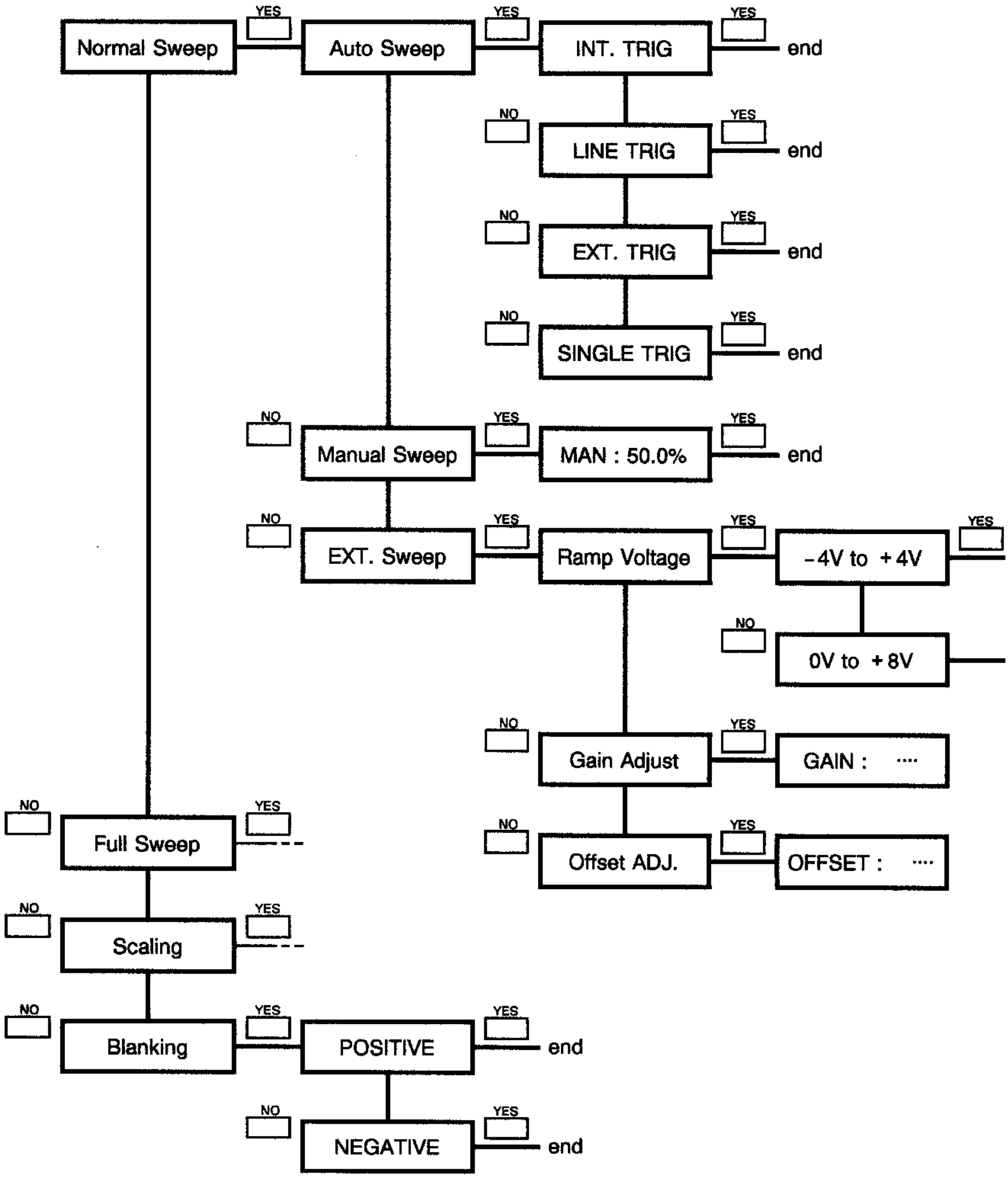
⑥ Blanking Signal Polarity Setting (BLANKING Function)

Sets the polarity of a blanking signal output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel during a period of transit from a stop frequency back to a start frequency.

POSITIVE : Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to 5V during blanking.

NEGATIVE : Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to −5V during blanking.

(5) Operational Map for A SWP Function



3.11.2 Analog Wide-band Frequency Sweep : A SWP

(1) Description

The analog wide-band frequency sweep (A SWP) function can be set by pressing the [0 / A SWP] key. When the lamp of the [FUNCTION / PRESET] key is on. When the A SWP function is set after the equipment is initialized, the individual parameters for the function will be set as follows :

Start frequency	:	1000MHz
Stop frequency	:	1500MHz
Sweep time	:	500ms
Sweep trigger	:	INT (Internal trigger)
Sweep mode	:	AUTO INT (Internal automatic sweep) mode

The above initial parameter values can be changed by following the instructions described in the subsequent paragraphs in this section.

(2) Example

Set the A SWP function.

	FUNCTION
Key operation	[FREQUENCY] [FUNCTION / PRESET] [0 / A SWP]
GPIB	SA

Indications

A SWP	START	
1	000	000
GHz	MHz	kHz

Then, the A SWP lamp will come on, indicating that the A SWP function has been set.

(3) Note

① Any frequency below 1kHz is invalid for the A SWP function.

② When the A SWP function is set, the frequency modulation.

(FM), phase modulation (øM), binary phase shift keying (BPSK), phase sweep (øSWP), and phase shift (PHASE SHIFT) functions are disabled. But the wide-band frequency modulation (WIDE FM) function can be used.

③ When the WIDE FM function is used together with the A SWP function, direct current waves can be modulated.

3.11.3 Start Frequency Setting : START

(1) Description

There are three means for setting a start frequency to be swept with the A SWP function: the keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the START key to select the start frequency setting (START (FREQ SWEEP)) function. When the START key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the A SWP function. Each time they are turned or pressed, they will increment or decrement, by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one but by the set step size.)

(2) Example

Set a start frequency for the A SWP function to 300MHz.

	FUNCTION	DATA ENTRY
Key operation	START	3 0 0 MHz
GPIB	FA300MZ	

Indications

A SWP	START	
300	000	
GHz	MHz	kHz

Then, a start frequency for the A SWP function will be set to 300MHz. The START key can also be used to switch a stop frequency to a start frequency for display on the carrier wave frequency display lamps.

3.11.4 Stop Frequency Setting : STOP

(1) Description

There are three means for setting a stop frequency to be swept with the A SWP function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the STOP key to select the stop frequency setting (STOP (FREQ SWEET)) function. When the START key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the A SWP function. Each time they are turned or pressed, they will increment or decrement, by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one but by the set step size.)

(2) Example

Set a stop frequency for the A SWP function to 820MHz.

	FUNCTION	DATA ENTRY
Key operation	STOP [ ]	[8] [2] [0] [MHz] (−dBm)
GPIB	FB820MZ	

Indications

A SWP	STOP	
	820	000
GHz	MHz	kHz

Then, a stop frequency for the A SWP function will be set to 820 MHz. The STOP [ ] key can also be used to switch a start frequency to a stop frequency for display on the carrier wave frequency display lamps.

3.11.5 Center Frequency Setting : CENTER

(1) Description

There are three means for setting a center frequency to be swept with the A SWP function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the CENTER [ ] key to select the center frequency setting (CENTER (FREQ SWEEP)) function. When the CENTER [ ] key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the A SWP function. Each time they are turned or pressed, they will increment or decrement, by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one but by the set step size.)

(2) Example

Set a center frequency for the A SWP function to 1250MHz.

	FUNCTION	DATA ENTRY
Key operation	CENTER [ ]	[1] [2] [5] [0] [-dBm MHz]
GPIB	FC1250MZ or CF1250MZ	

Indications

A SWP	CENTER	
	1250	000
GHz	MHz	kHz

Then, a center frequency for the A SWP function will be set to 1250MHz. The CENTER [ ] key can also be used to switch a frequency sweep span to a center frequency for display on the carrier wave frequency display lamps.

3.11.6 Frequency Sweep Span Setting : SPAN

(1) Description

There are three means for setting a span to be swept with the A SWP function : ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the SPAN [ ] key to select the center frequency setting (SPAN) function.

When the SPAN [ ] key is pressed, the frequency adjustment knob and the frequency step keys will function to set a frequency sweep span. Each time they are turned or pressed, they will increment or decrement, by one, span digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement span digits not by one but by the set step size.)

(2) Example

Set a sweep span for the A SWP function to 500MHz.

	FUNCTION	DATA ENTRY
Key operation	SPAN [ ]	[5] [0] [0] [MHz] (−dBm)
GPIB	FD500MHz or SP500MHz	

Indications

A SWP	SPAN	
500	000	
GHz	MHz	kHz

Then, a sweep span for the A SWP function will be set to 500MHz. The SPAN [ ] key can also be used to switch a center frequency to a frequency sweep span for display on the carrier wave frequency display lamps.

3.11.7 Sweep Time Setting : SWEEP TIME

(1) Description

Sweep time for the A SWP function can be set with ten keys. Confirm that the lamp of the FUNCTION [ ] PRESET key is on. (If it is not on, press the FUNCTION [ ] PRESET key.) Press the 3 [ ] SWP TIME key. Then, a sweep time currently set for the A SWP function will be displayed in the message window as follows :

TIME : 500ms

Enter a desired sweep time value through ten keys within a range and with resolutions specified in the table below :

Range	Resolution
50ms to 999ms	1ms
1.0s to 9.9s	100ms
10s to 100s	1s

(2) Example

Set a sweep time for the A SWP function to 300ms.

	FUNCTION	DATA ENTRY
Key operation	3 [ ] SWP TIME	[3] [0] [0] [Hz] (−dBu / ms / nV / deg)
GPIB	ST300MS	

Indications

TIME : 300ms

Then, a sweep time for the A SWP function will be set to 300ms.

3.11.8 Sweep Trigger Setting : TRIGGER

(1) Description

The sweep trigger setting (TRIGGER) function provides the following four types of sweep triggers for starting the A SWP function automatically :

① Internal trigger (INT. TRIG) : Starts automatic frequency sweep continuously at any time.

② Line trigger (LINE TRIG) : Starts antomatic frequency sweep synchronously with the AC LINE frequency (50/60Hz).

③ External trigger (EXT. TRIG) : Starts automatic frequency sweep through a TTL-level trigger signal input from the external trigger input (EXT TRIG IN) terminal on the rear panel when the signal becomes a low level.

④ Single trigger (SINGLE TRIG) : Starts automatic frequency sweep each time the YES [ ] key on the front panel is pressed.

(2) Procedure

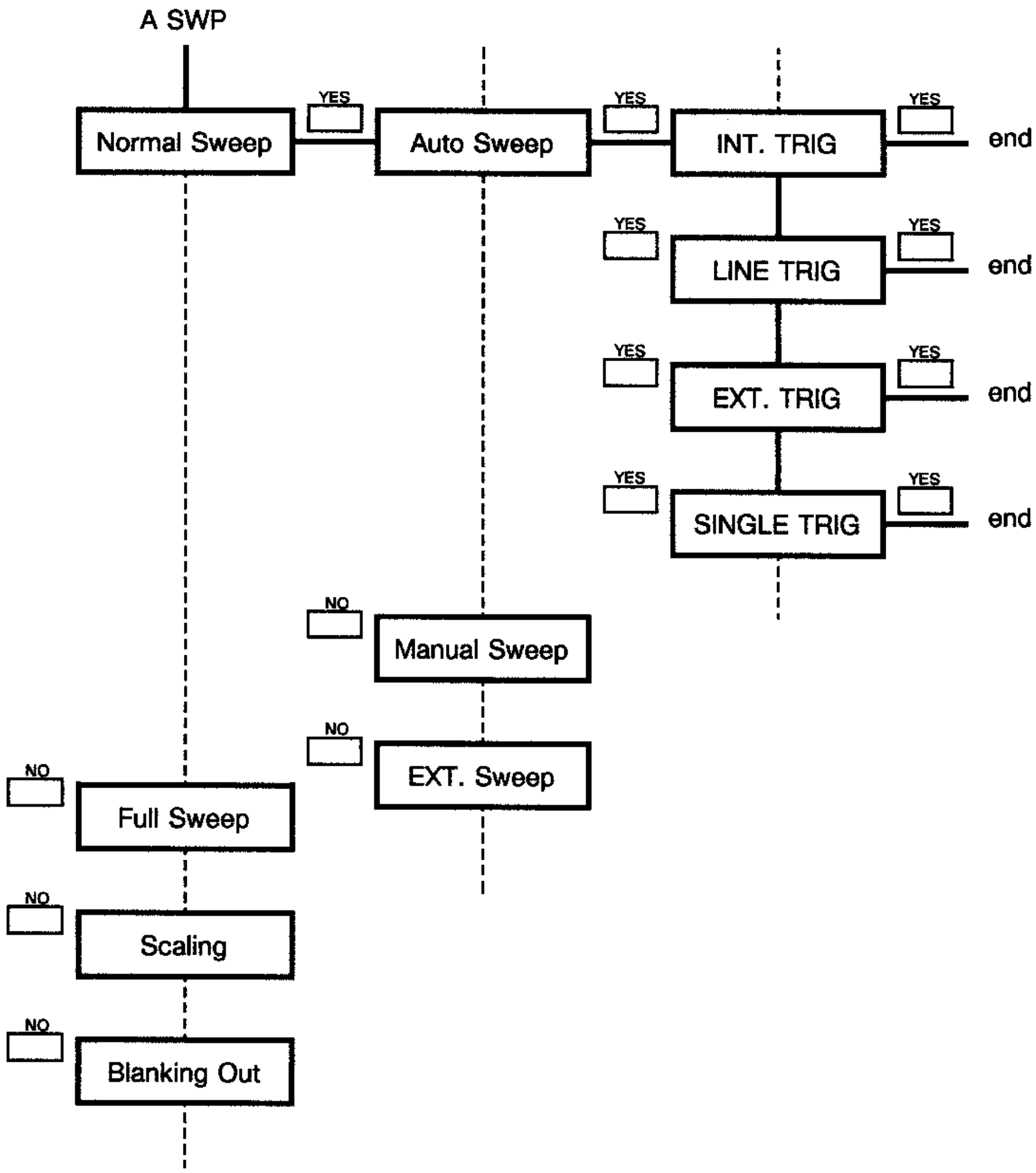
To set the TRIGGER function, use the 0 [ ] A SWP key.

(3) Note

① The TRIGGER function will be set forcibly to provide an internal trigger when the equipment is initialized by pressing the SHIFT and FUNCTION PRESET keys in this order).

② When the NO key is pressed to select whether to set theTRIGGER function to provide an internal trigger, line trigger, external trigger, or single trigger (indicated be "INT. TRIG", "LINE TRIG", "EXT. TRIG", or "SINGLE TRIG", respectively, displayed in the message window), it will automatically be set to the selected state even if the YES key is not pressed to complete the TRIGGER function. Therefore, when any function key is pressed after the NO key, the TRIGGER function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for TRIGGER Function



3.11.9 Manual Sweep : MANUAL SWEEP

(1) Description

The three basic types of the A SWP function are as follows :

① Automatic Sweep (AUTO SWEEP)

Analog wide-band frequency sweep started automatically by any of the four types of sweep triggers (i.e. internal trigger, external trigger, line trigger, and single trigger) to sweep frequencies during a preset sweep time.

② External Sweep (EXT. SWEEP)

Analog wide-band frequency sweep using ramp voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. Prohibits setting of any type of sweep trigger.

③ Manual Sweep (MANUAL SWEEP)

Analog wide-band frequency sweep performed by using the frequency digit adjustment knob and frequency digit setting keys on the front panel.

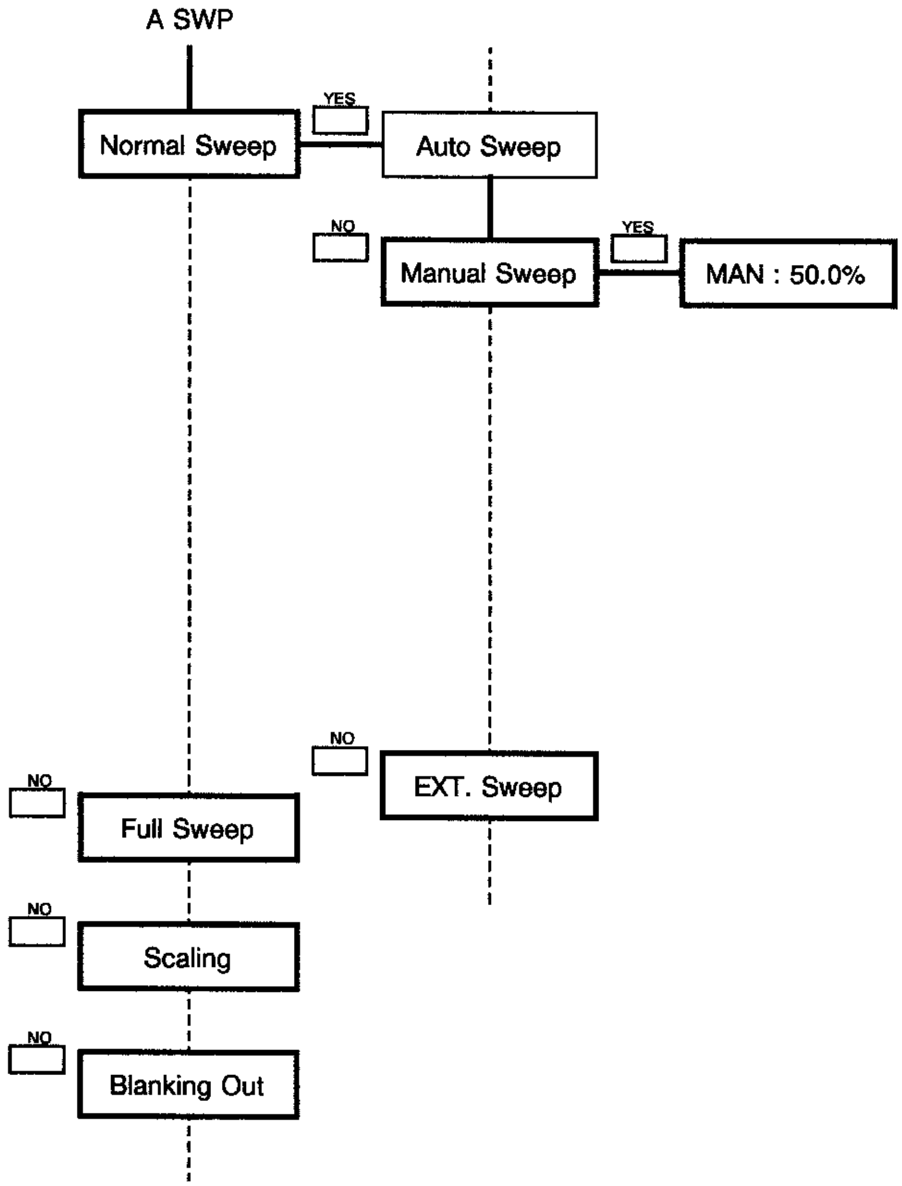
(2) Procedure

To set the MANUAL SWEEP function, use the [0 / A SWP] key.

(3) Note

The MANUAL SWEEP function will be replaced forcibly by the automatic sweep (AUTO SWEEP) function when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for MANUAL SWEEP Function



3.11.10 External Sweep Setting : EXT. SWEEP

(1) Description

The external sweep (EXT. SWEEP) function sweeps frequencies by using ramp voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. When the EXT. SWEEP function is set, any type of sweep trigger is disabled.

(2) Procedure

To set the EXT. SWEEP function, use the [0 / A SWP] key.

Arbitrary External Voltage Setting

Press the [NO] key when a message :

Ramp Voltage

is displayed in the message window.

Then, the above message will be raplaced by a message:

Gain Adjust

To input arbitrary external voltage, its range must be specified with input gain and input offset values, which can be entered by pressing the [YES] and [NO] keys, respectively, with the above message displayed in the message window.

First, enter an input gain value. Press the [YES] key with the above message displayed in the message window. Then, the above message will be replaced by a message:

GAIN : 255

This message indicates that an input gain stage currently set is 255. The maximum and minimum stages are 1 and 255, which provide 2040V and 8V, respectively, for each sweep. Note that any sweep voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal must not exceed an absolute value of ±12V. To enter a desired input gain value, use the ten keys; to enter its unit, use a unit key [-dBm / Hz]. For example, when entering an input gain value of 125, press the following keys:

[1] [2] [5] [-dBm / Hz]

After entering the desired input gain value, press the [YES] key. Then, the above message will be replaced by a message :

OFFSET : 127

This message indicates that an input offset stage currently set is 127. The maximum and minimum stages are 0 and 255, which provide −4V and +4V, respectively. Select an input offset value so that a sum of the input offset value and the value of an external voltage input for starting analog wide-band frequency sweep may be 0V. To enter a selected input offset value, use the ten keys; to enter its unit, use a unit key [−dBm Hz]. For example, when entering an input offset value of 25, press the following keys:

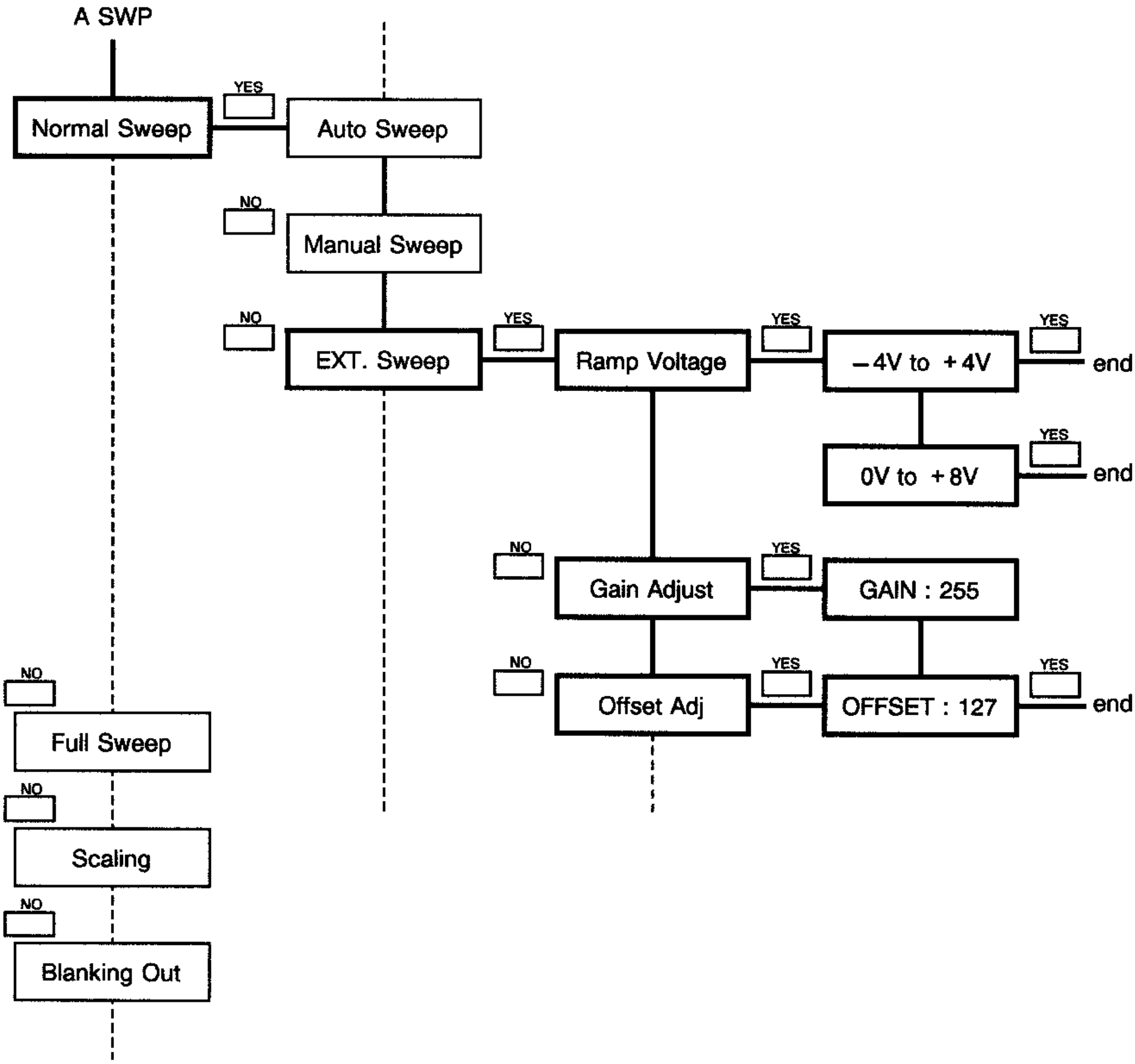
[2] [5] [−dBm Hz]

After entering the selected input offset value, press the [YES] key. An input offset value can also be entered by pressing the [YES] key when a message :

Offset Adj

is displayed in the message window.

(3) Operational Map for EXT. SWEEP Function



3.11.11 Full-band Frequency Sweep Setting : FULL SWEEP

(1) Ordinary analog wide-band frequency sweep functions sweeps frequencies within the following bands:

① 100kHz to 120MHz

② 10MHz to 2000MHz

③ 2000MHz to 4500MHz

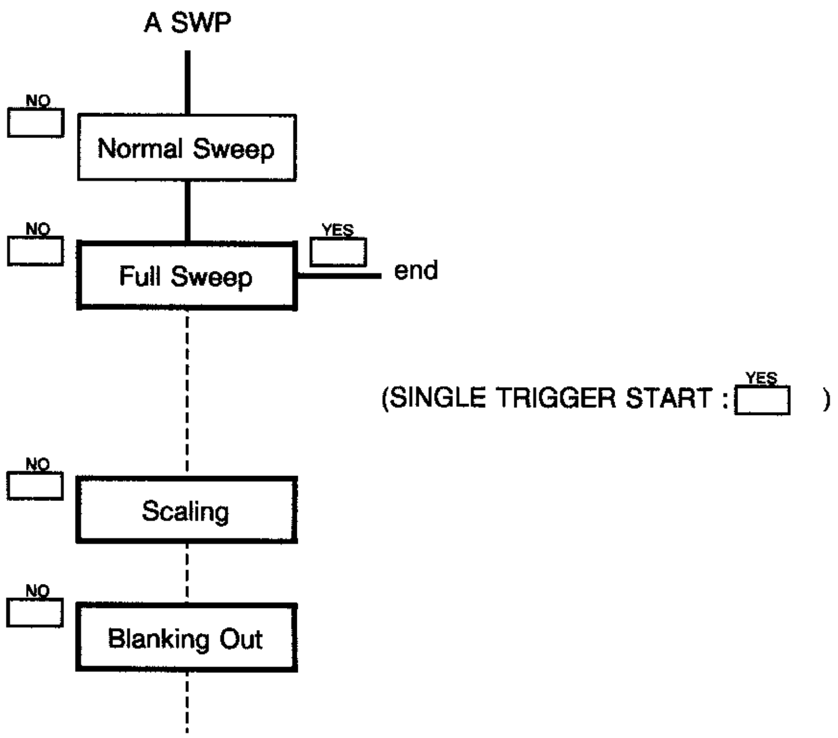
On the contrary, the full-band frequency sweep (FULL SWEEP) function can sweep frequencies within a combination of the above second and third bands, i,e, 10MHz to 4500MHz. At a crossing point of 2000MHz, however, waiting time required for switching between the second and third bands will be added to sweep time.

When the FULL SWEEP function is set, only the single trigger is available, thus disabling any continuous frequency sweep.

(2) Procedure

To set the FULL SWEEP function, use the 0 / A SWP key.

(3) Operational Map for FULL SWEEP Function



A frequency band to be swept with the FULL SWEEP function must be specified by using the START [ ] and STOP [ ] keys. No center frequency or span can be specified for the FULL SWEEP function.

Note that any full-band sweep frequency value that crosses the band without 10MHz to 4500MHz will cause an error.

3.11.12 Sweep Frequency Calibration : SCALING

(1) Description

The scaling (SCALING) function calibrates analog wide-band sweep frequencies (start frequency, stop frequency, center frequency, and span) to an accuracy of ±1% at the points of start and stop frequencies.

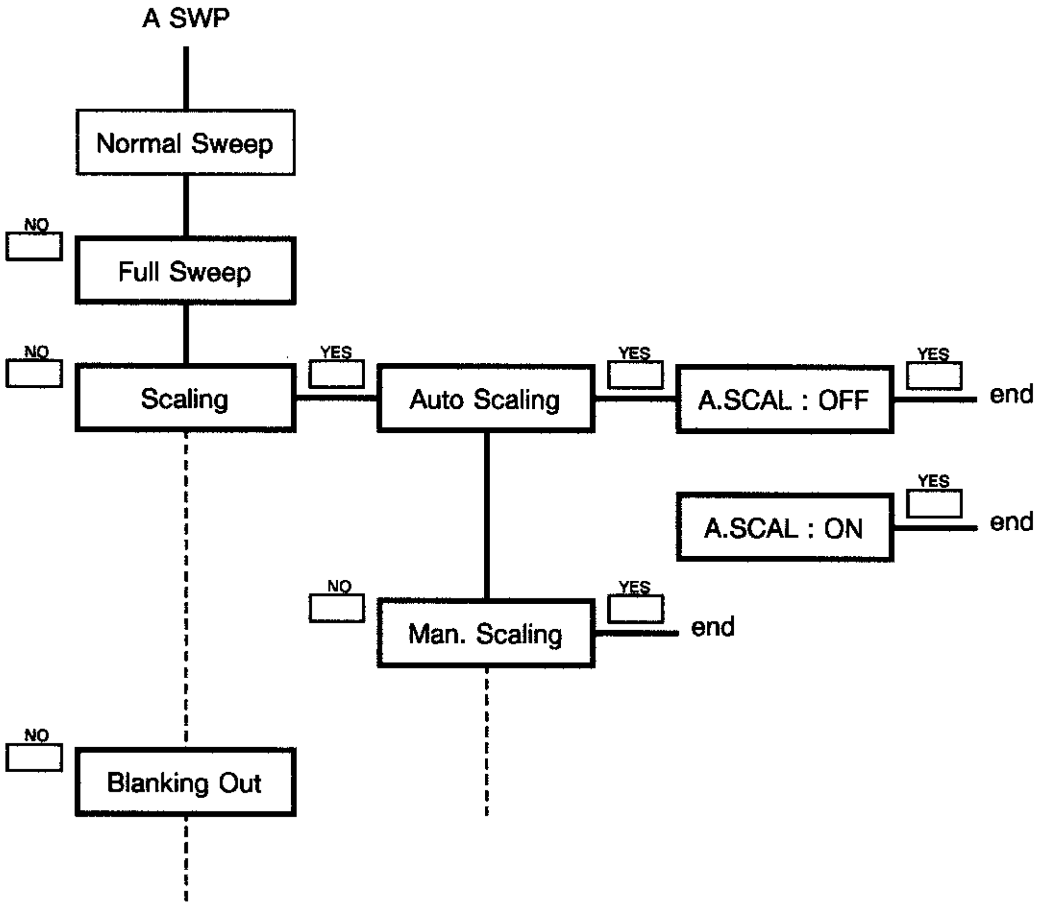
(2) Procedure

To set the SCALING function, use the 0 [ ] A SWP key.

(3) Note

The SCALING function will be set forcibly to OFF (indicated by "A. SCAL: OFF" displayed in the message window) when the equipment is initialized.

(4) Operational Map for SCALING Function



3.11.13 Blanking Signal Polarity Setting : BLANKING OUT

(1) Description

During transition of analog wide-band frequency sweep from a stop frequency back to a start frequency, a blanking signal is output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel. The blanking signal can be set to an either positiveor negative polarity with the BLANKING function for use in inputting Z axis for a sweep monitor or controlling the vertical movement of a X-Y recorder pen.

Figure 3-6 shows the blanking signal.

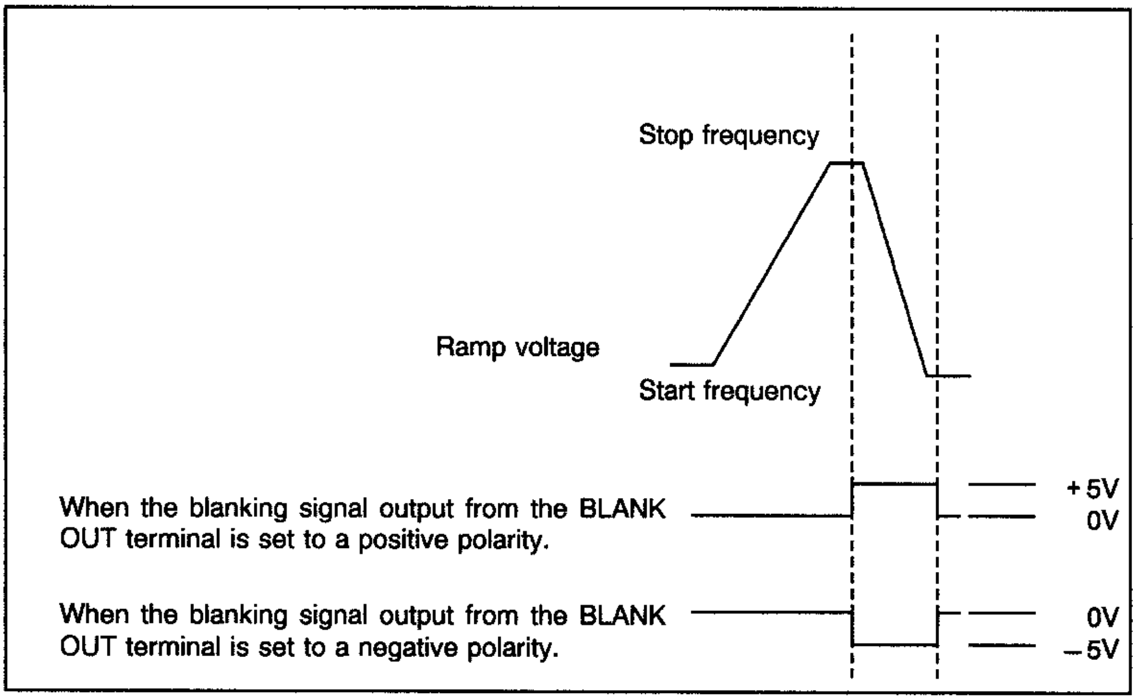


Figure 3 - 6 Blanking Signal

The following paragraphs describe the procedure of setting the polarity of a blanking signal.

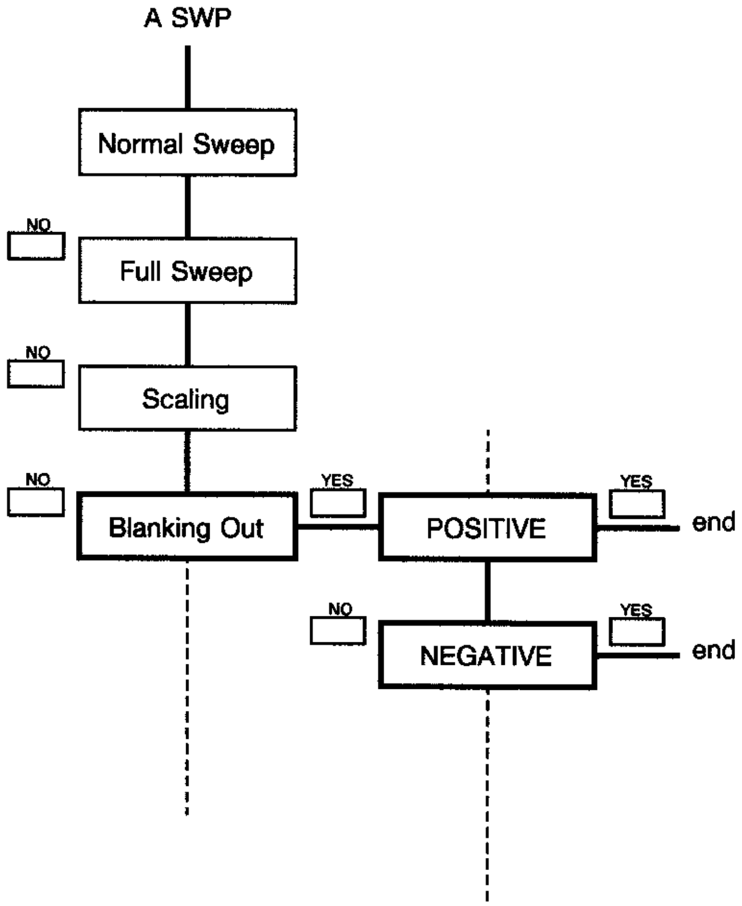
(2) Procedure

To set the BLANKING function, use the [0 / A SWP] key.

(3) Note

The BLANKING function will be set forcibly to set a blanking signal to a negative polarity (indicated by "NEGATIVE" displayed in the message window) when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for BLANKING Function



3.12 Digital Frequency Sweep

3.12.1 Digital Frequency Function

(1) Description

The digital frequency sweep (D SWP) function sweeps carrier wave frequecies in certain steps as shown in Figure 3.12-1. The phases of the individual steps are synchronized with one another with a synthesizer, thus realizing a high-accuracy frequency sweep.

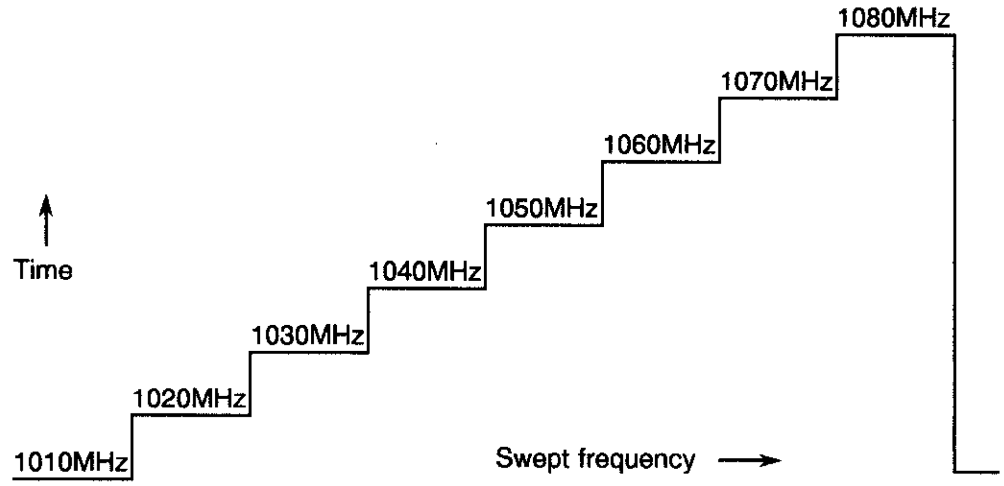


Figure 3.12 - 1 Concept of Linear Frequency Sweep

The D SWP function is available in two types: linear sweep (LINEAR SWEEP) function that sweeps frequencies in equal steps as shown in Figure 3.12-1 and the log sweep (LOG SWEEP) function that sweeps frequencies in logarithmic steps as shown in Figure

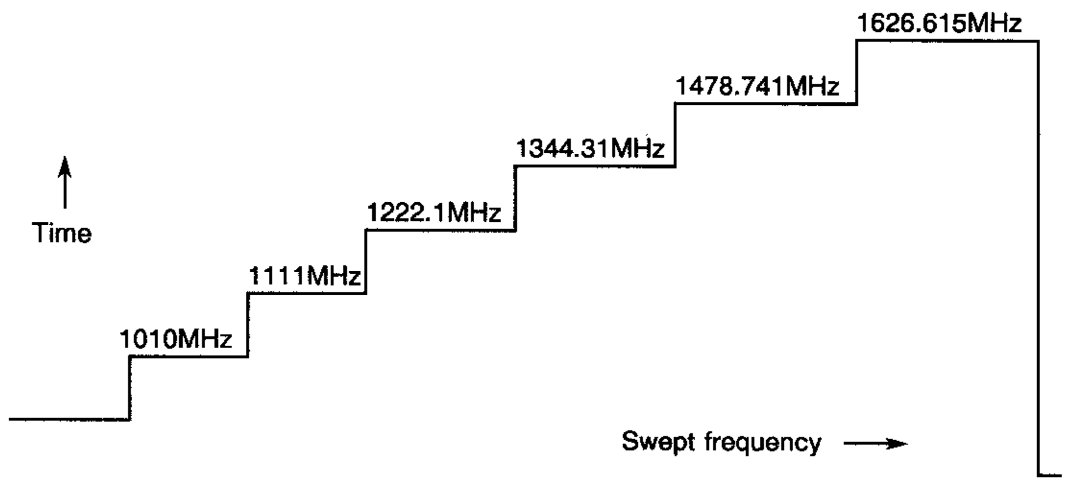


Figure 3.12 - 2 Concept of Log Frequency Sweep

The LINEAR SWEEP function works in two different ways. It automatically sets appropriate sweep step frequencies and number of sweep steps based on a preset start frequency, stop frequency, center frequency, span, and sweep time for digital frequency sweep. Or it automatically rounds a start frequecy, stop frequency, center frequency, span, and sweep time based on a preset sweep step frequency and number of sweep steps.

(2) Preparation

Like the analog wide-band frequency sweep (A SWP) function, the D SWP function can be set by pressing the [7 / SPCL FUNCTION] key and the following data entry keys:

—— FREQ SWEEP ——

[START] [STOP] [CENTER] [SPAN]

When any of the above data entry keys [START], [STOP], [CENTER], and [SPAN] are pressed, the frequency sweep function will be set immediately without any additional manual operation. In the initial state, the A SWP function will be set while the D SWP function and the narrow-band frequency sweep (A SWP SWP) function will be set once they are selected. If the [FREQUENCY] key is pressed after any one of the frequency sweep functions is set, it will be released.

To set a sweep time and sweep trigger for the D SWP function, press two of the function/memory keys [3 / SWP TIME] and [1 / D SWP], respectively when the lamp of the [FUNCTION / PRESET] key is on.

(3) Parameters for the D SWP function are as follows :

Span	:	Span (band) of frequencies to be swept 0kHz to 4.4999GHz
Sweep time	:	50ms to 100s
Sweep step frequencies	:	1Hz to 4.4999GHz
Number of sweep steps	:	1 to 2500 (Automatically set to a range of 1 to 9999 when preceded by sweep step frequencies.)
Sweep trigger	:	INT only
Sweep mode	:	Internal sweep mode only

(4) Procedure

To set the D SWP function, press the [D SWP] key when the lamp of the [FUNCTION / PRESET] key is on.

To set the A SWP function after the D SWP function, press one of the function/memory keys [0 / A SWP]. Select a desired sweep type (see (4) Operational Map for D SWP Function). When setting a sweep type displayed in the message window on the front panel, press the [YES] key; otherwise, press the [NO] key.

Continue to press the [NO] key until the desired sweep type is displayed in the message window, whereupon press the [YES] key.

> **Note**
>
> To initialize the equipment, press the [SHIFT] and [FUNCTION / PRESET] keys in this order.
> The following paragraphs describe the individual digital frequency sweep functions:

① Linear Frequency Sweep (LINEAR SWEEP) Function

Digital frequency sweep performed in equal steps linearly.

Allows setting of sweep step frequencies and the number of sweep steps.

Priority

When the LINEAR SWEEP function is being set, either sweep step frequencies or the number of sweep step frequencies can be set as a parameter for the function in priority over sweep time.

Step Number	:	Rounds sweep time based on any preset number of sweep steps.
1000 Step	:	Sets the number of sweep steps to 1000.
100 Step	:	Sets the number of sweep steps to 100.
Variable	:	Sets the number of sweep steps in any value in the range of 1 to 2500.
FREQ. Step	:	Sets sweep step frequencies and rounds sweep time based on the set sweep step frequencies.

② Log Frequency Sweep (LOG SWEEP) Function

Digital frequency sweep performed logarithmically. Prohibits setting of sweep step frequencies and the number of sweep steps.

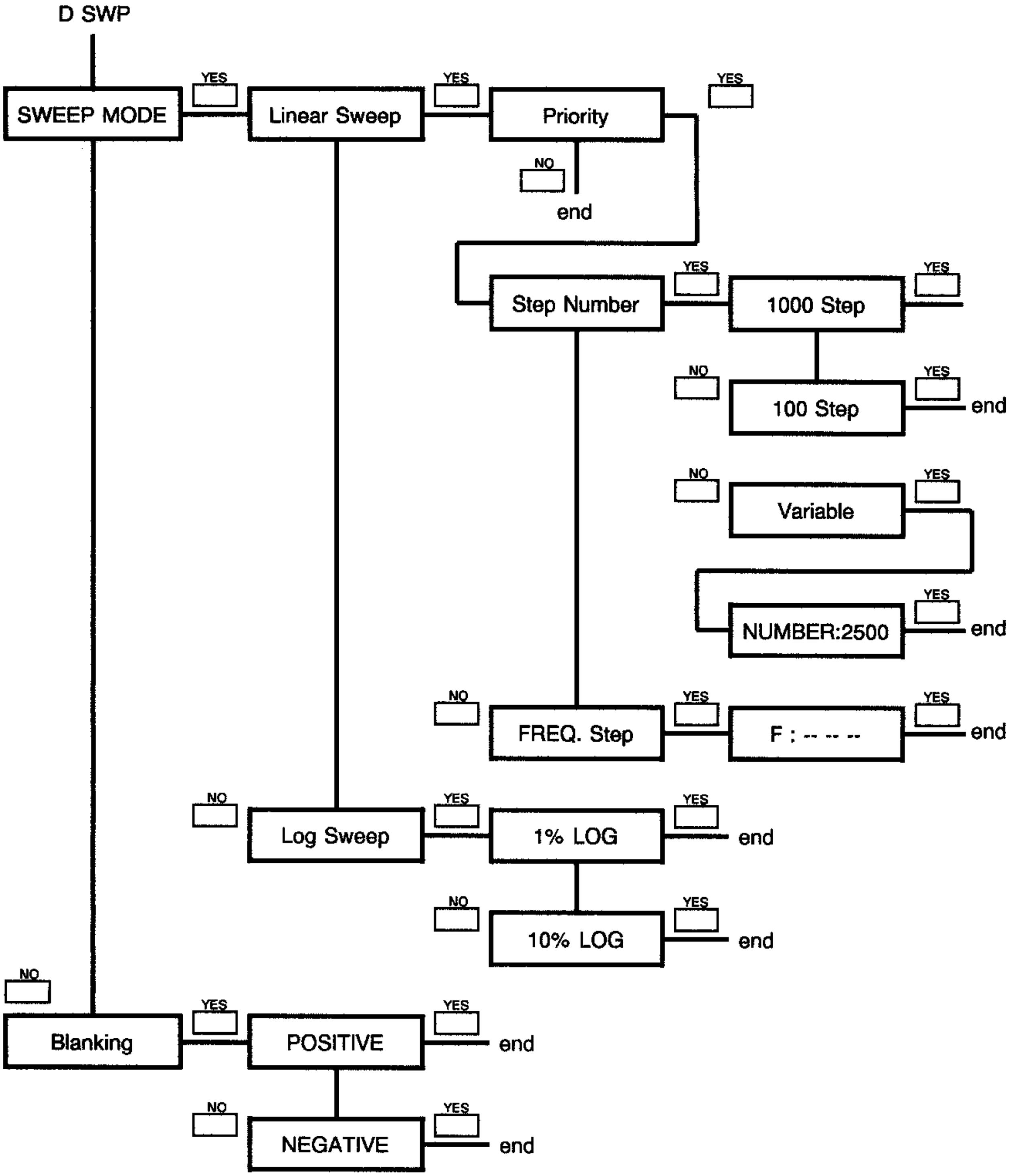
③ Blanking Signal Polarity Setting (BLANKING) Function

Sets the polarity of a blanking signal output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel during a period of transit from a stop frequency back to a start frequency.

POSITIVE : Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to 5V during blanking.

NEGATIVE : Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to −5V during blanking.

(5) Operational Map for D SWP Function



3.12.2 Digital Frequency Sweep : D SWP

(1) Description

The digital frequency sweep (D SWP) function can be set by pressing one of the function/memory key [1 / D SWP], when the lamp above the [FREQUENCY] key and the lamp of the [FUNCTION / PRESET] key are both on. When the D SWP function is set after the equipment is initialized, the individual parameters for the function will be set as follows :

Start frequency	:	1000MHz
Stop frequency	:	1500MHz
Sweep time	:	500ms
Sweep mode	:	LINEAR SWEEP (No priority)

The above initial parameter values can be changed by following the instructions described in the subsequent paragraphs in this section.

(2) Example

Set the D SWP function.

Key operation	FUNCTION
	[FREQUENCY] [FUNCTION / PRESET] [1 / D SWP]
GPIB	SB

Indications

D SWP	START		
1	000	000	000
GHz	MHz	kHz	Hz

Then, the D SWP lamp will come on, indicating that the D SWP function has been set. Frequencies to be swept with the D SWP function can be set up to a digit of 1Hz.

Note

When the D SWP function is set, the binary phase shift keying (BPSK), phase sweep (ø SWP), and phase shift (PHASE SHIFT) functions are disabled.

3.12.3 Start Frequency Setting : START

(1) Description

There are three means for setting a start frequency to be swept with the D SWP function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the START key to select the start frequency setting (START (FREQ SWEEP)) function.

When the START key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the D SWP function. Each time they are turned or pressed, they will increment or decrement by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one, but by the set step size.)

(2) Example

Set a start frequency for the D SWP function to 300MHz.

	FUNCTION	DATA ENTRY
Key operation	START	3 0 0 MHz (−dBm)
GPIB	FA300MZ	

Indications

D SWP	START	
300	000	000
MHz	kHz	Hz

Then, a start frequency for the D SWP function will be set to 300MHz.

The START key can also be used to switch a stop frequency to a start frequency for display on the carrier wave frequency display lamps.

3.12.4 Stop Frequency Setting : STOP

(1) Description

There are three means for setting a stop frequency to be swept with the D SWP function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the STOP key to select the stop frequency setting (STOP (FREQ SWEEP)) function. When the START key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the D SWP function. Each time they are turned or pressed, they will increment or decrement by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one, but by the set step size.)

(2) Example

Set a stop frequency for the D SWP function to 820MHz.

	FUNCTION	DATA ENTRY
Key operation	STOP	8 2 0 MHz (−dBm)
GPIB	FB820MZ	

Indications

D SWP	STOP	
820	000	000
MHz	kHz	Hz

Then, a stop frequency for the D SWP function will be set to 820MHz. The STOP key can also be used to switch a start frequency to a stop frequency for display on the carrier wave frequency display lamps.

3.12.5 Center Frequency Setting : CENTER

(1) Description

There are three means for setting a center frequency to be swept with the D SWP function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the [CENTER] key to select the center frequency setting (CENTER (FREQ SWEEP)) function.

When the [CENTER] key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the D SWP function. Each time they are turned or pressed, they will increment or decrement by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one, but by the set step size.)

(2) Example

Set a center frequency for the D SWP function to 1250MHz.

	FUNCTION	DATA ENTRY
Key operation	[CENTER]	[1] [2] [5] [0] [MHz] (−dBm)
GPIB	FC1250MZ or CF1250MZ	

Indications

D SWP	CENTER		
1	250	000	000
GHz	MHz	kHz	Hz

Then, a center frequency for the D SWP function will be set to 1250MHz.

The [CENTER] key can also be used to switch a frequency sweep span to a center frequency for display on the carrier wave frequency display lamps.

3.12.6 Frequency Sweep Span Setting : SPAN

(1) Description

There are three means for setting a span to be swept with the D SWP function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the [SPAN] key to select the center frequency setting (SPAN) function.

When the [SPAN] key is pressed, the frequency adjustment knob and the frequency step keys will function to set a sweep span for the D SWP function. Each time they are turned or pressed, they will increment or decrement by one, span digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement span digits not by one, but by the set step size.)

(2) Example

Set a sweep span for the D SWP function to 500MHz.

	FUNCTION	DATA ENTRY
Key operation	[SPAN]	[5] [0] [0] [-dBm MHz]
GPIB	FD500MZ or SP500MZ	

Indications

D SWP	SPAN		
	500	000	000
	MHz	kHz	Hz

Then, a sweep span for the D SWP function will be set to 500MHz.

The [SPAN] key can also be used to switch a center frequency to a digital frequency sweep span for display on the carrier wave frequency display lamps.

3.12.7 Sweep Time Setting : SWEEP TIME

(1) Description

Sweep time for the D SWP function can be set with ten keys. Confirm that the lamp of the FUNCTION [PRESET] key is on. (If it is not on, press the FUNCTION [PRESET] key.) Press the 3 [SWP TIME] key. Then, a sweep time currently set for the D SWP function will be displayed in the message window as follows :

TIME : 500ms

Enter a desired sweep time value through ten keys within a range and with resolutions specified in the table below :

Range	Resolution
50ms to 999ms	1ms
1.0s to 9.9s	100ms
10s to 100s	1s

(2) Example

Set a sweep time for the D SWP function to 300ms.

	FUNCTION	DATA ENTRY
Key operation	3 [SWP TIME]	[3] [0] [0] [Hz] (−dBU, ms, nV, deg)
GPIB	ST300MS	

Indications

TIME : 300ms

Then, a sweep time for the D SWP function will be set to 300ms.

3.12.8 Linear Frequency Sweep : LINEAR SWEEP

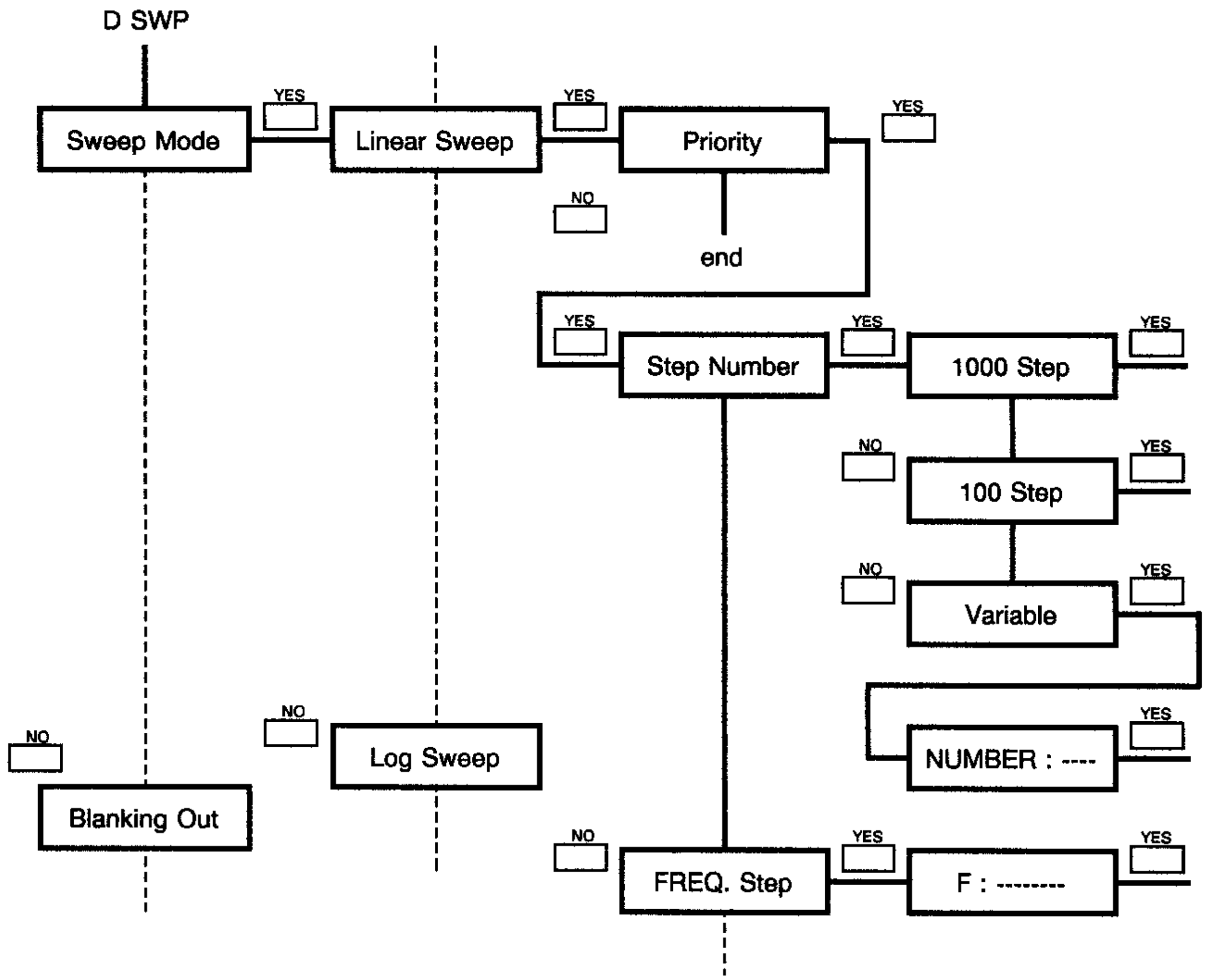
(1) Description

The linear frequency sweep (LINEAR SWEEP) function sweeps carrier wave frequencies between any specified start and stop frequencies linearly in equal steps. Ordinarily, sweep time will be used as a reference parameter for setting sweep frequencies and the number of sweep steps for the LINEAR SWEEP function. Thus, sweep step frequencies or the number of sweep steps will be set automatically based on any preset sweep time as well as start and stop frequencies. However, if desired, step frequencies or the number of sweep steps can be set as parameters for the LINEAR SWEEP function in priority over sweep time as well as start and stop frequencies. In this event, the former two either parameter will be rounded based on the latter three parameters.

(2) Procedure

To set the LINEAR SWEEP function, use the [1 / D SWP] key.

(3) Operational Map for LINEAR SWEEP Function



Pressing the NO key displays a sweep step menu item 100Step in the message window.

3.12.9 Log Frequency Sweep Setting : LOG SWEEP

(1) Description

The log frequency sweep (LOG SWEEP) function sweeps carrier wave frequencies between any preset start and stop frequencies in two logarithmic steps of 1% Log and 10% Log. If the 1% Log is selected, when any frequency is swept in one step, a frequency equal to 1.01 times that frequency will be swept in the next step. Suppose, for example, that a start frequency is set to 1GHz, the second frequency to be swept is 1GHz x 1.01 = 1.01GHz, the third frequency is 1.01GHz x 1.01 = 1.0201GHz, and so on. Likewise, if Log 10% is selected, when any frequency is swept in one step, a frequency equal to 1.1 times that frequency will be swept in the next step.

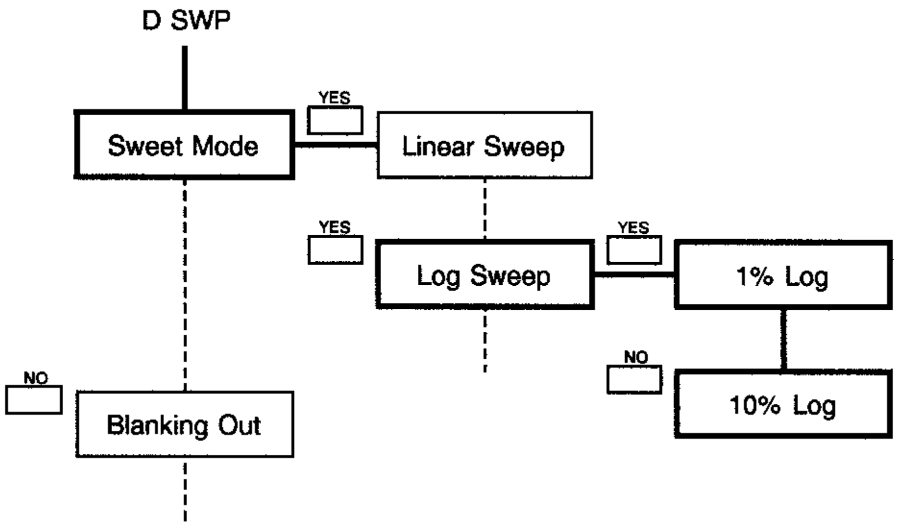
(2) Procedure

To set the LOG SWEEP function, use the [1 / D SWP] key.

(3) Note

As a paramenter for the LOG SWEEP function, the number of sweep steps will be set forcibly in priority over the others, considering that the sweep steps are logarithmic. Unlike the LINEAR function, therefore, this parameter setting priority cannot be changed.

(4) Operational Map for LOG SWEEP Function



3.12.10 Blanking Signal Polarity Setting : BLANKING OUT

(1) Description

During transition of digital frequency sweep from a stop frequency back to a start frequency, a blanking signal is output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel. The blanking signal can be set to an either positive or negative polarity with the BLANKING function for use in inputting Z axis for a sweep monitor or controlling the vertical movement of a X-Y recorder pen.

Figure 3-12-3 shows the blanking signal.

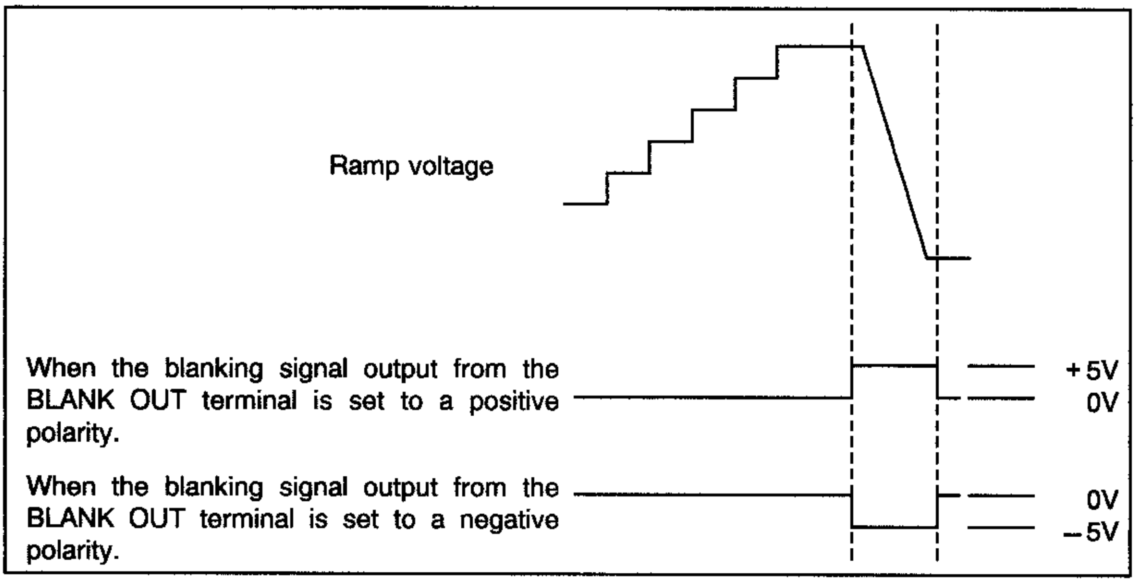


Figure 3.12 - 3 Blanking Signal

The following paragraphs describe the procedure of setting the polarity of a blanking signal.

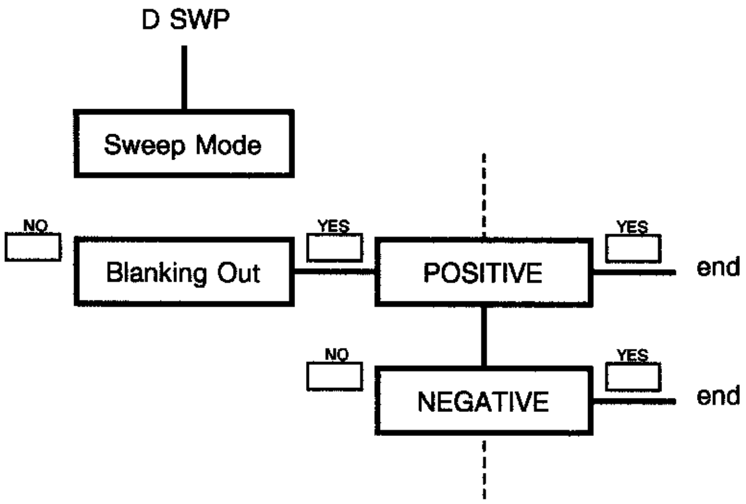
(2) Procedure

To set the BLANKING function, use the [1 / D SWP] key.

(3) Note

The BLANKING function will be set forcibly to set a blanking signal to a positive polarity (indicated by "POSITIVE" displayed in the message window) when the equipment is initialized (by pressing to [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for BLANKING Function



3.13 ±ΔF Frequency Sweep

3.13.1 Analog Narrow-band Frequency Sweep

(1) Description

The analog narrow-band frequency sweep (±ΔF) function uses the internal synthesizer built in the equipment to synchronize any carrier wave frequencies with any preset center frequency, thus providing high frequency accuracy and stability. The ±ΔF function maintains the accuracy of center frequency within 40kHz. Sweep span for the ±ΔF function can be set to various values less than a maximum of 8kHz depending on which carrier frequency band is selected.

(2) Preparation

The ±ΔF function can be set by pressing the following data entry keys :

—— FREQ SWEEP ——

CENTER [ ] SPAN [ ]

When any of the above data entry keys CENTER [ ] and SPAN [ ] keys are pressed, the frequency sweep function will be set immediately without any additional setting. In the initial state, the ±ΔF function will be set while the D SWP and ±ΔF functions will be set once they are selected. If the [FREQUENCY] key is pressed after any of the frequency sweep functions is set, it will be released.

(3) Parameters for the ±ΔF function are as follows :

Center frequency
: Middle frequency in the frequency band to be swept

100kHz to 4500MHz

Span : Width (band) of frequencies to be swept
When Band 7 (2000 to 4000MHz) and HET Band (10 to 2000MHz) are selected :

800kHz to 8000kHz (Range 1)
80.0kHz to 799.9kHz (Range 2)
0.00kHz to 79.99kHz (Range 3)

When Band 6 (1000 to 2000MHz) is selected:

400kHz to 4000kHz (Range 1)
40.0kHz to 399.9kHz (Range 2)
0.00kHz to 39.99kHz (Range 3)

When Band 1 (500MHz to 1000MHz), LEX Band (100kHz to 62.5MHz), and Band 5 (120MHz) are selected:

200kHz to 2000kHz (Range 1)
20.0kHz to 199.9kHz (Range 2)
0.00kHz to 19.99kHz (Range 3)

When Band 4 (250MHz to 500MHz) is selected:

100kHz to 1000kHz (Range 1)
10.0kHz to 99.9kHz (Range 2)
0.00kHz to 9.99kHz (Range 3)

When Band 3 (125MHz to 250MHz) is selected:

50kHz to 500kHz (Range 1)
5.0kHz to 49.9kHz (Range 2)
0.00kHz to 4.99kHz (Range 3)

When Band 2 (62.5MHz to 125MHz) is selected:

25kHz to 250kHz (Range 1)
2.5kHz to 24.9kHz (Range 2)
0.00kHz to 2.49kHz (Range 3)

Sweep time : 50ms to 100s

Sweep triggers : INT, LINE, SINGLE,, and EXT

Sweep modes : Internal sweep mode, external sweep mode, and manual sweep mode

(4) Procedure

To set the ±ΔF function, press one of the function/memory key switches [2 ±ΔF] when the lamp of the FUNCTION [ ] key is on. Select a desired sweep type (see (5) Operational Map for ±ΔF function). When setting a sweep type displayed in the message window on the front panel, press the YES [ ] key; otherwise, press the NO [ ] key. Until the desired sweep type is displayed in the message window, press the NO [ ] key. When it is displayed, press the YES [ ] key.

The following paragraphs describe the individual analog narrow-band frequency sweep functions :

① Automatic sweep (AUTO SWEEP Function)

Analog wide-band frequency sweep performed automatically with internal sweep voltage during a sweep time set with the [3 / SWP TIME] key.

Trigger types

Automatic frequency sweep can be stated with the following four types of triggers:

INT. TRIG : Starts automatic frequency sweep continuously at any time.
LINE TRIG : Starts automatic frequency sweep synchronously with the AC LINE frequency (50/60Hz).
EXT. TRIG : Starts automatic frequency sweep through a trigger signal input from the external trigger input (EXT TRIG IN) terminal on the rear panel.
SINGLE TRIG : Starts automatic frequency sweep each time the [YES] key is pressed.

② Manual Sweep (MANUAL Function)

Analog wide-band frequency sweep performed manually by turning the frequency digit adjustment knob. Turning the knob clockwise and counterclockwise causes frequency sweep in the direction of the start to stop frequencies and the stop to start frequencies, respectively. When the Manual Sweep is set using the ten keys, input the ratio (0 to 100%) of the output frequency against the sweep span.

③ External Sweep (EXT SWEEP Function)

Analog wide-band frequency sweep performed with sweep voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. Sweep voltage is available in two ranges of 0 to 8V and −4 to +4V. The ramp voltages for the two voltage ranges can be varied to any desired value.

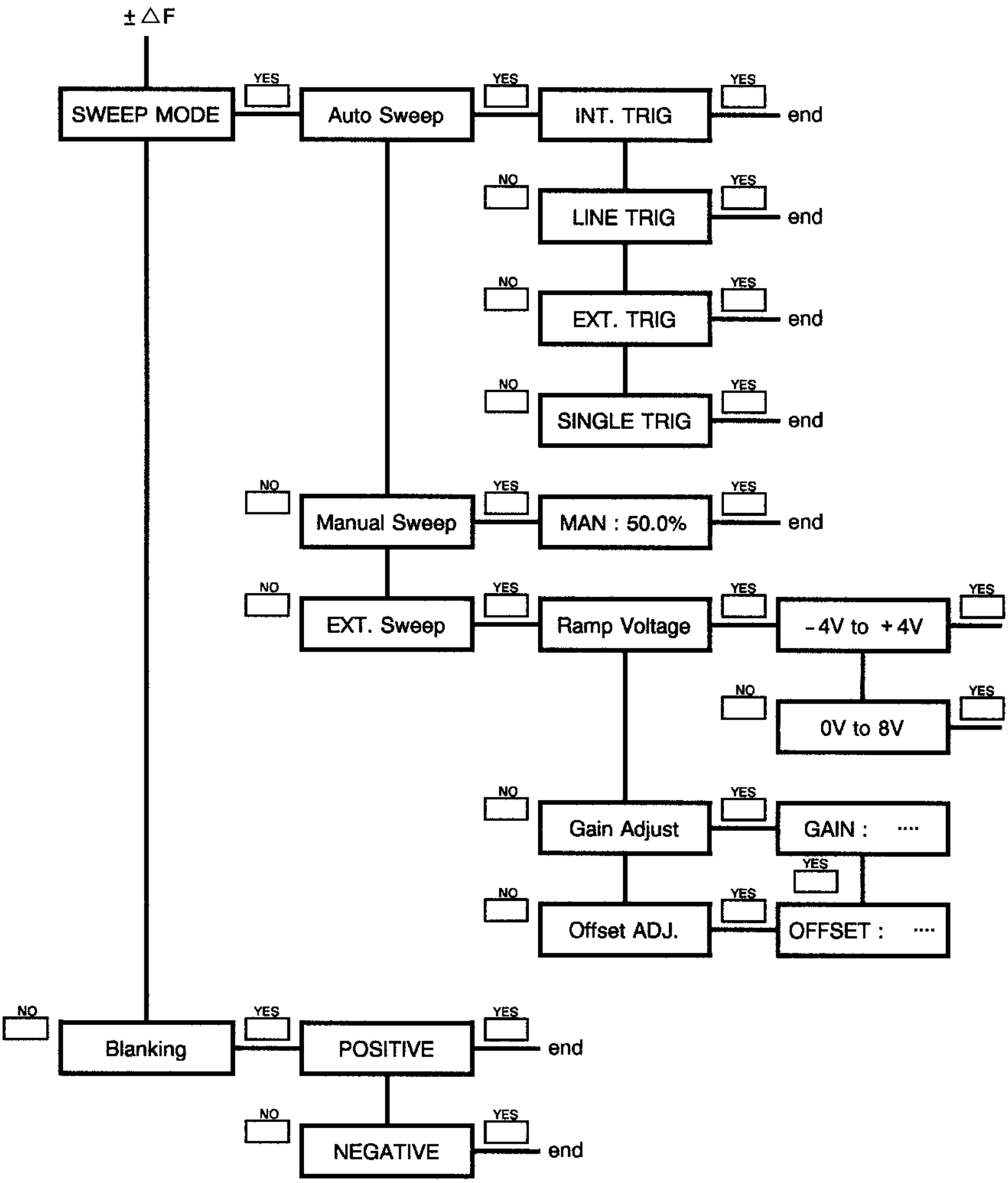
−4V to +4V : Inputs sweep voltage ranging from −4V to +4V.
0V to 8V : Inputs sweep voltage ranging from 0V to +8V.
Gain : Sets the amplitude of any sweep voltage in the stages of 0 to 255. For example, Stage 1 and Stage 255 provide about 2040V and 8V, respectively, for each sweep. Sweep voltage must be input within ±12V.
Offset : Sets the start voltage of any sweep voltage in the stages of 0 to 255. For example, Stage 0 and Stage 255 provide 0V and −8V, respectively.

④ Blanking Signal Polarity Setting (BLANKING Function)

Sets the polarity of a blanking signal output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel during a period of transit from a stop frequency back to a start frequency.

POSITIVE	:	Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to 5V during blanking.
NEGATIVE	:	Outputs a blanking signal with a voltage ranging from 0V during analog amplitude sweep to −5V during blanking.

(5) Operational Map for ±ΔF Function



3.13.2 Analog Narrow-band Frequency Sweep : ±ΔF

(1) Description

The analog narrow-band frequency sweep (±ΔF) function can be set by pressing one of the function/memory keys [2 / ±ΔF] when the lamp of the [FUNCTION / PRESET] key is on. When the ±ΔF function is set after the equipment is initialized, the individual parameters for the function will be set as follows :

Center frequency	:	1000MHz
Span	:	20kHz
Sweep time	:	500ms
Sweep trigger	:	INT (Internal trigger)
Sweep mode	:	AUTO INT (Internal automatic sweep) mode

The above initial parameter values can be changed by following the instructions described in the subsequent paragraphs in this section.

(2) Example

Set the ±ΔF function.

	FUNCTION
Key operation	[FREQUENCY] [FUNCTION / PRESET] [2 / ±ΔF]
GPIB	DF

Indications

±ΔF	CENTER		
1	000	000	000.0
GHz	MHz	kHz	Hz

Then, the ±ΔF lamp will come on, indicating that the ±ΔF function has been set.

When the ±ΔF function is set with the GPIB command "DF", a span currently set for the function will be displayed in the message window as follows:

Indications

±ΔF		SPAN	
		20	000.0
GHz	MHz	kHz	Hz

3.13.3 Center Frequency Setting : CENTER

(1) Description

There are three means for setting a center frequency to be swept with the ±ΔF function: ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, prees the CENTER key to select the center frequency setting (CENTER (FREQ SWEEP)) function.

When the CENTER key is pressed, the frequency adjustment knob and the frequency step keys will function to set a start frequency for the ±ΔF function. Each time they are turned or pressed, they will increment or decrement, by one, frequency digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement frequency digits not by one but by the set step size.)

(2) Example

Set a center frequency for the ±ΔF function to 900MHz.

	FUNCTION	DATA ENTRY
Key operation	CENTER [ ]	[9] [0] [0] [MHz] (−dBm)
GPIB	FC900MZ or CF900MZ	

Indications

±ΔF	CENTER		
900	000	000.0	
GHz	MHz	kHz	Hz

Then, a center frequency for the ±ΔF function will be set to 900MHz. The CENTER [ ] key can also be used to switch a frequency sweep span to a center frequency for display on the carrier wave frequency display lamps.

3.13.4 Frequency Sweep Span Setting : SPAN

(1) Description

There are three means for setting a span to be swept with the ±ΔF function : ten keys, frequency adjustment knob, and frequency step keys on the front panel.

Before using the ten keys, press the SPAN [ ] key to select the center frequency setting (SPAN) function.

When the SPAN [ ] key is pressed, the frequency adjustment knob and the frequency step keys will function to set a frequency sweep span. Each time they are turned or pressed, they will increment or decrement by one, span digits set with the frequency digit setting keys. (When an increment step size is set, however, they will increment and decrement span digits not by one, but by the set step size.)

(2) Example

Set a sweep span for the ±ΔF function to 200kHz.

	FUNCTION	DATA ENTRY
Key operation	[SPAN]	[2] [0] [0] [+dBu kHz]
GPIB	FD200KZ or SP200KZ	

Indications

±ΔF		SPAN	
		200	000.0
GHz	MHz	kHz	Hz

Then, a sweep span for the ±ΔF function will be set to 200kHz. The [SPAN] key can also be used to switch a center frequency to a frequency sweep span for display on the carrier wave frequency display lamps.

3.13.5 Sweep Time Setting : SWEEP TIME

(1) Description

Sweep time for the ±ΔF function can be set with ten keys.

Confirm that the lamp of the [FUNCTION / PRESET] key is on. (If it is not on, press the [FUNCTION / PRESET] key.) Press one of the function/memory keys [3 / SWP TIME]. Then, a sweep time currently set for the ±ΔF function will be displayed in the message window as follows :

TIME : 500ms

Enter a desired sweep time value through ten keys within a range and with resolutions specified in the table below :

Range	Resolution
50ms to 999ms	1ms
1.0s to 9.9s	100ms
10s to 100s	1s

(2) Example

Set a sweep time for the ±ΔF function to 300ms.

	FUNCTION	DATA ENTRY
Key operation	3 [ ] SWP TIME	[3] [0] [0] −dBu [Hz] ms nV deg
GPIB	ST300MS	

Indications

TIME : 300ms

Then, a sweep time for the ±ΔF function will be set to 300ms.

3.13.6 Sweep Trigger Setting : TRIGGER

(1) Description

The sweep trigger setting (TRIGGER) function provides the following four types of sweep triggers for starting the ±ΔF function automatically :

① Internal trigger (INT. TRIG) : Starts automatic frequency sweep continuously at any time.

② Line trigger (LINE TRIG) : Starts automatic frequency sweep synchronously with the AC LINE frequency (50/60Hz).

③ External trigger (EXT. TRIG) : Starts automatic frequency sweep through a TTL-level trigger signal input from the external trigger input (EXT TRIG IN) terminal on the rear panel when the signal becomes a low level.

④ Single trigger (SINGLE TRIG) : Starts automatic frequency sweep each time the [YES] key on the front panel is pressed.

(2) Procedure

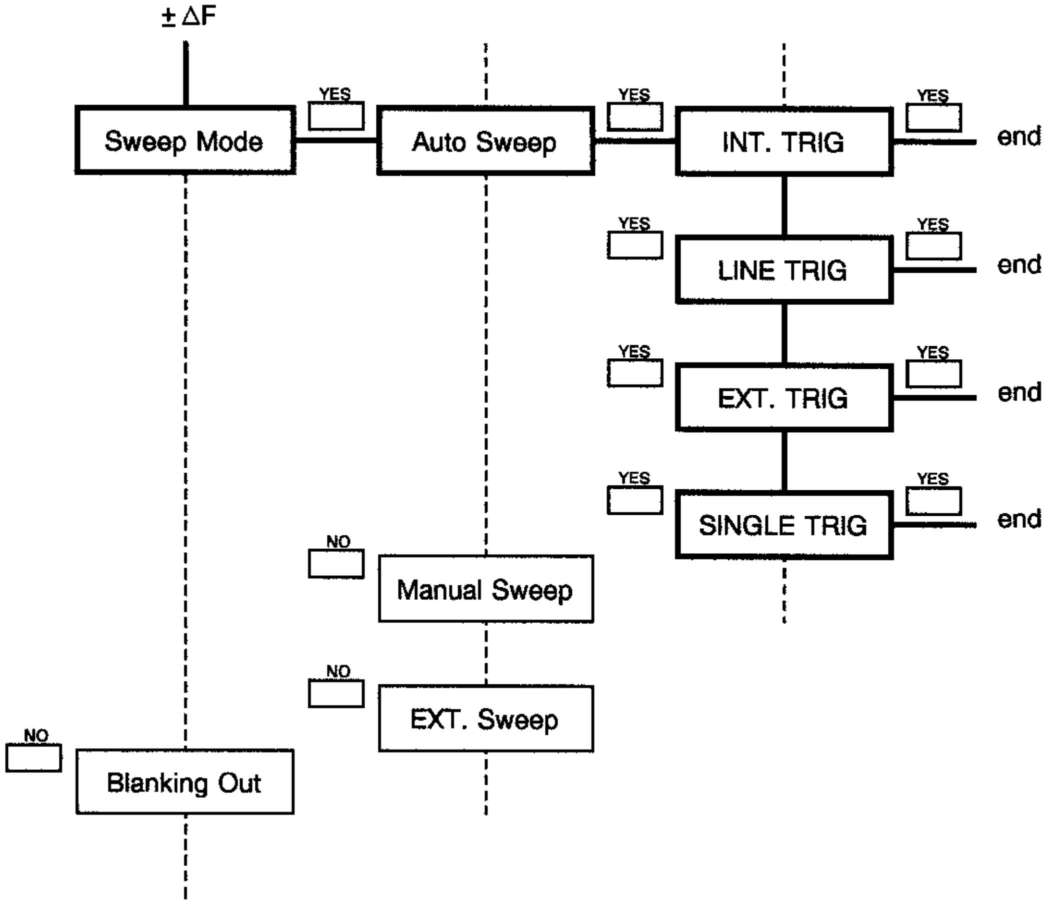
To set the TRIGGER function, use the [2 / ±ΔF] key.

(3) Note

① The TRIGGER function will be set forcibly to provide an internal trigger when the equipment is initialized by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

② When the [NO] key is pressed to select whether to set the TRIGGER function to provide an internal trigger, line trigger, external trigger, or single trigger (indicated by "INT. TRIG", "LINT TRIG", "EXT. TRIG", or "SINGLE TRIG", respectively, displayed in the message window), it will automatically be set to the selected state even if the [YES] key is not pressed to complete the TRIGGER function. Therefore, when any function key is pressed after the [NO] key, the TRIGGER function will be completed in the state indicated by the message window to execute the function corresponding to the pressed function key.

(4) Operational Map for TRIGGER Function



3.13.7 Manual Sweep : MANUAL SWEEP

(1) Description

The three basic types of the ±ΔF function are as follows :

① Automatic Sweep (AUTO SWEEP)

Analog wide-band frequency sweep started automatically by any of the four types of sweep triggers. (i. e. internal trigger, external trigger, line trigger, and single trigger) to sweep frequencies during a preset sweep time.

② External Sweep (EXT. SWEEP)

Analog wide-band frequency sweep using ramp voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. Prohibits setting of any type of sweep trigger.

③ Manual Sweep (MANUAL SWEEP)

Analog wide-band frequency sweep performed by using the frequency digit adjustment knob and frequency digit setting keys on the front panel.

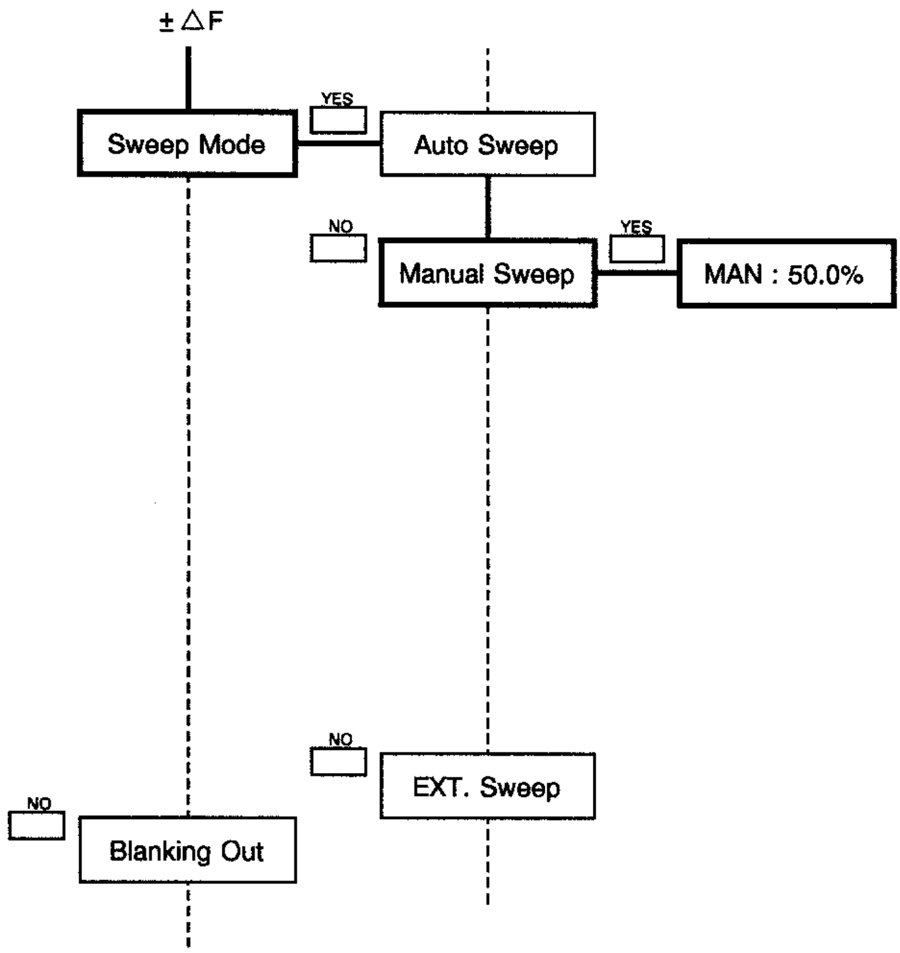
(2) Procedure

To set the MANUAL SWEEP function, use the [2 / ±ΔF] key.

(3) Note

The MANUAL SWEEP function will be replaced forcibly by the automatic sweep (AUTO SWEEP) function when the ewuipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order).

(4) Operational Map for MANUAL SWEEP Function



3.13.8 External Sweep Setting : EXT. SWEEP

(1) Description

The external sweep (EXT. SWEEP) function sweeps frequencies by using ramp voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel. When the EXT. SWEEP function is set, any type of sweep trigger is disabled.

(2) Procedure

To set the EXT. SWEEP function, use the [2 / ±ΔF] key.

Arbitrary External Voltage Setting

Press the [YES] key when a message :

Ramp Voltage

is displayed in the message window.

Then, the above message will be replaced by a message:

Gain Adjust

To input arbitrary external voltage, its range must be specified with input gain and input offset values, which can be entered by pressing the [YES] and [NO] keys, respectively, with the above message displayed in the message window.

First, enter an input gain value. Press the [YES] key with the above message displayed in the message window. Then, the above message will be replaced by a message:

GAIN : 255

This message indicates that an input gain stage currently set is 255. The maximum and minimum stages are 1 and 255, which provide 2040V and 8V, respectively, for each sweep. Note that any sweep voltage input from the sweep voltage input/output (SWEEP IN/OUT) terminal must not exceed an absolute value of ±12V. To enter a desired input gain value, use the ten keys; to enter its unit, use a unit key [Hz]. For example, when entering an input gain value of 125, press the following keys :

[1] [2] [5] [−dBu / Hz]

Then, the above message will be replaced by a message:

GAIN : 125

After entering the desired intput gain value, press the YES key.

Then, the above message will be replaced by a message:

OFFSET : 127

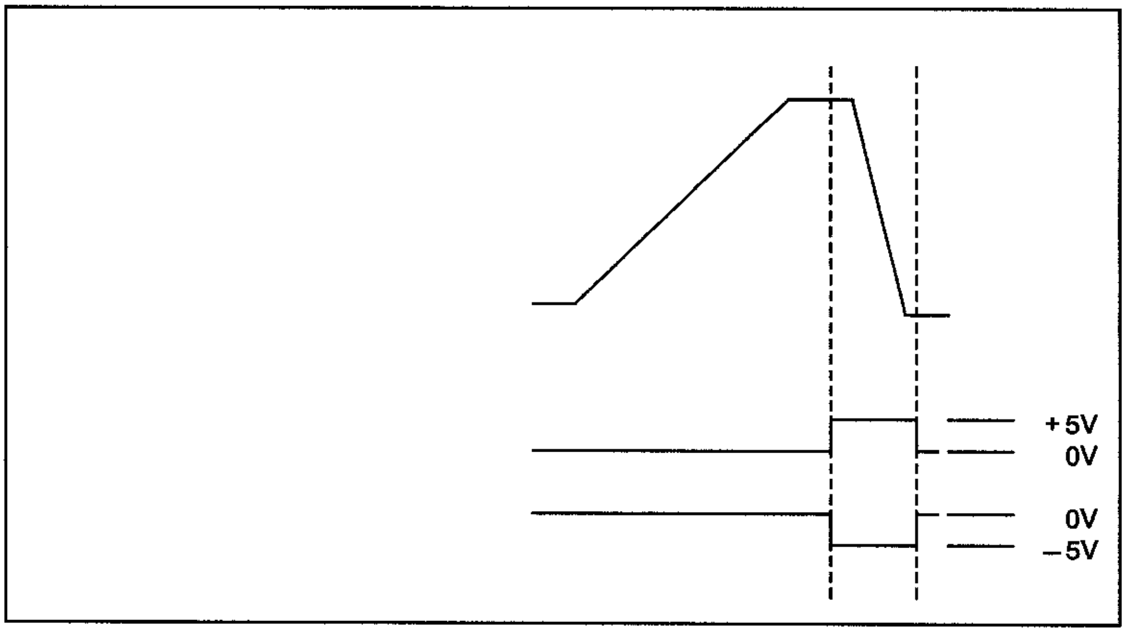
This message indicates that an input offset stage currently set is 127. The maximum and minimum stages are 0 and 255, which provide −4V and +4V, respectively. Select an input offset value so that a sum of the input offset value and the value of an external voltage input for starting analog narrow-band frequency sweep may be 0V. To enter a selected input offset value, use the ten keys; to enter its unit, use a unit key Hz. For example, when entering an input offset value of 25, press the following keys :

2 5 Hz

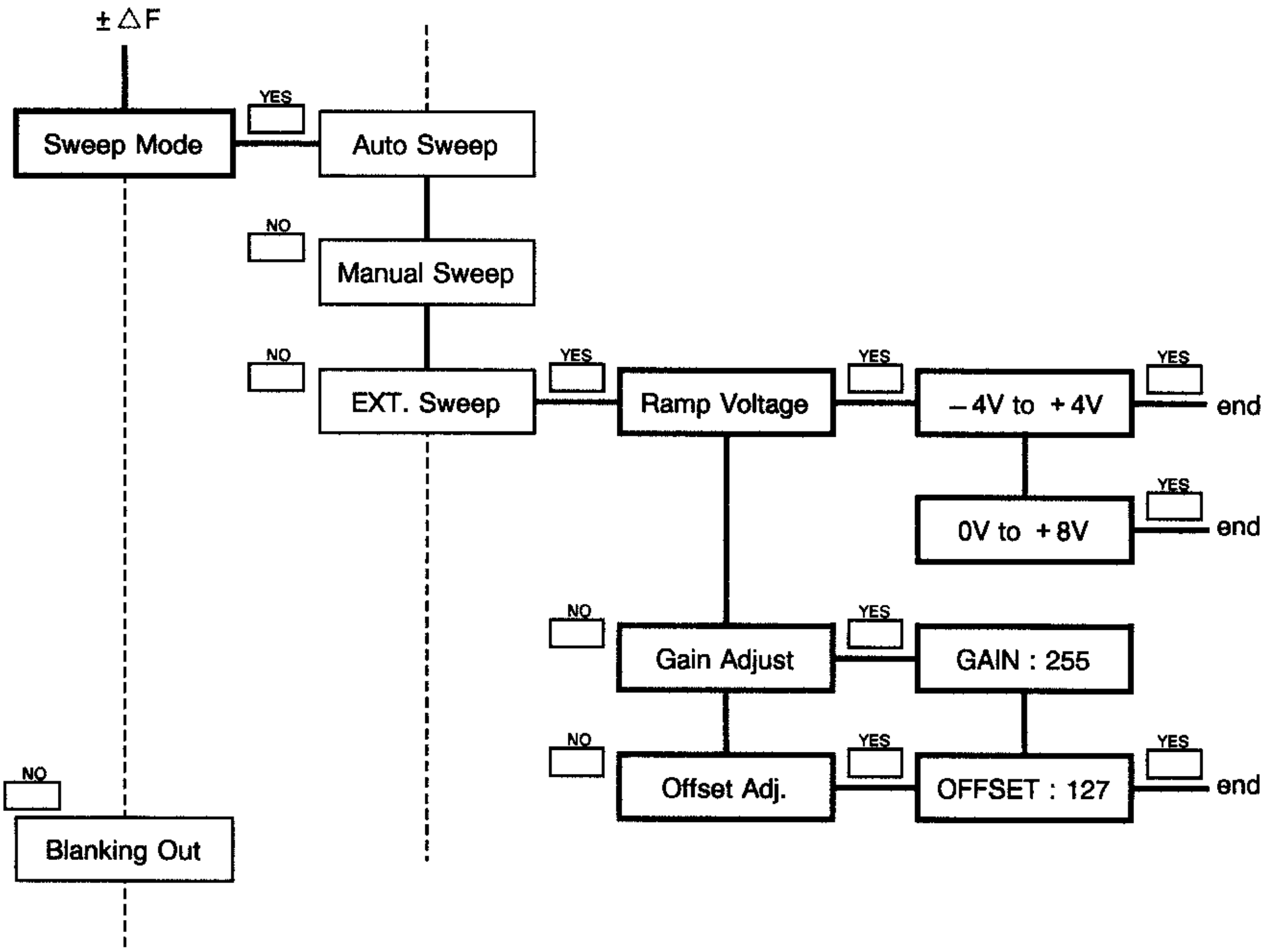
After entering the selected input offset value, press the YES key. An input offset value can also be entered by pressing the YES key when a message:

Offset Adj.

is displayed in the message window.



(3) Operational Map for EXT. SWEEP Function



3.13.9 Blanking Signal Polarity Setting : BLANKING OUT

(1) Description

During transition of analog narrow-band frequency sweep from a stop frequency back to a start frequency, a blanking signal is output from the sweep blanking signal output (BLANK OUT) terminal on the rear panel. The blanking signal can be set to an either positive or negative polarity with the BLANKING function for use in inputting Z axis for a sweep monitor or controlling the vertical movement of a X-Y recorder pen.

Figure 3.13-1 shows the blanking signal.

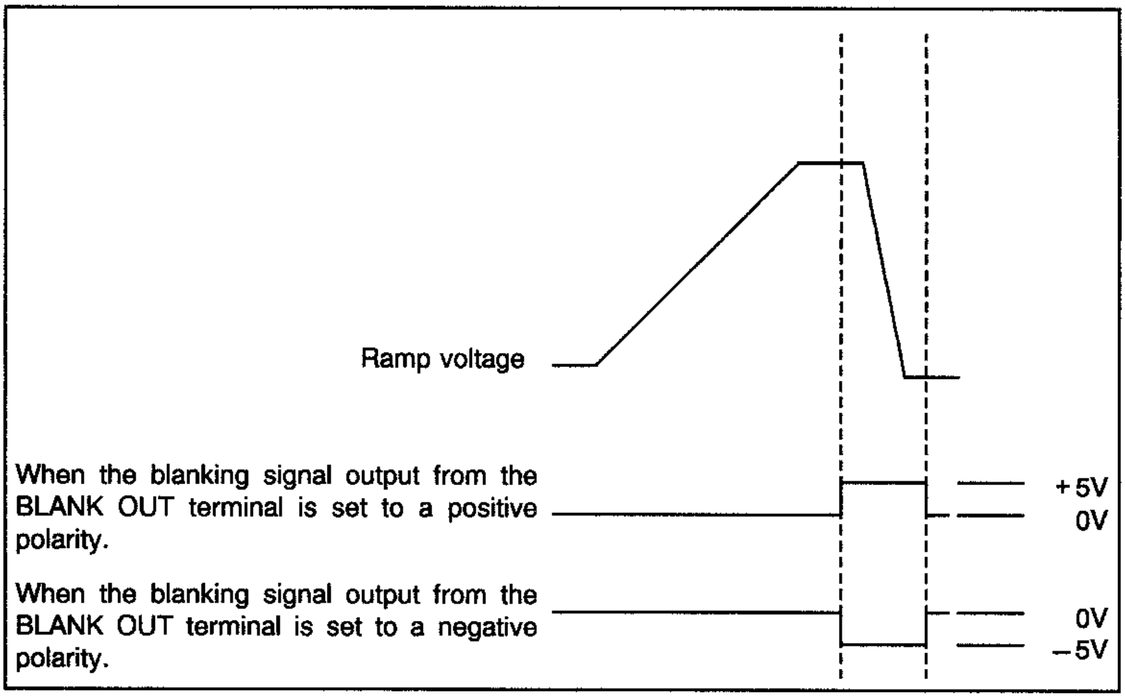


Figure 3.13 - 1 Blanking Signal

The following paragraphs describe the procedure of setting the polarity of a blanking signal.

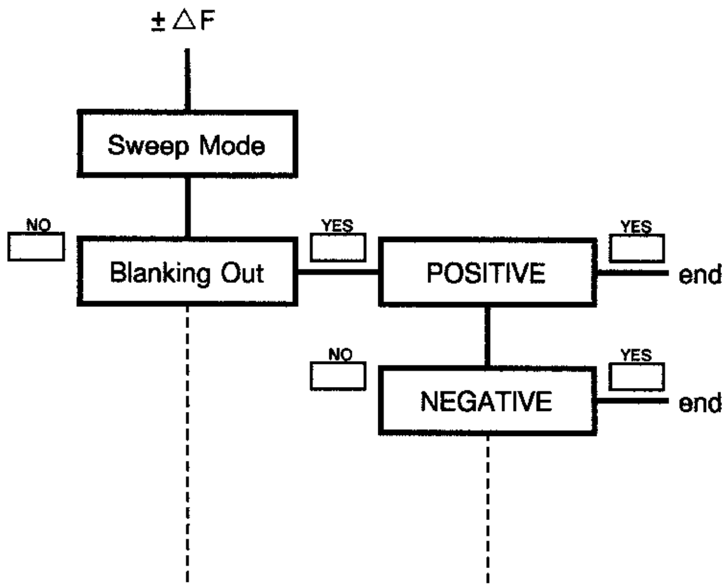
(2) Procedure

To set the BLANKING function, use the 2 ±ΔF key.

(3) Note

The BLANKING function will be set forcibly to set a blanking signal to a positive polarity (indicated by "POSITIVE" displayed in the message window) when the equipment is initialized (by pressing the SHIFT and FUNCTION PRESET keys in this order).

(4) Operational Map for BLANKING Function



3.14 Marker Signal Output : MARKER Function

(1) Description

The R4262 can generate a marker signal for indicating that a specific frequency (marker frequency) is swept with the analog wide-band frequency sweep (A SWP), analog narrow-band frequency sweep ($\pm\Delta F$), or digital frequency sweep (D SWP) function. This is called the MARKER function. The marker signal is output from the marker signal output (MARKER OUT) terminal on the rear panel and input in a luminance signal input (Z input) terminal of a penrecorder or oscilloscope. Figure 3. shows 14-1 the relationship between the marker signal and sweep ramp voltage output from the sweep voltage input/output (SWEEP IN/OUT) terminal on the rear panel.

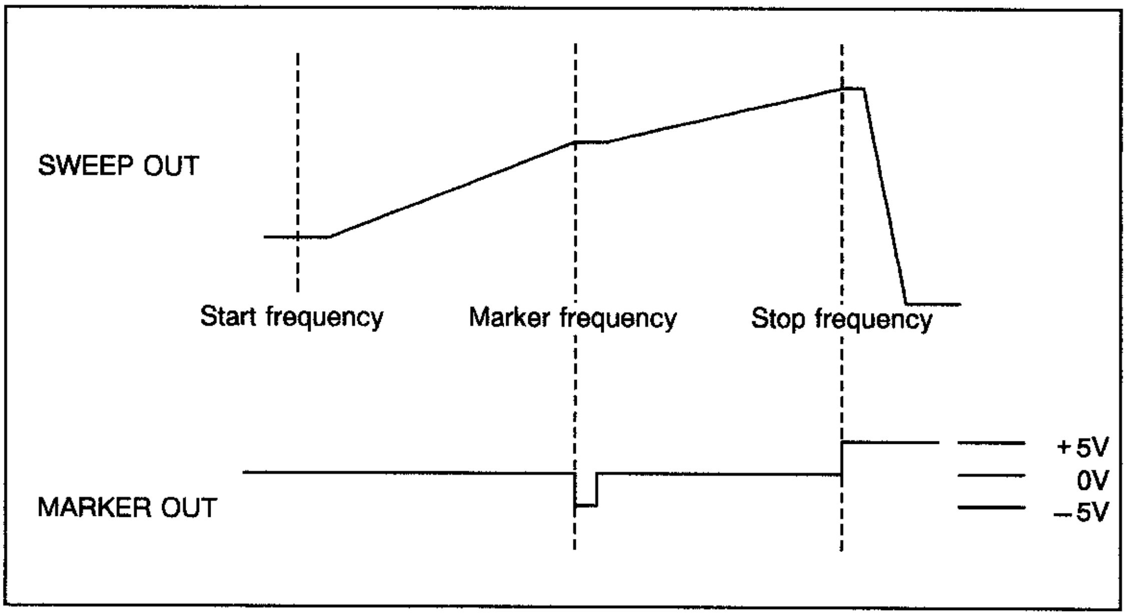


Figure 3.14 - 1 Relationship between Marker Signal and Sweep Ramp Voltage

The marker signal remains at 0V while ordinary frequencies are swept, falls to −5V when a marker frequency is swept, and rises to +5V when the BLANKING function is used. When the marker signal is output, any frequency sweep function will stop during a certain period that depends on preset sweep time, e.g. 1/10 of any sweep time preset to below 10 seconds and about 1 second for any sweep time preset to above 10 seconds.

A maximum of 10 marker frequencies, each ranging from 100kHz to 4500MHz, can be set simultaneously for each frequency sweep function.

Also available is an active marker signal especially when the A SWP function is used. Among 10 marker signals corresponding to the maximum of 10 marker frequencies, only one active marker signal can be selected to maintain the accuracy of the corresponding selected marker frequency within 1% of any preset sweep span.

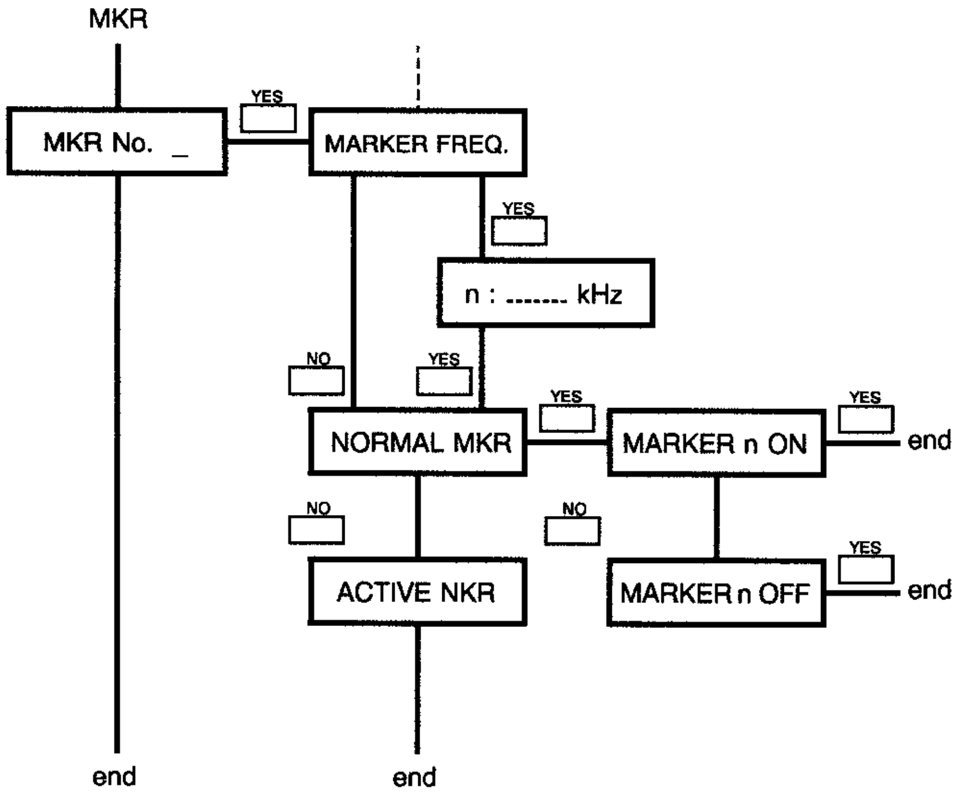
(2) Procedure

To set the MARKER function, use the [6 / MKR] key.

Note

Setting any marker frequencies that are outside a range of currently swept frequencies or that are too close to one another causes a beep sound and invalidate the set marker frequencies but leaves any entered data intact.

(3) Operational Map for MARKER Function



3.15 Function Key Switches

(1) Description

When the lamp of the FUNCTION key is on, the following function/memory keys function as function key switches to perform their assigned functions:

FUNCTION/MEMORY

0	1	2	3	4	5	6	7	8	9
A SWP	D SWP	$\pm\Delta F$	SWP TIME	SPCL MOD	BAND	MKR	SPCL FUNCTION		SEQ

The functions of the above individual function key switches are described below:

0 A SWP ... Sets the analog wide-band frequency sweep (A SWP) function and its various parameters.

1 D SWP ... Sets the digital frequency sweep (D SWP) function and its parameters.

2 $\pm\Delta F$ ... Sets the analog narrow-band frequency sweep ($\pm\Delta F$) function and its various parameters.

3 SWP TIME ... Sets sweep time.

4 SPCL MOD ... Sets special functions for the amplitude modulation (AM), frequency modulation (FM), and phase modulation (øM).

5 BAND ... Sets frequency bands.

6 MKR ... Sets marker frequencies for frequency sweep.

7 SPCL FUNCTION ... Sets special functions for frequency setting, amplitude setting, keying, and serial interfaces.

9 SEQ ... Executes sequences and sets procedures.

The Appendix 3 lists the functions of the individual function key switches. For more information on those functions, see relevant sections (e.g. Section "3.11 Analog Frequency Sweep" for the 0 A SWP key switch).

(2) Procedure

Confirm that any one of the function names enclosed in $\square$ in the Appendix 3 are displayed in the message window. Press the $\overset{\text{YES}}{\square}$ or $\overset{\text{NO}}{\square}$ key to display the right lower function name or the lower function name, respectively, in the message window. When the lowermost function is set, its name will disappear from the message window, returning to the initial state before any of the function key switches $\overset{0}{\underset{\text{A SWP}}{\square}}$ to $\overset{9}{\underset{\text{SEQ}}{\square}}$ is pressed.

For example, when the $\overset{0}{\underset{\text{A SWP}}{\square}}$ key switch is pressed, a message :

Normal Sweep

will be displayed in the message window. At this time, press the $\overset{\text{YES}}{\square}$ key, and the above message will be replaced by a message :

Auto Sweep

Further, press the $\overset{\text{NO}}{\square}$ key at this time, and the above message will be replaced by a message :

Full Sweep

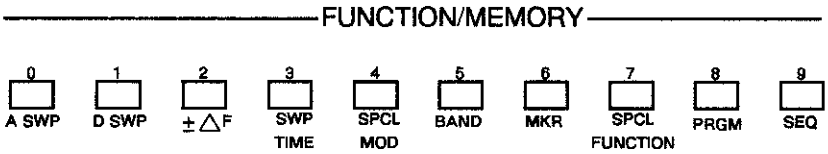
3.16 Memory Key Switches

3.16.1

The memory key switches are used to save (SAVE function) or recall (RECALL function) the values of function parameters in and from memory built in the equipment. The memory is divided into two sections: one for store all function parameter values and the other for storing only carrier wave frequency and amplitude values. A total of 50 channels constitute the memory, 10 channels being assigned to the former section and the remaining 40 channels being assigned to the latter section.

Any data saved in the memory will be retained for about six months even after the equipment is powered off and disconnected from the AC power line. It is convenient to save function parameter values in the order of channel numbers by item such as measurement and test items.

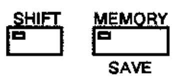
The following 10 memory key switches are available :



The channels of numbers 0 to 9 are assigned to the first memory section for saving all function parameter values while the channels 10 to 49 are assigned to the memory second section for saving only carrier wave frequency and amplitude values. The memory numbers 0 to 9 markerd above the individual memory key switches correspond to the channel numbers 0 to 9.

3.16.2 Saving in Memory : SAVE

The following paragraphs describe the procedure of using the SAVE function to save new function parameter values in any selected channel of memory built in the equipment.



in this order. Then, the message window will display a message :

Memory No. ?

This message asks a number for the selected channel. When selecting any of channels 0 to 9 to save all function parameter values, press any of the 10 memory key switches [0 / A SWP] to [9 / SEQ] whose memory number corresponds to a number for the selected channel.

When selecting any of channels 10 to 49 to save only carrier wave frequency and amplitude values, enter a number for the selected channel with the ten keys. For example, when selecting channel 3, press one of the fourth memory key switch :

[3 / SWP TIME]

And when selecting channel 25, press the ten keys:

[2] [5] [Hz]

Suppose that channel 3 is selected, the message window will display a message:

No. 03 Sure ?

This message confirms whether to save new function parameter values in channel 3 or not. Note here that any newly saved data will overwrite any previously saved data in any channel.

Therefore, confirm whether a channel whose number is displayed in the above confirmation message is the selected channel or not. If so, press the [YES] key to execute the SAVE function. If not, press the [NO] key to suspend the SAVE function, press the [NO] key.

No. 03 Sure ?

↓

[NO]	[YES]
↓	↓
Suspends saving new function parameter values in channel 3.	Saves new function parameter values in channel 3.

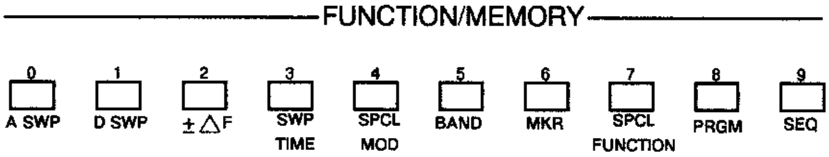
Pressing the [YES] key will immediately execute the SAVE function. When the message window displays a message "Memory No. ?", prompting entry of a desired channel number, pressing any function keys instead of the ten keys will suspend the SAVE function.

Note

Any data saved in the memory will remain unerased even when the equipment is initialized (by pressing the [SHIFT] and [FUNCTION / PRESET] keys in this order) or powered off.

3.16.3 Recalling from Memory : RECALL

Any previous parameter values can be recalled from any selected channel of memory built in the equipment with the RECALL function by pressing any of the following ten memory key switches whose memory number corresponds to a number for the selected channel when the lamp of the MEMORY SAVE key is on.



When the lamp of the MEMORY SAVE key is off, press the MEMORY SAVE key.

Then, the message window will display a message :

MEMORY 00-09

This message indicates that the memory numbers 0 to 9 marked above the ten memory key switches correspond to the channel numbers 0 to 9. Pressing MEMORY SAVE key again will display a message :

MEMORY 10-19

This message indicates that the memory numbers 0 to 9 marked above the ten memory key switches correspond to the channel numbers 10 to 19. Likewise, pressing the MEMORY SAVE key repeatedly will display message indicating the correspondence between memory and channel numbers in the following cycle :

MEMORY 10-19

↓

MEMORY SAVE

↓

MEMORY 20-29

↓

MEMORY SAVE

↓

MEMORY 30-39

↓

MEMORY
SAVE

↓

MEMORY 40-49

↓

MEMORY
SAVE

↓

MEMORY 00-09

When a correspondence message showing the selected channel number is displayed, press any of the ten memory keys corresponding to that number. Then, the RECALL function will be executed immediately.

> Note
>
> The SAVE or RECALL function can also be executed with GPIB commands. In this event, any other GPIB commands than SV or RC that are described consecutively in one line will be ignored.

3.17 SEQUENCE Function

3.17.1 Description

Any data saved in memory built in the equipment can be read automatically with the SEQUENCE function. Two modes of the SEQUENCE function are available : AUTO SEQUENCE function that automatically reads memory data between any specified starting and ending channel numbers repeatedly and the ALTERNATE SEQUENCE function that automatically reads memory data in every frequency sweep. The following paragraphs describe these two modes of the SEQUENCE function.

(1) AUTO SEQUENCE Function

Automatically reads currently set values of parameters for all functions between any specified starting and ending channel numbers repeatedly at various time intervals specified with step time. Note that the values of the parameters for the frequency sweep (F SWP) function or amplitude sweep (A SWP) function will also be read from the memory at time intervals specified with step time and not with sweep time. This means that the F SWP or A SWP function will be executed inaccurately when its parameters are read with the AUTO SEQUENCE function.

(2) ALTERNATE SEQUENCE Function

Automatically reads currently set values of parameters for the frequency sweep (F SWP) or amplitude sweep (A SWP) function between any specified starting and ending channel numbers in every execution of the function. The time intervals for execution of the ALTERNATE SEQUENCE function is specified with sweep time and not with step time. Note that the values of Parameters for any other function than the F SWP or A SWP function cannot be read with the ALTERNATE SEQUENCE function.

When either of the above two modes of the SEQUENCE functions is under execution, the message window will display a message :

SEQUENCE

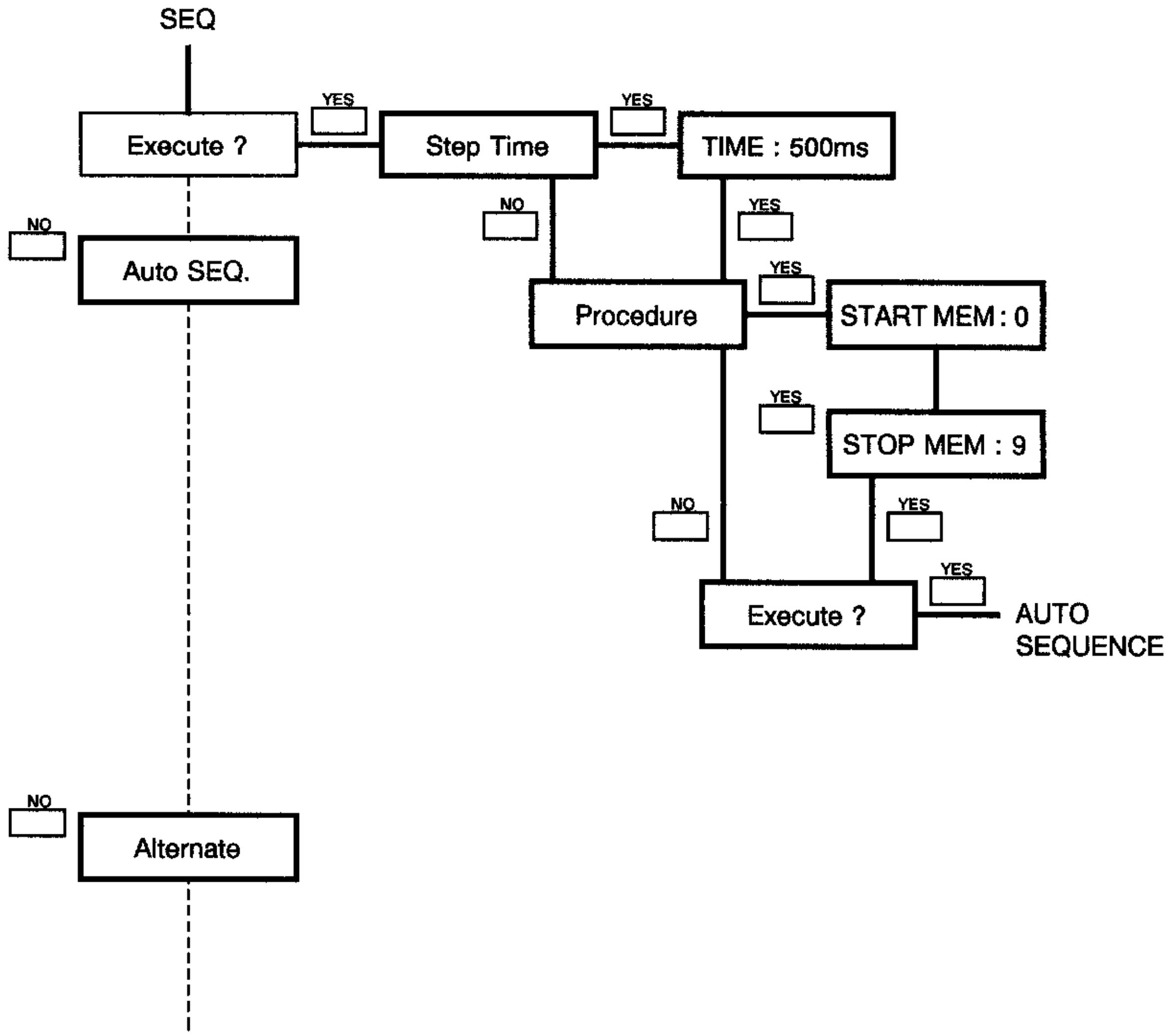
Both the above two modes of the SEQUENCE function can be stopped by pressing any function key.

3.17.2 AUTO SEQUENCE Function

(1) Procedure

To set and execute the AUTO SEQUENCE function, use the [9 / SEQ] key.

(2) Operational Map for AUTO SEQUENCE Function

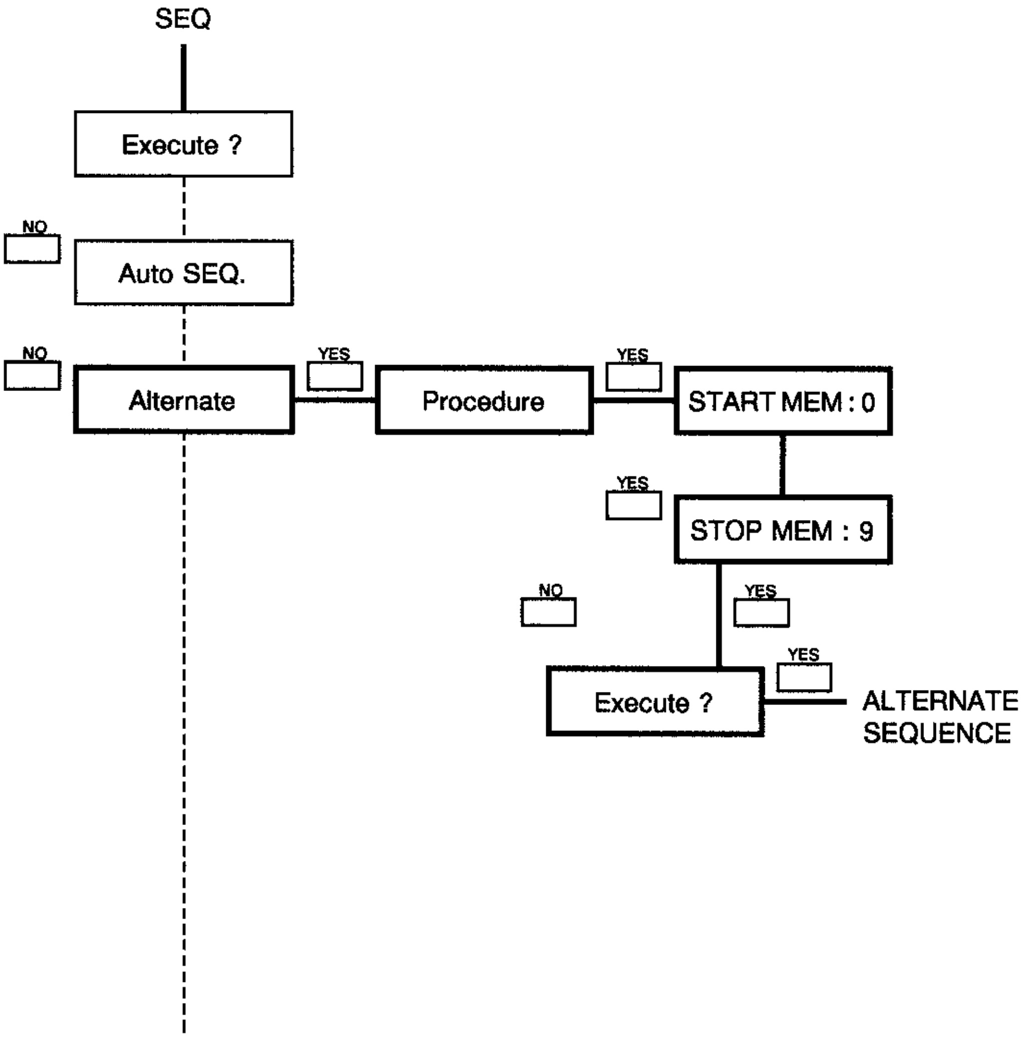


3.17.3 ALTERNATE SEQUENCE Function Setting : ALTERNATE

(1) Procedure

To set and execute the ALTERNATE SEQUENCE function, use the [9 / SEQ] key.

(2) Operationl Map for ALTERNATE SEQUENCE Function



4. GPIB Interface

4.1 General Information

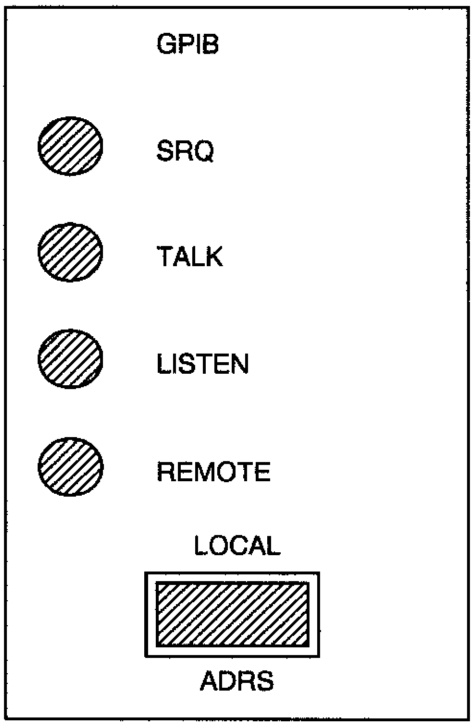
(1) Extendability and Compatibility of GPIB

A general-purpose interface bus (GPIB) is an interface system allows a measuring equipment to be connected to a controller and peripheral equipment with one or more simple cables (GPIB lines). Compared with the conventional Digital Interface for Programmable Instrumentation, the GPIB provides an excellent extendability as well as electrical, mechanical, and functional compatibility with other interfaces by different manufacturers, thus facilitating configuration of various measuring systems ranging from a simple one connected with a single cable to an automated complex one.

(2) Talker, Listener, and Controller

In a GPIB-based automatic measuring system, each configuration unit connected to one or more GPIB lines must be assigned an appropriate GPIB address in accordance with the procedure described in Section 4.1.2. Each configuration unit can perform one or more of the functions of a talker, listener, and controller.

During operation of the GPIB measuring system, only one talker can transmit data over the GPIB lines while more than one listener can receive the data. The controller can transfer data from specified GPIB address of the talker to the GPIB addresses of the listeners and set measuring conditions for the listeners.



SRQ	Service Request LED : Lights during transmission of a service request (SRQ).
TALK	TALKer LED : Lights during transmission of data.
LISTEN	LISTENer LED: Lights during reception of data.
REMOTE	REMOTE LED : Lights during the remote control mode of the equipment.
LOCAL / ADRS	REMOTE/LOCAL Switching Key : Terminates the remote control mode of the equipment to enable data input from the panels when pressed during lighting of the REMOTE lamp. Allows assignment of GPIB addresses when pressed after the SHIFT key.

The GPIB provides remote control for the following:

① Measuring Condition Input: Entering various measuring conditions for the equipment through keys on the front panel

② Measuring Conditions Output: Recalling various measuring conditions for the equipment.

③ Service Request for Controller: Request to the controller for interrupt to its control and output of status bits

④ Operating Conditions Output: Output of mode strings

4.1.1 System Configuration

When a GPIB-based automatic measuring system is being configured with the equipment as a central unit, the following controllers, recorders, and their equivalents can be connected via the GPIB to the equipment as peripheral equipment :

Peripheral equipment	Recommended unit		Remarks
Controller	PC9801 Series by Nippon Electric Company (NEC)		
Bus cable	Standard bus cable by Advantest		The length of each bus cable must not exceed 4m while the total length of all bus cables must not exceed 20m.
	Length	Model name	
	0.5m	408JE-1P5	
	1m	408JE-101	
	2m	408JE-102	
	3m	408JE-104	

Before the equipment is connected to peripheral equipment to configure a GPIB-based automatic measuring system, each piece of the peripheral equipment must be checked to confirm its normal status and operation.

4.1.2 Address Assignment

A GPIB address can be assigned to a configuration unit in a GPIB-based automatic measuring system by operating appropriate keys on the front panel as follows:

Press the SHIFT and LOCAL keys in this order to set an address assignment mode, the message window will display a currently assigned GPIB address.

When choosing to use the current GPIB address, press any of the unit keys [Hz] to [GHz] to exit from the address assignment mode.

When choosing to assign a new GPIB address, for example, "01", press [0], [1], and [Hz] (-dBu / deg) keys in this order. A total of 31 GPIB addresses of 00 to 30 are available.

To complete assignment of any desired GPIB address, press any of the unit keys [Hz] to [GHz].

Once any GPIB address has been assigned, various GPIB functions, such as the delimiter, header, service request, etc., which are described later will be initialized.

4.2 Function Programming

4.2.1 Examples of Function Programming

All functions of the equipment can be programmed for remote setting by the controller in the GPIB-based automatic measuring system. Two examples of function programming on PC9801 Series and HP200 Series are shown below :

<Example> Set a carrier wave frequency and frequency to 500MHz and −12dBm, respectively.

PC9801 Series

PRINT @ 01 ; "CW500MZ LE-12DM"

- PRINT — Specifies the controller as a talker.
- @ — I/F selector
- 01 — GPIB address
- "CW500MZ LE-12DM" — See an example of programming using HP9825 Series.

HP200 Series

OUTPUT 701 ; "CW500MZ LE - 12DM"

- OUTPUT — Specifies the controller as a talker.
- 7 — I/F selector
- 01 — GPIB address
- CW — Specifies a carrier wave frequency.
- 500MZ — Sets a carrier wave frequency of 500MHz
- LE — Output level
- 12DM — Sets a carrier wave amplitdue of −12dBm.

In the above function programming examples, the codes such as "CW", "MZ", and "LE" are GPIB commands of the R4262. The Appendix 2 lists all the GPIB commands.

* Note on GPIB Commands "DM" and "DU"

Both GPIB commands "DM" and "DU" and the unit keys [GHz] (+dBm, v) and [MHz] (−dBm, %, mV) are used to set the unit for any function parameter value but their specifications differ as follows:

A carrier wave amplitude can be set to, for example, +10dBm or −10dBm by pressing the [AMPLITUDE] [1] [0] [GHz] (+dBm, v) and [MHz] (−dBm, %, nV) keys, respectively.

Thus, either of the two unit keys [GHz] (dBm, V) and [MHz] (−dBm, mV) must be selected depending on whether a function parameter value to be set is positive or negative. This selection of either a positive or negative unit is, however, troublesome in function programming. To eliminate this inconvenience, the GPIB of the R4262 is designed to automatically select either a positive or negative unit depending on whether a function parameter value to be set is positive or negative. Therefore, either of the GPIB commands "DM" and "DU" can be used in function programming regardless of whether a parameter value to be set is positive or negative.

<Example>

PC9801 Series

```
10    FOR  I = -10  TO  10
20    PRINT @1 ;  "LE";  I ;  "DM"
30    NEXT  I
```

HP200 Series

```
10    FOR  I = -10  TO  10
20    OUTPUT  701 ;  "LE";  I ;  "DM"
30    NEXT  I
```

* Note that exponential function parameter values cannot be transmitted with any GPIB commands.

4.2.2 Output of Parameter Values from R4262 to GPIB

Parameter values can be output from the R4262 to the GPIB with the following two GPIB commands:

OA (Output Active Parameter) : Outputs active parameter values.

OP (Output Interrogated Parameter) : Outputs program-specified parameter values.

(1) Example of OA Command Input

The OA (Output Active Parameter) command outputs from the R4262 to the GPIB those parameters values which are active when the equipment is specified as a talker. Two programming examples for OS command input on PC9801 Series and HP200 Series are shown below :

PC9801 Series

```
10    DiM  A$  [20]
20    PRINT @1 ;  "SA FA OA"
30    GOSUB *AWAITE
40    INPUT @ ;  A$
50    DISP  A$
60    END
```

HP200 Series

```
10    DiM  A$  [20]
20    OUTPUT 701 ;  "SA FA OA"
30    ENTER  701 ;  A$
40    DISP  A$
50    END
```

Line number		Processing
PC9801 Series	HP200 Series	
10	10	Secures 20 bytes of characters string variables "A$".
20	20	Sets the analog frequency sweep function and enables a start frequency. Instructs the R4262 to output active parameter values.
30	30	Specifies the R4262 as a talker for receiving active paramenter values. At this time, the R4262 will output the value of the start frequency, which has been enabled in the line 20.
40		Prohibits input in the R4262 as necessary unless there is any wait time.
50	40	Instructs the R4262 to display input data. (Example : SAFA ␣1234567890.0 + E0)
60	50	Ends the programs.

(2) Example of Function Programming Using OP Command

The OP (Output Interrogated Parameter) command outputs program-specified parameter values from the R4262 to the GPIB. In function programming, the OP command must be followed by the code of a parameter value to be output. Table 2-7 provided at the end of this section lists all parameter codes.

Two programming examples for OP command input on PC9801 Series and HP200 Series are shown below:

PC9801 Series

```
10  DIM  A$  [20]
20  PRINT  @1 ;  "CW1.2GZ  LE-15DM"
30  PRINT  @1 ;  "OPLE"
40  GOSUB  *AWAITE
50  INPUT  @1 ;  A$
60  DISP  A$
70  END
```

HP200 Series

```
10  DIM  A$  [20]
20  OUTPUT  701 ;  "CW1.2GZ  LE-15DM"
30  OUTPUT  701 ;  "OPLE"
40  ENTER  701 ;  A$
50  DISP  A$
60  END
```

Line number		Processing
PC9801 Series	HP200 Series	
10	10	Secures 20 bytes of character string variables "A$".
20	20	Sets a carrier wave frequency and amplitude to 1.2GHz and −15dBm, respectively.
30	30	Instructs the R4262 to output amplitude parameter values.
40		Prohibits input in the R4262 as necessary unless there is any wait time.
50	40	Specifies the R4262 as a talker for receiving program-specified parameter values. At this time, the R4262 will output amplitude parameter values, which has been specified in line 30.
60	50	Instructs the R4262 to display input data. (Example: DM-0000000015.0E+0)
70	60	Ends the program.

4.2.3 Block Delimiter

The R4262 provides the following four commands for setting block delimiters "CR" and "LF":

DLA : Sets two 1-byte block delimiters "CR" and "LF".
DLB : Sets two 1-byte block delimiters "CR" and "LF".
Also outputs a unline message "EOI" simultaneously with "LF".
DLC : Sets one 1-byte block delimiter "LF".
DLD : Outputs a unline message "EOI" simultaneously with the last byte of data transmitted to the R4262.

The R4262 will receive any command or data from the controller or other units in the GPIB-based automatic measuring system as long as block delimiters are set in the received command or data with any one of the above four commands. Otherwise, the GPIB will not operate normally.

Conversely, the controller or other units in the GPIB system will receive any command or data from the R4262 as long as block delimiters are set in the received command or data with any selected one of the above four commands so that the block delimiters can be processed by the controller or other units. The above four commands, which are transmitted from the controller, can also be used to change block delimiters. The Appendix 2 also lists all these four commands.

Two programming examples for block delimiter setting on PC9801 Series and HP200 Series are shown below:

PC9801 Series

```
PRINT  @1 :  "DLC"
```

HP200 Series

```
OUTPUT  701 ;  "DLC"
```

The above programming examples set the block delimiter of "LF" with the DLC command. Note that the DLA command (setting the block delimiters "CR" and "LF") will automatically be selected when the equipment is powered on.

4.2.4 Output Data Format (Talker Message Format)

Program-specified parameter values are output by the OP command in the format shown below.

In the sample output data format below, the section marked with

"* " should be specified as a header in frequency setting and as "␣" or "-" indicating a positive or negative sign, respectively, in amplitude setting.

Excluding block delimiters, data output by the OP command contains a total of 19 bytes. However, any data input as character string variables from the controller and other units in the GPIB-based automatic measuring system must be declared an array containing more than 19 bytes through array declaration.

Headers used in the output data format by the OP command are listed in Appendix 2.

HHH ␣ DDDDDDDDDD. DE ± D CRLF

- CRLF: Block delimiter
- DDDDDDDDDD. DE ± D: Output data (Example : 0000123456.0E + 0)
- ␣: Header or sign (Positive : Space "␣", Negative : Minus sign "-")
- HHH: Header (Example : "CW ␣"

4.2.5 Header

A header appears at the head of data output by the OP command and indicates the type of the output data.

If unnecessary, headers can be omitted. Appendix 2 shows the relationship between headers and output data.

Two programming examples of header setting on PC9801 Series and HP200 Series are shown below:

PC9801 Series

```
 10   DIM  A$  [20]
 20   PRINT @1 ;  "HDOF"
 30   PRINT @1 ;  "CW123MZ"
 40   PRINT @1 ;  "OPCW"
 50   GOSUB  *AWAITE
 60   INPUT @ ;  A$
 70   LPRINT A$
 80   PRINT @1 ;  "HDON"
 90   PRINT @1 ;  "OPCW"
100   GOSUB  *AWAITE
110   INPUT @1 ;  A$
120   LPRINT A$
130   STOP
```

HP200 Series

```
 10   DIM  A$  [20]
 20   OUTPUT 701 ;  "HDOF"
 30   OUTPUT 701 ;  "CW123MZ"
 40   OUTPUT 701 ;  "OPCW"
 50   ENTER 701 ;  A$
 60   PRINT A$
 70   OUTPUT 701   "HDON"
 80   OUTPUT 701   "OPCW"
 90   ENTER 701 ;  A$
100   PRINT A$
110   END
```

Line number		Processing
PC9801 Series	HP200 Series	
10	10	Secures 20 bytes of characterr string variables "A$".
20	20	Turns off a header for data output by the OP command.
30	30	Sets the CW mode and a carrier wave frequency of 123MHz.
40	40	Instructs the R4262 to output data following the OP command.
50		Prohibits input in the R4262 as necessary unless there is any wait time.
60	50	Specifies the R4262 as a talker for receiving data without any header.
70	60	Instructs the R4262 to output any input data to the printer. (Example: "␣␣␣␣0123000000.0E+0")
80	70	Turns on a header for data output by the OP command.
90	80	Instructs the R4262 to output data following the OP command.
100		Prohibits input in the R4262 as necessary unless there is any wait time.
110	90	Specifies the R4262 as a talker for receiving data with a header.
120	120	Instructs the R4262 to output any input data to the printer. (Example : "CW␣␣0123000000.0E+0")
130	110	Ends the program.

4.2.6 Service Request

The R4262 provides a service request function that enables the GPIB controller to detect a status in which the R4262 completes the analog wide-band frequency sweep (A SWP), digital frequency sweep (D SWP), or analog narrow-band frequency sweep ($\pm\Delta F$) function.

This status is indicated by a status byte through serial poll.

Table 4-1 shows the configuration of status bytes.

Table 4 - 1 Configuration of Status Bytes

BIT#	7	6	5	4	3	2	1	0
Decimal number	128	64	32	16	8	4	2	1
Function		SERVICE REQUEST (SRQ)	END OF SCAL.	END OF SWEEP	SCAL. ERROR	MODE SET ERROR	SYNTAX ERROR	DATA SET ERROR

BIT 0 : DATA SET ERROR
Set to 1 when any data exceeding its predetermined range has been set by the GPIB.

BIT 1 : SYNTAX ERROR
Set to 1 when there was any error in a command code transmitted from the GPIB.

BIT 2 : MODE SET ERROR
Set to 1 when any function has failed to be set (e.g. the frequency modulation (FM) function fails to be set when the analog wide-band frequency sweep (A SWP) function is set).

BIT 3 : SCALING ERROR
Set to 1 when the sweep frequency calibration (SCALING) function fails to end normally.

BIT 4 : END OF SWEEP
Set to 1 when each time the analog wide-band frequency sweep (A SWP), analog narrow-band frequency sweep ($\pm\Delta$F), digital frequency sweep (D SWP), amplitude sweep (AMPT SWP) function, or phase sweep (øSWP) function is completed.

BIT 5 : END OF SCALING
Set to 0 when the sweep frequency calibration (SCALING) function is completed.

BIT 6 : SERVICE REQUEST (SRQ)
Set to 1 when the service request function is turned on with any of BIT 0 to BIT 5 set to 1

The service request function can be turned on and off with GPIB commands "SRQON" and "SRQOF" . (See Appendix 2.)

Note

When the "SRQON" command is input to turn on the service request function, the R4262 will clear any status byte upon serial poll.

4.3 Standard for GPIB and Specifications for GPIB of R4262

(1) GPIB Lines

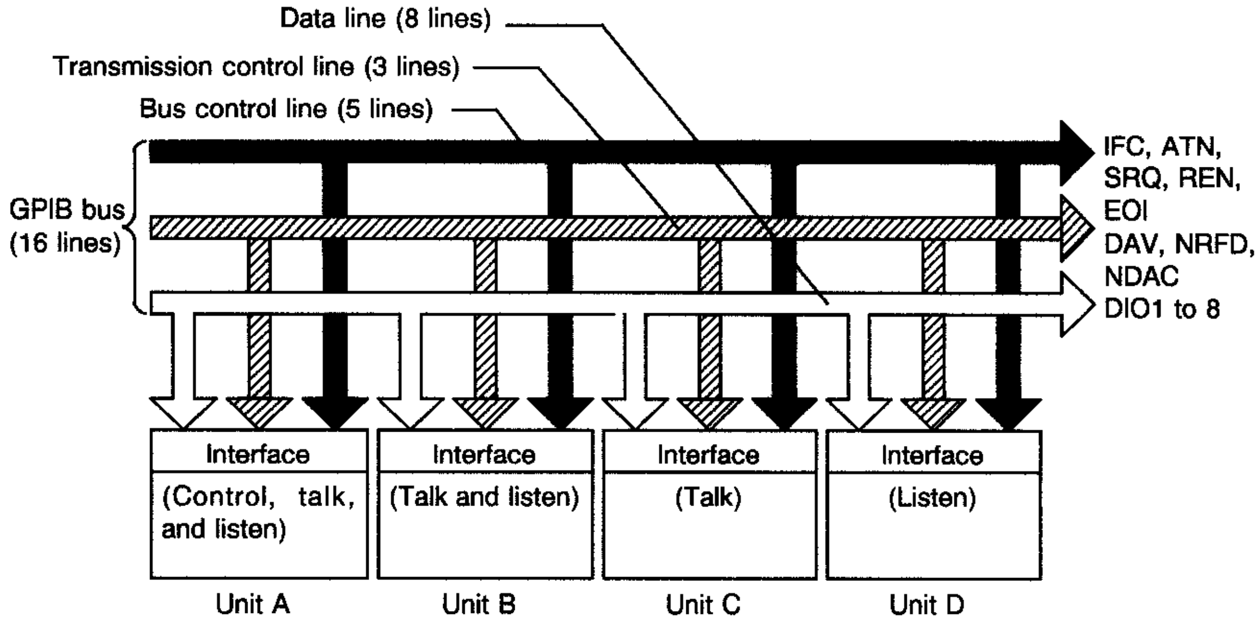


Figure 4 - 1 Configuration of GPIB Bus Line

There are 16 GPIB lines, which are: data lines for transferring data between different units, 3 transmission control lines (handshake lines) for controlling asynchronous data communication between different units, and 5 bus control lines for controlling the flow of data on the GPIB.

- Data lines : Used for bi-directional asynchronous transfer of data between different units in a bit-parallel and byte-serial method. Capable of freely connecting any high-speed and low-speed units for asynchronous transfer of data between them. Thransferred data (or messages) include measurement data, measurement conditions (programs), various commands, etc. and are represented by the ASCII code.

- Transmission control line (handshake line) : Conveys the following signals:

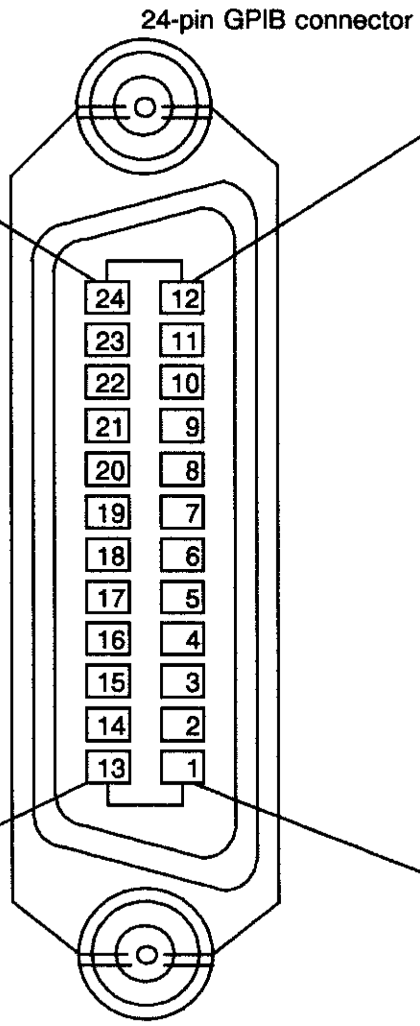
DAV (Data Valid) signal	:	Indicates valid data.
NRFD (Not Ready for Data) signal	:	Indicates data ready for transmission.
NDAC (Not Date Accepted) signal	:	Indicates data that has been received.

- Bus control line: Conveys the following signals:

ATN (Attention) signal	:	Distinguishes addresses or commands from any other information on the data lines.
IFC (Interface Clear) signal	:	Clears the GPIB interface.
EOI (End of Identity) signal	:	Indicates the end of data transfer.
SRQ (Service Request) signal	:	Requests to the controller from any other unit for services.
REN (Remote Enable) signal	:	Remotely controls remotely programmable equipment.

(2) Connector : 24-pin GPIB connector 57-20240-D35A (Equivalent to Anphenol Corporation's product)

Output signal name	Pin No
GND LOGIC	24
GND (ATN)	23
GND (SRQ)	22
GND (IFC)	21
GND (NDAC)	20
GND (NRFD)	19
GND (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13



Pin No	Output signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Figure 4 - 2 Pin Arrangement for GPIB Connector

(3) Specifications for GPIB of R4262

Applicable code : ASCII code (or binary code for a packed format)

Logic level : More than +2.4V for logic 0 and high level
Less than +0.4V for logic 1 and low level

Signal line termination : The 16 GPIB lines are terminated as shown in Figure 4-3.

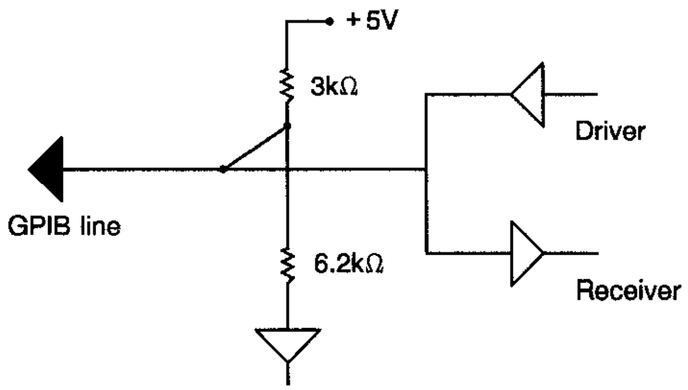


Figure 4 - 3 Signal Line Termination

Specifications for Driver : Open-collector type
Output voltage of less than +0.4V, 48mA at low level
Output voltage of more than +2.4V, −6.2mA at high level

Specifications for Receiver : Low level under less than +0.6V
High level under more than +2.0V

Length of Bus Cable : The length of each bus cable shall not exceed 4m while the total length of all bus cables (Number of units connected to GPIB x 2m) shall not exceed 20m.

Address assignment : 31 talk addresses and listen addresses are available.

(4) GPIB Interface Fnuctions : Table 4-2 lists the interface functions of the GPIB of the R4262.

Table 4 - 2 Interface Functions of GPIB of R4262

Code	Description of interface function
SH1	Source handshake function
AH1	Acceptor handshake function
T6	Basic talker function, serial poll function, and talker release function through listener designation
L4	Basic listener function and listener release function through talker designation
SR1	Service request function
RL1	Remote setting function
PP0	Parallel function disabled
DC1	Device clear function enabled
DT0	Device trigger function disabled
C0	Controller function disabled
E1	Uses an open-collector type bus driver. But E2 (three-state bus driver) shall be used for EOI and DAV signals.

5. PRINCIPLE OF OPERATION

Figure 5-1 is a block diagram of the R4262 Synthesized Signal Source.

The following paragraphs describe the functions of the individual sections of the R4262 which are shown in the block diagram.

① Reference Frequency Generator Section

The reference frequency generator section synthesizes (adds or multiples) frequencies of 40MHz, 180MHz, 360MHz, 420MHz, 800MHz, 2.4GHz, 3.6GHz, and 200MHz to 1GHz for supply as reference frequencies to the other sections.

② YTF Synchronizer Section

The YTF synthesizer section selects one harmonic wave from a 1.8GHz to 4.6GHz harmonic wave string obtained by synthesizing 200MHz to 1GHz (200MHz step) and 2.4GHz or 3.6GHz signals to generate high-purity local oscillator frequencies. It operates in response to 100MHz digits of a preset carrier wave frequency.

③ YTO PLL Section

The R4262 constitutes a main synthesizer with a YIG tuned oscillator (YTO), thus making itself a high-purity signal source.

A signal output from the YTO is mixed with a local oscillation frequency signal output from the YTF Synthesizer section and a signal output from the VHF synthesizer section to generate a 40MHz intermediate frequency, which is, in turn, synchronized with a 40MHz signal output from the frequency/phase modulator section to generate a 2GHz to 4.5GHz original signal for the R4262.

The original signal is output from the FR signal output (RF OUTPUT) terminal on the front panel as it is divided, heterodyned, or left unchanged. Therefore, the greater the dividing factor for the divider section, the higher the purity of the original signal.

When the analog wide-band frequency sweep (A SWP) function is executed, the intermediate frequency is swept with sweep voltage generated by the sweep voltage generator section without being synchronized with the 40MHz signals generated by the FM/øM modulator section.

④ VHF Synthesizer Section

The VHF synthesizer section synthesizes nine digits (0.1Hz to 10MHz) of preset carrier wave frequency in the range of 200MHz to 300MHz with a multi-loop synthesizer. It can be set independently of frequency modulation, frequency sweep, etc., thus ensuring a stable supply of siganls.

⑤ Frequency/Phase Modulator Section

When the frequency modulation (FM), phase modulation (øM), phase sweep offset (OFFSET), or phase sweep (øSWP) function is executed, a 40MHz signal is output from the frequency modulator section. When no modulation function is executed, a signal of fixed frequency of 40MHz is output from the reference frequency generator section. When the analog narrow-band frequency sweep ($\pm\Delta$F) function is executed, a 40MHz signal is output from the frequency/phase modulator section. Any signal output from the frequency/phase modulator section is synchronized directly with a signal output from the YTO PLL section, so that the greater the dividing factor for the divider section, the smaller is the drift of a DC carrier wave when the FM function is executed.

⑥ Sweep Voltage Generator Section/YTO Control Section

The YTO control section generates pre-tuning voltage for the YTO PLL section to synchronize a signal output from the YTO with a 40MHz signal output from the frequency/phase modulator section when the R4262 is set as a synthesized signal source. The sweep voltage generator section generates sweep voltage to sweep YTO signal frequency when the analog narrow-band frequency sweep ($\pm\Delta$F) function is executed.

⑦ Audio Singnal Generator Section

The audio signal generator section is composed of two sets of low-frequency oscillators and amplitude attenuators, whose output signals are fed to the amplitude modulator section and frequency/phase modulation sections, respectively. The amplitude attenuators are used to set modulation depth or deviation and calibrate are amplitude of any external modulation signal. An oscillator built in the frequency/phase modulator section is equipped with a pre-emphasis circuit.

⑧ Divider Section

The divider section divides 2GHz to 4.5GHz original signals output from the YTO PLL section by two, four, eight, sixteen, or thirty-two depending on preset carrier wave frequency.

⑨ Heterodyne Section

The heterodyne section downconverts a 2GHz to 4.5GHz original signal output from the YTO PLL section into a 10MHz to 2GHz signal through a heterodyne technique without dividing it. It also heterodynes a signal divided by the divider section and a 800MHz signal output from the reference frequency generator section to generate a 100kHz to 120MHz signal.

⑩ Output Amplifier Section

The output amplifier section amplifies a carrier wave signal output from the divider section and the heterodyne section up to about +20dBm.

⑪ Amplitude Modulator Section

The amplitude modulator section modulates the amplitude of a carrier wave in accordance with a modulating signal. It also superimposes ALC reference voltage with a modulating signal simultaneously with the amplitude modulator, thus allowing modulation of DC carrier waves.

⑫ ALC Section

When actual voltage of a signal output from the output amplifier section is detected by an Auto Level Control (ALC) circuit, the ALC section compares it with reference voltage supplied by the ALC ciruit and regulates it at a constant level through feedback control, thus ensuring a stable amplitude of signals output from the R4262. This section can also be used to set the amplitude of R4262 output signals in steps of 1 or 0.1dB by varying the reference voltage supplied by the ALC circuit. When the analog amplitude sweep (AA SWP) function is executed, this section superimposes the ALC reference voltage with sweep voltage. When the pulse modulation (PULSE) function is executed, this section samples or holds actual voltage detected by the ALC circuit to superimpose feedback voltage with a pulse signal.

⑬ Attenuator Section

The attenuator section is composed of a programmable attenuator with variable steps of 5dB, 10dB, 20dB, and 40dB and a constant attenuator with a fixed step of 70dB, thus providing the maximum attenuation capacity of 145dB. This section is equipped on its output side with a counterelectromotive force prevention circuit for protecting it from any excessive counterelectromotive force input.

⑭ Microprocessor Control Section

The microprocessor control section interprets key settings on and data entered from the front panel and control codes transmitted from the GPIB to make internal settings in the R4262. This section contains a 16-bit microprocessor intended mainly for control and a 8-bit microprocessor for controlling the GPIB and the input/output by the EIA-232-D. This section also contains a main memory, which is equipped with a backup battery so that any preset data may be retained even after the R4262 is powered off.

Upon completing desired internal settings, this section will automatically stop operating in order to minimize the influence of non-harmonic spurious waves upon output signals and radiated electromagnetic interference by the R4262. No dynamic lighting indication is made on the indicators on the front panel (except messages displayed in the message window) in order to prevent any clock pulse loss.

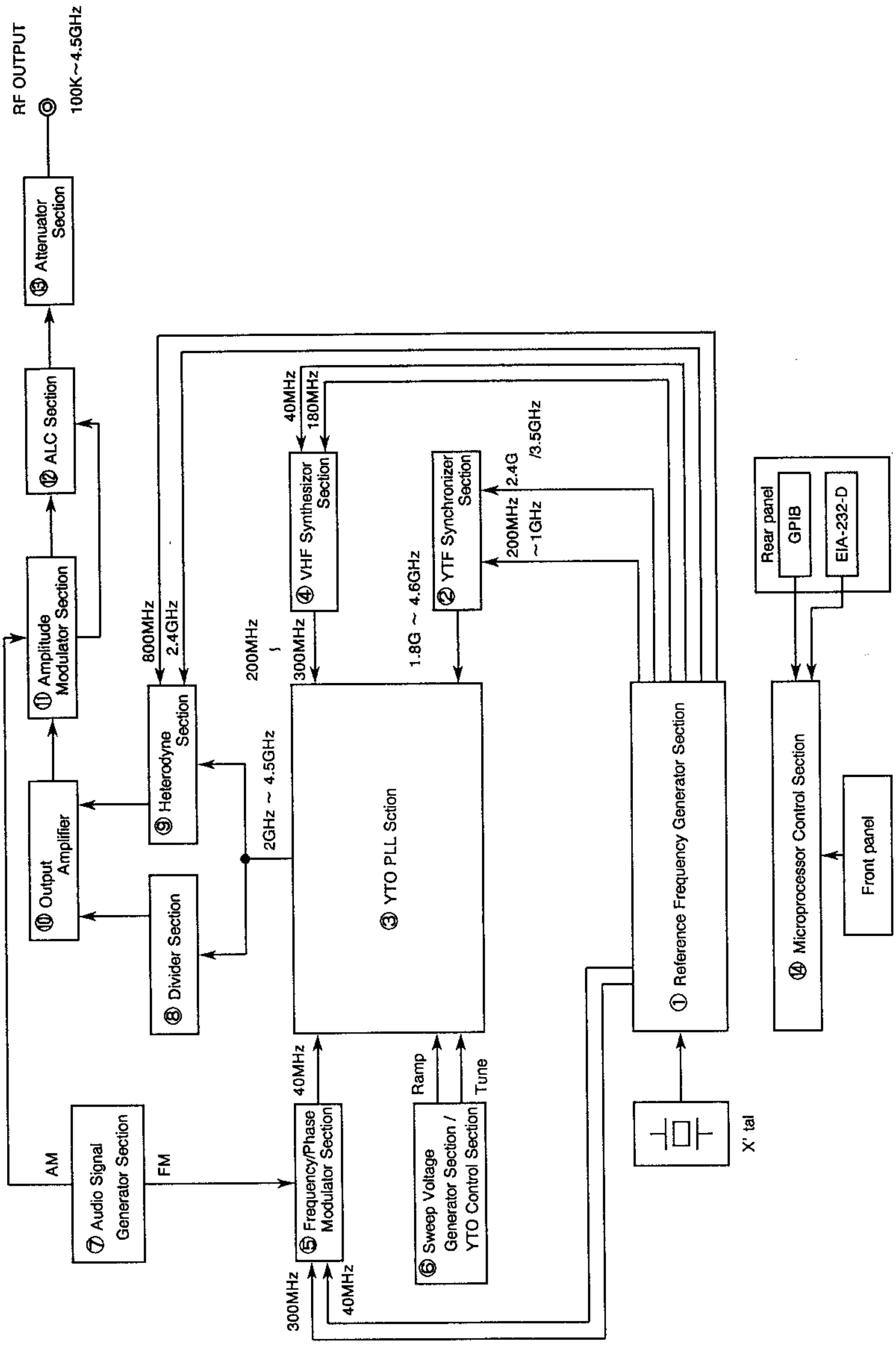


Figure 5 - 1 Block Diagram of R4262

6. SPECIFICATIONS

Table 6-1 and Table 6-2 shows the performance specifications and supplemental characteristics of the R4262.

Table 6 - 1 Specifications (1/12)

Electrical characteristics	Range	Setting conditions
Frequency		
Output radio frequency range	100kHz to 4500MHz	
Carrier wave frequency band		
Band 7	2000.0000001 to 4500.0000000MHz	
6	1000.0000001 to 2000.0000000MHz	
5	500.0000001 to 1049.9999999MHz	
4	250.0000001 to 524.9999999MHz	
3	125.0000001 to 262.4999999MHz	
2	62.5000001 to 131.1999999MHz	
1	0.1000000 to 69.9999999MHz	
HET	10.0000000 to 2000.0000000MHz	
Iex	0.1000000 to 120.0000000MHz	
Preset resolution	0.1Hz	In the normal mode
	1Hz	In the Fast mode
Stability	Same as a reference crystal oscillator.	
Internal reference crystal oscillator		
Aging rate	2×10^{-8}/day, 8×10^{-8}/month	
Long-term stability	1×10^{-7}/year	
Temperature characteristics	$\pm 5 \times 10^{-8}$	+25°C ±25°C
Signal purity		
SSB phase noise	Offset 10kHz	When the CW and AM modes are set for normal bands
Band 7 (>4GHz)	−124dBc/Hz	
7 (≤4GHz)	−126dBc/Hz	
6	−132dBc/Hz	
5	−137dBc/Hz	
4	−138dBc/Hz	
Residual FM	<2Hzrms (Demodulation bandwidth: 0.3 to 3kHz)	In the CW mode
Residual AM	<0.01% AMrms (Demodulation bandwidth: 0.3 to 3kHz)	

Table 6 - 1 Specifications (2/12)

Electrical characteristics	Range	Setting conditions
Signal purity		
Spurious		When the CW, AM, and FM (DEV. 10kHz) modes are set for normal bands
Harmonic wave	−30dBc	
Non-harmonic wave	Off-carrier ≥10kHz	
Band 7	−78dBc	Amplitude ≤ 10dBm
6	−84dBc	
2 to 5	−90dBc	
1	−78dBc	
Amplitude		
Amplitude range	−140.0dBm to +16.0dBm	Bands 1 to 5
	−133.0dBm to +16.0dBm	Band 6 and HET Band
	−120.0dBm to +16.0dBm	Band 7 (≤4GHz)
	−120.0dBm to +13.0dBm	Band 7 (>4GHz)
Preset resolution	0.1dB	
Absolute accuracy +25°C ±10°C Except during analog sweep	±1dB ±2dB	Amplitude ≥ −120dBm Amplitude −120dBm to −133dBm Bands 1 to 6 and HET Band
Amplitude switching time	<50ms	
Output impedance	50Ω (Nominal value)	From input of the last command to stabilization of output
Flatness	±0.8dB (When +5dBm is set) ±0.5dB (When +5dBm is set)	100kHz to 4.5GHz 100kHz to 1.0GHz
SWR	<1.5 <2.0	Amplitude < 0dBm Amplitude ≤ +5dBm
Counter electromotive force prevention	20W, ±25VDC	
Amplitude setting unit	dBm, dBμ, dBμ EMF, dBf, V, mV, μV, nV	
Amplitude modulation		
Modulation depth	0 to 99%	Bands 1 to 5, ≤ +7dBm INT, EXT AC

Table 6 - 1 Specifications (3/12)

Electrical characteristics	Range	Setting conditions
Amplitude modulation (Continued)		
Modulation depth	0 to 95%	Band 6≤ +7dBm INT, EXT AC
	0 to 90%	Bands 1 to 6≤ +7dBm When the EXT DC function is set, and Band 7 (<4GHz) ≤ +7dBm, INT, EXT AC
Preset resolution	0.1%	
Designated AM accuracy	(Any specified value ±6%) ±1%	Modulation frequency 1kHz Modulation depth ≤ 90%
AM distortion		
Modulation depth 0 to 30%	<1.5%	When the INT and EXT AC functions are set in Bands 1 to 6
30 to 70%	<2.0%	
70 to 90%	<4.0%	
0 to 30%	<4.0%	When the INT and EXT AC functions are set in Band 7 or when the EXT DC function is set in Bands 1 to 6
30 to 70%	<6.0%	
70 to 90%	<10.0%	
AM 3dB bandwidth (When AM depth ≤90%)		
	DC to 1kHz	When the EXT DC function is set in Bands 1 to 6
	DC to 15kHz	When the INT and EXT AC/DC functions are set in Band 7
	20Hz to 50kHz	When the INT and EXT AC functions are set in Band 6
Parasitic phase modulation	Modulaion frequency = 1kHz, AM 30% Demodulation bandwidth = 0.3 to 3kHz	
	<0.2 radian at peak	Bands 1 to 6
	<0.4 radian at peak	Band 7
Frequency modulation		
Maximum modulation deviation	800kHz (Modulation frequency = 1kHz)	Band 7 and HET Band
	400kHz (Modulation frequency = 1kHz)	Band 6
	200kHz (Modulation frequency = 1kHz)	Band 5 and 1 and lex
	100kHz (Modulation frequency = 1kHz)	Band 4
	50kHz (Modulation frequency = 1kHz)	Band 3
	25kHz (Modulation frequency = 1kHz)	Band 2

Table 6 - 1 Specifications (4/12)

Electrical characteristics	Range	Setting conditions
Frequency modulation (Continued)		
Preset resolution Band 7 and HET Band	1kHz 100Hz 10Hz	Dev. 800 to 201kHz Dev. 200 to 20.1kHz Dev. 20 to 0kHz
Band 6	1kHz 100Hz 10Hz	Dev. 400 to 101kHz Dev. 100 to 10.1kHz Dev. 10 to 0kHz
Band 5 and 1 and LEX Band	1kHz 100Hz 10Hz	Dev. 200 to 51kHz Dev. 50 to 5.1kHz Dev. 5 to 0kHz
Band 4	1kHz 100Hz 10Hz	Dev. 100 to 26kHz Dev. 25.9 to 2.6kHz Dev. 2.59 to 0kHz
Band 3	1kHz 100Hz 10Hz	Dev. 50 to 13kHz Dev. 12.9 to 1.3kHz Dev. 1.29 to 0kHz
Band 2	1kHz 100Hz 10Hz	Dev. 25 to 7kHz Dev. 6.9 to 0.7kHz Dev. 0.69 to 0kHz
Designate FM accuracy	Any specified value ±7% ±10Hz	Modulation frequency =1kHz Modulation deviation <400kHz
FM deviation	Modulation frequency 20Hz to 20kHz 1% or less 0.5% or less	EXT. DC Max Dev. (Max Dev.)/2
FM 3dB bandwidth	Dc to 200kHz 20Hz to 200kHz 20Hz to 100kHz	EXT. DC EXT. AC INT .
Parasitic AM	1% or less	Modulation frequency =1kHz Modulation deviation =75kHz

Table 6 - 1 Specifications (5/12)

Electrical characteristics	Range	Setting conditions
Frequency modulation (Continued) Carrier wave frequency Offset	 <4kHz <2kHz <1kHz	EXT.DC <(Max Dev.)/10 Band 7 and HET Band Band 6 Bands 1 to 5
Wide FM	When Band 7 and HET Band are set	
Wide FM 1		
Maximum modulation deviation	>28MHzp-p	10kHz rectangular wave modulation
Modulation frequency	20Hz to 300kHz (3dB bandwidth)	CW mode
Wide FM 2		
Maximum modulation deviation	>28MHzp-p	10kHz rectangular wave modulation
Modulation frequency	20Hz to 1MHz (3dB bandwidth)	CW mode
Wide FM 3		
Maximum modulation deviation	>28MHzp-p	10kHz rectangular wave modulation
Modulation frequency	DC to 300kHz (3dB bandwidth) DC to 1MHz (3dB bandwidth)	Wide FM 1 + Wide FM 3 Wide FM 2 + Wide FM 3
When the R4262 is combined with the TR45101		
Maximum modulation deviation	>20MHzp-p	(Same setting conditions for the R4262 and the TR45101)
Modulation frequency	20Hz to 8.5MHz DC to 8.5MHz	CW mode Analog wide-band frequency sweep Zero span
Phase modulation (øM)		
Maximum modulation deviation	When a unit of radian is selected: / When a unit of degree is selected:	
	9.3rad / --	Band 2
	18.7rad / --	Band 3
	37.5rad / --	Band 4
	75rad / --	Band 1, lex Band, and Band 5
	150rad / --	Band 6
	300rad / 150deg	Band 7 and HET Band

Table 6 - 1 Specifications (6/12)

Electrical characteristics	Range	Setting conditions
Phase modulation (øM)		
Modulation accuracy	Any specified value +10%	Modulation frequency 1kHz
Preset resolution		Modulation deviation range
Band 7 and HET Band	0.1rad 0.01rad 0.001rad	300.0 to 32.1rad 32.00 to 3.21rad 3.200 to 0rad
	0.1deg 0.01deg 0.001deg	150.0 to 15.1deg 15.00to 1.51deg 1.500 to 0deg
Band 6	0.1rad 0.01rad 0.001rad	150.0 to 16.1rad 16.0 to 1.61rad 1.600 to 0rad
Band 1 and lex Band , and Band 5	0.1rad 0.01rad 0.001rad	75.0 to 8.1rad 8.00 to 0.81rad 0.800 to 0rad
Band 4	0.1rad 0.01rad 0.001rad	37.5 to 4.1rad 4.00 to 0.41rad 0.400 to 0rad
Band 3	0.1rad 0.01rad 0.001rad	18.7 to 2.1rad 2.00 to 0.21rad 0.200 to 0rad
Band 2	0.1rad 0.01rad 0.001rad	9.3 to 1.1rad 1.00 to 0.11rad 0.100 to 0rad
Phase modulation distortion	<2% (Demodulation bandwidth = 20Hz to 20kHz)	When a unit of radian is selected : Modulation frequency 1kHz Modulation deviation 5rad
øM 3dB bandwidth (EXT.DC)	20Hz to 2.66kHz	When a unit of radian is selected
	DC to 320kHz	When a unit of degree is selected
Binary phase shift keying (BPSK)		
Carrier null	>30dB	100kHz rectangular wave Ambient temperature 20 to 35°C

Table 6 - 1 Specifications (7/12)

Electrical characteristics	Range	Setting conditions
Pulse modulation On-off ratio	>35dB >50dB	HET Band Band 7
Rise/fall time	<2.5μs (10% to 90%)	
Minimum pulse width	<5μs	
Repetitive frequency	30Hz to 50kHz	
Input threshold level	1.5V (Nominal value)	
Internal modulation oscillator		
Modulation frequency	20Hz to 100kHz	
Frequency resolution	Any specified value 1%	
Frequency accuracy	Any specified value ±3%	
Output amplitude range	$1V_{P-P}$ (600Ω load)	
Output amplitude resolution	$1mV_{P-P}$	
distortion	<0.04% <1% (Output amplitude = 0.2 Vpeak)	20Hz to 10kHz >10kHz
Output amplitude accuracy	Any specified value ±4%	
Output impedance	600Ω ±10%	
Analog wide-band frequency modulation		
Center frequency range	100kHz to 120MHz 10MHz to 4500MHz	
Span	8MHz to 2500MHz (Also available is less than 8MHz) (When a frequency value of 2000 MHz is to be crossed, the Full sweep function must be set.)	
Start/stop frequency range	100kHz to 120MHz 10MHz to 4500MHz (When a frequency value of 2000 MHz is to be crossed, the Full sweep function must be set.)	

Table 6 - 1 Specifications (8/12)

Electrical characteristics	Range	Setting conditions
Analog wide-band frequency sweep (Continued)		
Preset resolution	Approx. 6.25kHz	
Accuracy	Any specified span ±1% ±1MHz (After automatic calibration)	
Center frequency accuracy when a zero span is set	< ±1MHz	
Sweep mode	AUTO (INT., EXT., LINE), SINGLE, MANUAL	
Sweep time	Approx. 50ms to 100s	
Automatic calibration	The accuracy of sweep start or stop frequency is set to any specified value ±1% ±1MHz.	
Analog narrow-band sweep (±ΔF)		
Center frequency range	100kHz to 4500MHz	
Maximum span	≤8MHz (Depends on center frequency values.)	
Span (ΔF) range		
Range 1 (See specified resolution.)	250kHz to 25kHz	Band 2
	500kHz to 50kHz	Band 3
	1000kHz to 100kHz	Band 4
	2000kHz to 200kHz	Band 1 and lex Band, and Band 5
	4000kHz to 400kHz	Band 6
	8000kHz to 800kHz	Band 7 and HET Band
Range 2	24.9kHz to 2.5kHz	Band 2
	49.9kHz to 5.0kHz	Band 3
	99.9kHz to 10.0kHz	Band 4
	199.9kHz to 20.0kHz	Band 1 and lex Band, and Band 5
	399.9kHz to 40.0kHz	Band 6
	799.9kHz to 80.0kHz	Band 7 and HET Band
Range 3	2.49kHz to 0kHz	Band 2
	4.99kHz to 0kHz	Band 3
	9.99kHz to 0kHz	Band 4
	19.99kHz to 0kHz	Band 1 and lex Band, and Band 5
	39.99kHz to 0kHz	Band 6
	79.99kHz to 0kHz	Band 7 and HET Band

Table 6 - 1 Specifications (9/12)

Electrical characteristics	Range	Setting conditions
Analog narrow-band frequency modulation (Continued)		
Preset resolution	1kHz (Range 1) 0.1kHz (Range 2) 0.01kHz (Range 3)	$\Delta F \leq 4000kHz$ $\Delta F \leq 400kHz$ $\Delta F \leq 40kHz$
Designated span accuracy	Any specified span ±2%	
Center frequency accuracy		
Range 1	40kHz 20kHz 10kHz	Band 7 and HET Band Band 6 Bands 1 to 5
Range 2	4kHz 2kHz 1kHz	Band 7 and HET Band Band 6 Bands 1 to 5
Range 3	0.4kHz 0.2kHz 0.1kHz	Band 7 and HET Band Band 6 Bands 1 to 5
Sweep mode	AUTO (INT., EXT., LINE), SINGLE MANUAL	
Sweep time	Approx. 50ms to 100s	
Digital frequency sweep		
Frequency range	100kHz to 4500MHz	
Linear sweep	Sweeps frequencies between any specified start and stop frequencies or between any specified center frequency and span linearly for any specified sweep time with any specified step frequency or number of steps.	
Log sweep	Sweeps frequencies between any specified start and stop frequencies in two logarithmic steps of Log 1% (1.01 times) and Log 10% (1.1 times).	

Table 6 - 1 Specifications (10/12)

Electrical characteristics	Range	Setting conditions
Digital frequency sweep (Continued)		
Number of steps	1 to 2500 1 to 9999	Manual setting Automatic sweep
Sweep mode	AUTO (INT.), SINGLE	
Sweep time	Approx. 40ms to 100s/sweep Approx. 40ms to 100s/sweep	Manual setting Manual setting
Analog amplitude sweep		
Range	15dB log sweep	
Sweep time	Approx. 50ms to 100s	
Sweep mode	AUTO (INT., EXT., LINE), SINGLE MANUAL	
Analog phase sweep		
Maximum span	600deg	Band 7 and HET Band
Sweep mode	AUTO (INT., EXT., LINE), SINGLE MANUAL	
Sweep time	Approx. 50ms to 100s	
Phase shift		
Maximum shift range	600deg	Band 7 and HET Band
Preset resolution	Same as for analog phase sweep.	

Table 6 - 1 Specifications (11/12)

Electrical characteristics	Range	Setting conditions
Input/output		
Front panel		
RF signal output	Terminal for outputting 100kHz to 4500MHz RF signals (equipped with reverse power protection). N type connector	
Modulation signal input	Terminal for inputting AM, FM, øM, BPSK, Wide FM 1, Wide FM 2, and pulse modulation signals. BNC connector	
Modulation signal output	Terminal for outputting modulation signals generated by the internal modulation (AM and FM) oscillator. BNC connector	
Rear panel		
REFERENCE EXT IN	Terminal for inputting external reference frequencies. 10MHz ≥ $1V_{P-P}$ Impedance 1kΩ BNC connector	
REFERENCE 10MHz OUT	Terminal for outputting internal reference frequencies. 10MHz ≥ $1V_{P-P}$ Impedance = 50Ω BNC connector	
SWEEP IN/OUT	Terminal for inputting or outputting sweep voltage of 0 to +8V or −4 to +4V. BNC connector	
STOP SWEEP	Terminal for inputting sweep stop signals. TTL level Low : Stop High : Sweep BNC connector	
EXT TRIG IN	Terminal for inputting an external sweep trigger. TTL level Low : Tregger High : Non-trigger BNC connector	
BLANK OUT	Terminal for outputting sweep blanking signals of 0 to +5V or 0 to −5V. 0V : Sweep ±5V : Blanking BNC connector	
AUX MOD IN	Auxiliary terminal for inputting external modulation signals. BNC connector	
MARKER OUT	Terminal for outputting marker signals of −5 to +5V. +5V : Blanking 0V : Sweep −5V : Marker frequency BNC connector	

Table 6 - 1 Specifications (12/12)

Electrical characteristics	Range	Setting conditions
GPIB interface	Conforms to the IEEE 488-1978.	
Function control	Controls various function except the power switch in the same manner as key operation of the front panel.	
Interface function	Listener and talker	
IEEE-488 function	SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1	
General specifications		
Memory function	Saves a maximum of 10 values set with the keys on the front panel and a maximum of 40 carrier wave frequency and amplitude values (a total of 50 values). Any saved data will be retained even when the equipment is powered off.	
Radiated electromagnetic interference	$<1\mu V$ Measured with a 1-inch two-turn 50Ω terminal coil at a distance of 1 inch from the panel surface.	
Operating environment		
Temperature range	0°C° to +40°C	
Humidity range	RH 85% or less	
Storage temperature range	−25°C to +70°C	
Power	90V to 110V, 48Hz to 66Hz	Standard
Power consumptions	440VAMAX	
Weight	45kg or less	
Dimensions	Approx., 221mm (high) x Approx. 424mm (wide) x Approx. 550mm (deep)	

Table 6 - 2 Reference Characteristics (1/3)

Frequency

Heterodyne Band : The R4262 can mix together any two frequencies within a band of 10MHz to 2000MHz to produce a heterodyne band (HET Band). The HET Band can be used to set large modulation deviation for the frequency modulation (FM) or phase modulation (øM) function and perform the analog wide-band frequency sweep (A SWP) function.

Signal Purity

Single Sideband (SSB) Phase Noise for 1GHz Carrier Wave Frequency (dBc/Hz) :

100Hz	1kHz	10kHz	100kHz	250kHz	1MHz	10MHz
−100.2	−123.0	−139.0	−139.7	−143.0	−147.0	−147.0

Example of Measured SSB Phase Noise for 1GHz Carrier Wave Frequency

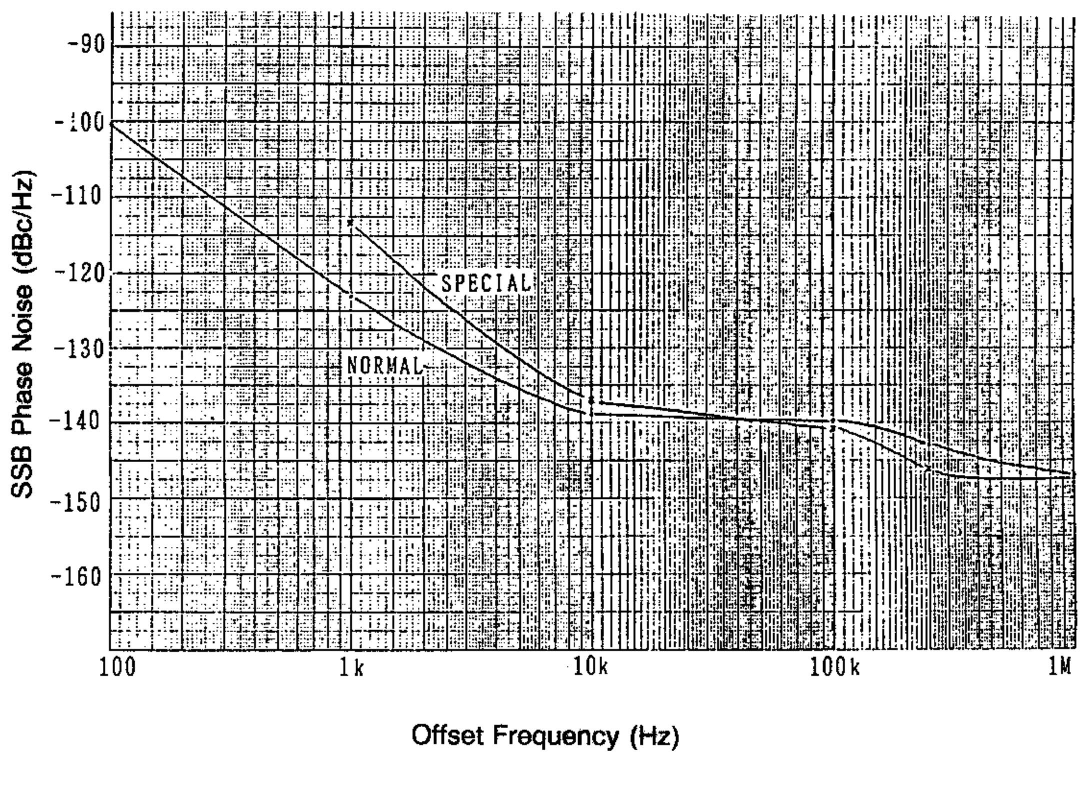


Table 6 - 2 Reference Characteristics (2/3)

Modulation Frequency

External Input Impedance : 100kΩ

External Input FM Signal Amplitude : When the external AC frequency modulation (EXT AC FM) function is set, an external FM signal input from the external FM signal input (FM IN) terminal, when falling within the voltage range of $0.9V_{P\text{-}P}$ to $1.1V_{P\text{-}P}$, will be calibrated automatically to a preset modulation depth by the internal Auto Gain Control (AGC) circuit built in the R4262.

When an external FM signal input for the EXT AC FM function and the external DC frequency modulation (EXT DC FM) function exceeds the voltage range of $0.9V_{P\text{-}P}$ to $1.1V_{P\text{-}P}$ and $1V_{P\text{-}P}$ ±1%, respectively, a message to that effect will be displayed in the modulation display lamps on front panel.

Modulation signal Source : The amplitude modulation (AM), frequency modulation (FM), or phase modulation (øM) function can be performed by using an internal modulation signal, i.e. an AM, FM, or øM signal output from its internal low-frequency AM, FM, or øM oscillator or by using an external modulation signal, i.e. an AM, FM, or øM signal input from external sources. Meanwhile, the pulse modulation (PULSE) or binary phase shift keying (BPSK) function can be performed only by using an external modulation signal. The AM, FM, or øM function can also be performed by using both internal and external modulation signals simultaneously or by using a modulation signal intended for any other modulation function, e.g. an internal AM signal for the FM function, an internal FM signal for the AM function, and so on.

Simultaneous Modulation Function : The AM and FM function, AM and øM functions, and øM and PULSE functions can be performed simultaneously.

Frequency Modulation (FM)

Band 7 and HET Band (When the FM stereo separation and the EXT DC FM function are set) :

>50dB (Modulation frequency = 1kHz, modulation depth = 75kHz)

Low-distortion FM/øM Function : The low-distortion mode can decrease any distortion that may occur when the FM or øM function is performed without affecting the FM stereo separation.

Table 6 - 2 Reference Characteristics (3/3)

FM Pre-emphasis : The R4262 provides the pre-emphasis function that is available in three types with three dfferent time constants of 50μs, 75μs, and 750μs. The PRE-EMPHASIS function can be used to test FM communication equipment.

A1 LIST OF ERROR MESSAGES

When the R4262 is operated improperly or when any value exceeding a valid range is set for any function parameter for the R4262, an error message to that effect will be displayed in the message window on the lower part of the front panel. This section lists all the message windows, their meanings, and, necessary, appropriate corrective actions in an alphabetical order.

AMPTD SWEEP	Indicates that the amplitude sweep function is currently set.
BAND7 or HET	Indicates that an attempt is made to set a function parameter value that is valid only in Band 7 or HET Band. As a frequency band, Band 7 or HET Band must be selected.
FREQ SWEEP	Indicates that the frequency sweep function is currently set.
Illegal CODE	Indicates that an undefined code has been transmitted on the GPIB.
MEMORY ERROR	Indicates that an attempt is made to read from vacant memory.
Mode Error	Indicates that the selected mode cannot be set.
Not RELEASED	Indicates that an attempt is made to perform a function that is not available on any previously released software version for the R4262.
NOT SWEEP	Indicates that no sweep function is set.
PHASE SWEEP	Indicates that the phase sweep function is currently set.
RAM Error	Indicates that an error has occurred in the random-access memory (RAM) built in the R4262.

ROM Error	Indicates that an error has occurred in the read-only memory (ROM) built in the R4262.
RP Protected	Indicates that the reverse power protection circuit has operated to turn off radiofrequency (RF) output. To release the reverse power protection circuit, press the RF OUTPUT ON/OFF key after eliminating all reverse power factors.
SCALING ERR	Indicates that the scaling function hasn't operated as an error has occurred in the R4262.
Turn OFF AM	Indicates that an attempt is made to turn on any function, such as the PULSE function, that is incompatible with the AM function when using the AM function. Turn off the AM function before turning on the selected function.
Turn OFF BPSK	Indicates that an attempt is made to turn on any function, such as the FM, øSWP, A SWP, D SWP, and ±ΔF SWP functions, that is incompatible with the BPSK function when using the BPSK function. Turn off the BPSK function before turning on the selected function.
Turn OFF FM	Indicates that an attempt is made to turn on any function, such as the øM, øSWP, A SWP, D SWP, and ±ΔF SWP function, that is incompatible with the FM function when using the FM function. Turn off the FM function before turning on the selected function.
Turn OFF LSWP	Indicates that an attemt is made to turn on any function, such as the AM function, that is incompatible with the amplitude sweep functions when using the amplitude sweep functions. Turn off the amplitude sweep functions before turning on the selected function.
Turn OFF MIX1	Indicates that the source mixer function should be turned off for the FM function.

Turn OFF MIX2	Indicates that the source mixer function should be turned off for the AM function.
Turn OFF PLM	Indicates that an attempt is made to turn on any function, such as the AM function, that is incompatible with the PULSE function when using the PULSE function. Turn off the WIDE FM function before turning on the selected function.
Turn OFF PM	Indicates that an attempt is made to turn on any function, such as the FM, øSWP, A SWP, D SWP, and $\pm\Delta$F SWP functions, that is incompatible with the øM function when using the øM function. Turn off the øM function before turning on the selected function.
Turn OFF PS	Indicates that an attempt is made to turn on any function, such as the FM, øSWP, A SWP, D SWP, and $\pm\Delta$F SWP functions, that is incompatible with the PHASE SHIFT function when using the PHASE SHIFT function. Turn off the PHASE SHIFT function before turning on the selected function.
Turn OFF PSWP	Indicates that an attempt is made to turn on any function, such as the FM, øSWP, A SWP, D SWP, and $\pm\Delta$F SWP functions, that is incompatible with the øSWP function when using the øSWP function. Turn off the øSWP function before turning on the selected function.
Turn OFF RECT	Indicates that an attempt is made to turn on any function, such as the AM function, that is incompatible with the RECTANGULAR function when using the RECTANGULAR function. Turn off the RECTANGULAR function before turning on the selected function.
Turn OFF WFM	Indicates that an attempt is made to turn on any function that is incompatible with the WIDE FM function when using the WIDE FM function. Turn off the WIDE FM function before turning on the selected function.
Turn OFF WFM3	Indicates that an attempt is made to turn on any function that is incompatible with the WIDE FM3 function when using the WIDE FM3 function. Turn off the WIDE FM3 function before turning on the selected function.

Turn ON AM	Indicates that the AM function should be turned on.
Turn ON FM	Indicates that the FM function should be turned on.
Turn ON PM	Indicates that øM function should be turned on.
Use INTERNAL	Indicates that internal modulation frequency should be used.
Turn OFF OFS	Indicates that an attempt was made to turn on any function that is incompatible with the OFFSET DISP function when using the OFFSET DISP function. Turn off the OFFSET DISP function before turning on the selected function.
Turn OFF REL	Indicates that an attempt was made to turn on any function that is incompatible with the RELATIVE DISP function when using the RELATIVE DISP function. Turn off the RELATIVE DISP function before turning on the selected function.
Turn OFF SWP	Indicates that the øSWP, A SWP, D SWP, and ±ΔF SWP functions should be turned off.
Use dB unit	Indicates that any of the units of dBm, dBμ, dBμEMF, and dBf should be used.
Turn ON fSWP	Indicates that any one of the A SWP, D SWP, and ±ΔF SWP functions should be turned on.
Turn ON ASWP	Indicates that any one of the A SWP, ±ΔF SWP, and AA SWP functions should be turned on.
Turn Normal	Indicates that normal sweep should be selected for the A SWP function.
SAVE ERROR	Indicates that an attempt was made to select a memory number that exceeds a valid range of 0 to 49.
Set MEM. NO.	Indicates that a sequence start memory number and a sequence stop memory number should be set.

A2 LIST OF GPIB COMMANDS

Table A2 - 1 List of GPIB Command Codes

Setting	Code	Processing
Output data header setting	HDOF HDON	Turns off the output data header. Turns on the output data header.
Initialization	IP	equipment preset
Output data setting	OA OP	Output Active Parameter Output Interrogated Parameter
Service request setting	SRQON SRQOF	Turns on service request. Turns off service request.
Block delimiter setting	DLA DLB DLC DLD	"CR", "LF" "CR", "LF" + EOI "LF" EOI

Table A2 - 2 List of "OP" Parameter Codes (1/2)

Function	Mode	Code	Header	Output parameter
FREQUENCY	– –	CW	CW	Carrier wave frequency
	– –	ISA	ISA	Frequency step size
AMPLITUDE	– –	LE	DM	Amplitude (dBm)
	– –	LE	DU	Amplitude (dBμ)
	– –	LE	DBF	Amplitude (dBf)
	– –	LE	DUE	Amplitude (dBμemf)
	– –	LE	V	Amplitude (Volt)
	Analog Level	AA	AA	START
	Analog Level	AB	AB	STOP
	Analog Level	AC	AC	SLOPE
	– –	ISB	ISB	Amplitude step size

Table A2 - 2 List of "OP" Parameter Codes (2/2)

Function	Mode	Code	Header	Output parameter
MODULATION	FM Dev.	FM	FM	Frequency deviation
	FM Freq.	MFB	MFB	Internal FM frequency
	AM Depth.	AM	AM	Modulation depth
	AM Freq.	MFA	MFA	Internal AM frequency
	øM Dev.	PM	PM	Frequency deviation
	øM Freq.	MFC	MFC	Internal øM frequency
	ø Sweep.	PSA	PSA	øSweep offset
	ø Sweep.	PSB	PSB	øM span
	SWEEP	FA	FA	Start frequency
	SWEEP	FB	FB	Stop frequency
	SWEEP	FC	FC	Center frequency
	SWEEP	FD	FD	Frequency span
MARKER	– –	MKA	MKA	Marker 1 frequency
	– –	MKB	MKB	Marker 2 frequency
	– –	MKC	MKC	Marker 3 frequency
	– –	MKD	MKD	Marker 4 frequency
	– –	MKE	MKE	Marker 5 frequency
	– –	MKF	MKF	Marker 6 frequency
	– –	MKG	MKG	Marker 7 frequency
	– –	MKH	MKH	Marker 8 frequency
	– –	MKI	MKI	Marker 9 frequency
	– –	MKJ	MKJ	Marker 10 frequency
Delta F	– –	DF	DF	Delta F frequency width
Sweep Time	– –	ST	ST	Sweep time

Table A2 - 3 List of GPIB Commands for RF Setting

FUNCTION	GPIB CODE
FREQ	FR, CW
Digit Left	KL, KLA
Digit Right	KR, KRA
Step UP	UP, UPA
Step Down	DN, DNA
INC	ISA, SHKRA
	IS
HOLD	SHKLA
ON	KHON, KHAON
OFF	KHOF, KHAOF
Knob UP	KI, KIA
Knob DOWN	KD, KDA
Band 1	BANDA
Band 2	BANDB
Band 3	BANDC
Band 4	BANDD
Band 5	BANDE
Band 6	BANDF
Band 7	BANDG
Band HET	BANDI
Band lex	BANDH
NORMAL BAND	BANDOF
BAND FIX	BANDON
Noise Slope NORMAL	NSLPOF
Noise Slope SPECIAL	NSLPON
FAST ON	FASTON
FAST OFF	FASTOF
FREQ OFS	OFSCW
ON	OFSCWON
OFF	OFSCWOF
FREQ REL ON	RELCWON
FREQ REL OFF	RELCWOF

UNIT	GPIB CODE
GHz	GZ
MHz	MZ
kHz	KZ
Hz	HZ

Table A2 - 4 List of GPIB Commands for Amplitude Setting

FUNCTION	GPIB CODE
AMPLITUDE	LE, AP
Digit Left	KLB
Digit Right	KRB
Step UP	UPB
Step Down	DNB
INC	ISB, SHKRB
HOLD	SHKLB
ON	KHBON
OFF	KHBOF
Knob UP	KIB
KNob DOWN	KDB
ALC ON	ALCON
ALC OFF	ALCOF
Upper Limit	ULMT
ON	ULMTON
OFF	ULMTOF
Lower Limit	LLMT
ON	LLMTON
OFF	LLMTOF
AMPTD OFFSET	OFSLV
ON	OFSLVON
OFF	OFSLVOF
AMPTD REL.	RELLV
ON	RELLVON
OFF	RELLVOF
ANLG L. SWP.	LVSA
DGTL L. SWP.	LVSB
INT. TRIG.	TRGA
LINE TRIG.	TRGB
EXT. TRIG.	TRGC
SINGLE TRIG.	TRGD
SINGLE START	TRGE
AUTO SWEEP	SAA
MANUAL SWEEP	SAB
EXT. SWEEP	SAC
Sweep Time	ST
RF OUTPUT	RF
ON	RFON
OFF	RFOF
AMPTD SWEEP	
START	AA
STOP	AB
SLOPE	AC

UNIT	GPIB CODE
dBm	DM
dBμ	DU
dBμEMF	EM
dBf	BF
dB	DB
V	V
mV	MV
μV	UV
nV	NV
s	SC
ms	MS

Any GPIB command that is to be input to change parameter values for the amplitude sweep function must always be preceded by a code "LVSA" or "LVSB".

Table A2 - 5 List of GPIB Commands for Modulation Setting (1/3)

FUNCTION	GPIB CODE
AM ON	AM
AM DEPTH	AM
AM INT	MFA
AM EXT AC	AEA
AM EXT DC	AEB
AM MOD OUT	
ON	AMOUTON
OFF	AMOUTOF
AM LOW DIST.	
ON	AMLDON
OFF	AMLDOF
AM POLARITY	
+	AMPL+
–	AMPL–
RECTANGULAR	
ON	RECTON
OFF	RECTOF
FM OSC→AM	
ON	OSCBAON
OFF	OSCBAOF
AM OSC→AM	
ON	OSCAAON
OFF	OSCAAOF
AUX MOD IN→AM	
ON	AUXAON
OFF	AUXAOF
AM EXT IN CAL	
ON	EIACAON
OFF	EIACAOF
FM ON	FM

FUNCTION	GPIB CODE
FM DEVIATION	FM
FM INT	MFB
FM EXT AC	FEA
FM EXT DC	FEB
FM MOD OUT	
ON	FMOUTON
OFF	FMOUTOF
FM LOW DIST.	
ON	FMLDON
OFF	FMLDOF
FM POLARITY	
+	FMPL+
–	FMPL–
PRE-EMPHASIS	
50μs	EMA
75μs	EMB
750μs	EMC
OFF	EMOF
SIN WAVE	WAVEA
TRIANGLE	WAVEB
AM OSC→FM	
ON	OSCABON
OFF	OSCABOF
FM OSC→FM	
ON	OSCBBON
OFF	OSCBBOF
AUX MOD IN→FM	
ON	AUXBON
OFF	AUXBOF

Table A2 - 5 List of GPIB Commands for Modulation Setting (2/3)

FUNCTION	GPIB CODE
FM	
EXT IN CAL	
ON	EIACBON
OFF	EIACBOF
øM ON	PM
øM DEV.	PM
øM INT	MFC
øM EXT AC	PEA
øM EXT DC	PEB
øM MOD OUT	
ON	PMOUTON
OFF	PMOUTOF
øM LOW DIST	
ON	FMLDON
OFF	FMLDOF
øM POLARITY	
+	PMPL+
–	PMPL–
AM OSC→øM	
ON	OSCABON
OFF	OSCABOF
øM OSC→øM	
ON	OSCBBON
OFF	OSCBBOF
AUX MOD IN→ øM	
ON	AUXBON
OFF	AUXBOF
øM EXT IN CAL	
ON	EIACBON
OFF	EIACBOF
øM UNITS	
DEGREE	PUNA
RADIAN	PUNB

FUNCTION	GPIB CODE
PHASE SHIFT	
–180deg	PSHA
–90deg	PSHB
0deg	PSHC
+90deg	PSHD
+180deg	PSHE
variable	PSHF
PULSE MOD.	PL
ON	PLON
OFF	PLOF
WIDE FM 1	
ON	SHNT, WFA
OFF	WFOF
WIDE FM 2	
ON	SHXA, WFB
OFF	WFOF
WIDE FM 3	
ON	SHXD, WFC
OFF	WFOF
BPSK	SHFM
ON	BPON
OFF	BPOF
ø SWP	
ON	SHPM, PSON
OFF	PSOF
OFFSET	PSA
SPAN	PSB
SWEEP TIME	ST
MOD OFF	MDOF
ALL OFF	ALOF
MOD. FREQ	
KNOB	
UP	KIC
DOWN	KDC
DIGIT	
LEFT	KLC
RIGHT	KRC
HOLD	SHKLC
ON	KHCON
OFF	KHCOF

Table A2 - 5 List of GPIB Commands for Modulation Setting (3/3)

FUNCTION	GPIB CODE
MOD DEP/DEV	
KNOB	
UP	KID
DOWN	KDD
DIGIT	
LEFT	KLD
RIGHT	KRD
HOLD	SHKLD
ON	SHDON
OFF	SHDOF

UNIT	GPIB CODE
MHz	MZ
kHz	KZ
Hz	HZ
%	PC, %
deg	DE
rad	RD
s	SC
ms	MS

Table A2 - 6 List of GPIB Commands for Analog Wide-band Frequency Sweep Setting

FUNCTION	GPIB CODE
ANALOG	
FREQ. SWEEP	SA
START FREQ	FA
STOP FREQ	FB
CENTER FREQ	FC, CF
SPAN	FD, SP
SWEEP TIME	ST
INT. TRIG	TRGA
LINE TRIG	TRGB
EXT. TRIG	TRGC
SINGLE TRIG	TRGD
Single Start	TRGE
Auto sweep	SAA
Manual Sweep	SAB
EXT. Sweep	SAC
Full Sweep	FLSA
Auto Scaling	
ON	SCLON
OFF	SCLOF
MAN. Scaling	SCL
Branking OUT	
POSITIVE	BLK+
NEGATIVE	BLK−
Ramp Voltage	
−4V to +4V	RMPA
0V to +8V	RMPB
Gain	RMPG
Offset	RMPO
Digit Left	KL, KLA
Digit Right	KR, KRA
Step UP	UP, UPA
Step Down	DN, DNA

FUNCTION	GPIB CODE
INC	IS, ISA
HOLD ON	KHON, KHAON
HOLD OFF	KHOF, KHAOF
Knob UP	KI, KIA
Knob Down	KD, KDA

UNIT	GPIB CODE
GHz	GZ
MHz	MZ
kHz	KZ
Hz	HZ
s	SC
ms	MS

Any GPIB command that is to be input to change parameter values for the analog wide-band frequency sweep function must always be preceded by a code "SA".

Table A2 - 7 List of GPIB Commands for Digital Frequency Sweep Setting

FUNCTION	GPIB CODE
DIGITAL	
FREQ. SWEEP	SB
START FREQ	FA
STOP FREQ	FB
CENTER FREQ	FC, CF
SPAN	FD, SP
SWEEP TIME	ST
Linear Sweep	SBC
Priority ON	PRION
Priority OFF	PRIOF
1000 step	PRID
100 step	PRIE
Variable	PRIA
FREQ. Step	PRIB
Log sweep	
1% LOG	SBD
10% LOG	SBE
Branking OUT	
POSITIVE	BLK+
NEGATIVE	BLK−
Digit Left	KL, KLA
Digit Right	KR, KRA
Step UP	UP, UPA
Step Down	DN, DNA
INC	IS, ISA
HOLD ON	KHON, KHAON
HOLD OFF	KHOF, KHAOF
Knob UP	KI, KIA
Knob Down	KD, KDA

UNIT	GPIB CODE
GHz	GZ
MHz	MZ
kHz	KZ
Hz	HZ
s	SC
ms	MS

Any GPIB command that is to be input to change parameter values for the digital frequency sweep function must always be preceded by a code "SB".

Table A2 - 8 List of GPIB Commands for Analog Narrow-band Frequency Sweep Setting

FUNCTION	GPIB CODE
±ΔF SWEEP	DF
CENTER FREQ	FC, CF
SPAN	FD, SP
SWEEP TIME	ST
INT. TRIG	TRGA
LINE TRIG	TRGB
EXT. TRIG	TRGC
SINGLE TRIG	TRGD
Single Start	TRGE
Auto Sweep	SAA
Manual Sweep	SAB
Branking OUT	
POSITIVE	BLK+
NEGATIVE	BLK-
Ramp Voltage	
−4V to +4V	RMPA
0V to +8V	RMPB
Gain	RMPG
Offset	RMPO
Digit Left	KL, KLA
Digit Right	KR, KRA
Step UP	UP, UPA
Step Down	DN, DNA
INC	IS, ISA
HOLD ON	KHON, KHAON
HOLD OFF	KHOF, KHAOF
Knob UP	KI, KIA
Knob Down	KD, KDA

UNIT	GPIB CODE
GHz	GZ
MHz	MZ
kHz	KZ
Hz	HZ
s	SC
ms	MS

Any GPIB command that is to be input to change parameter values for the analog narrow-band frequency sweep function must always be preceded by a code "DF".

Table A2 - 9 List of GPIB Commands for Marker Setting

FUNCTION	GPIB CODE
Marker No. 0	MKRA
1	MKRB
2	MKRC
3	MKRD
4	MKRE
5	MKRF
6	MKRG
7	MKRH
8	MKRI
9	MKRJ
Normal Marker ON	
0	MKRAON
1	MKRBON
2	MKRCON
3	MKRDON
4	MKREON
5	MKRFON
6	MKRGON
7	MKRHON
8	MKRION
9	MKRJON
Normal Marker OFF	
0	MKRAOF
1	MKRBOF
2	MKRCOF
3	MKRDOF
4	MKREOF
5	MKRFOF
6	MKRGOF
7	MKRHOF
8	MKRIOF
9	MKRJOF
Active Marker	
0	MKRAAC
1	MKRBAC
2	MKRCAC
3	MKRDAC
4	MKREAC
5	MKRFAC
6	MKRGAC
7	MKRHAC
8	MKRIAC
9	MKRJAC

Table A2 - 10 List of GPIB Commands for Save/Recall Sequence

FUNCTION	GPIB CODE
SAVE	SV
RECALL	RC
Auto Sequence	SEQB
Auto Sequence Stop	SEQOF
Step Time	SEQTIM (ms)
Start MEM.	SEQSRT
Stop MEM.	SEQSTP
Alterrate Sequence	ALT
Alterrate Seq. Stop	ALTOF
Start MEM.	ALTSRT
Stop MEM.	ALTSTP

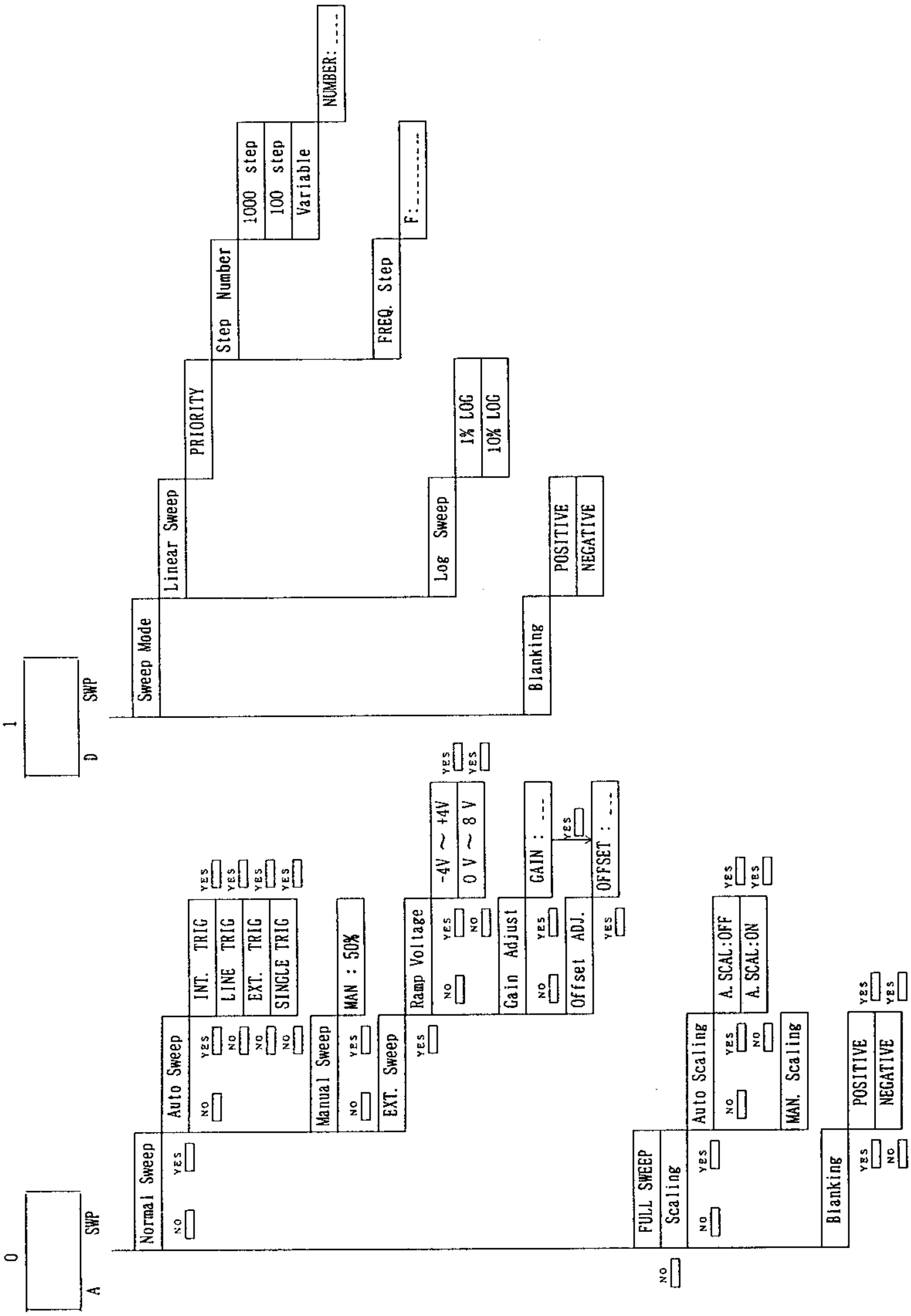
Table A2 - 11 List of GPIB Commands for Phase Shift Function

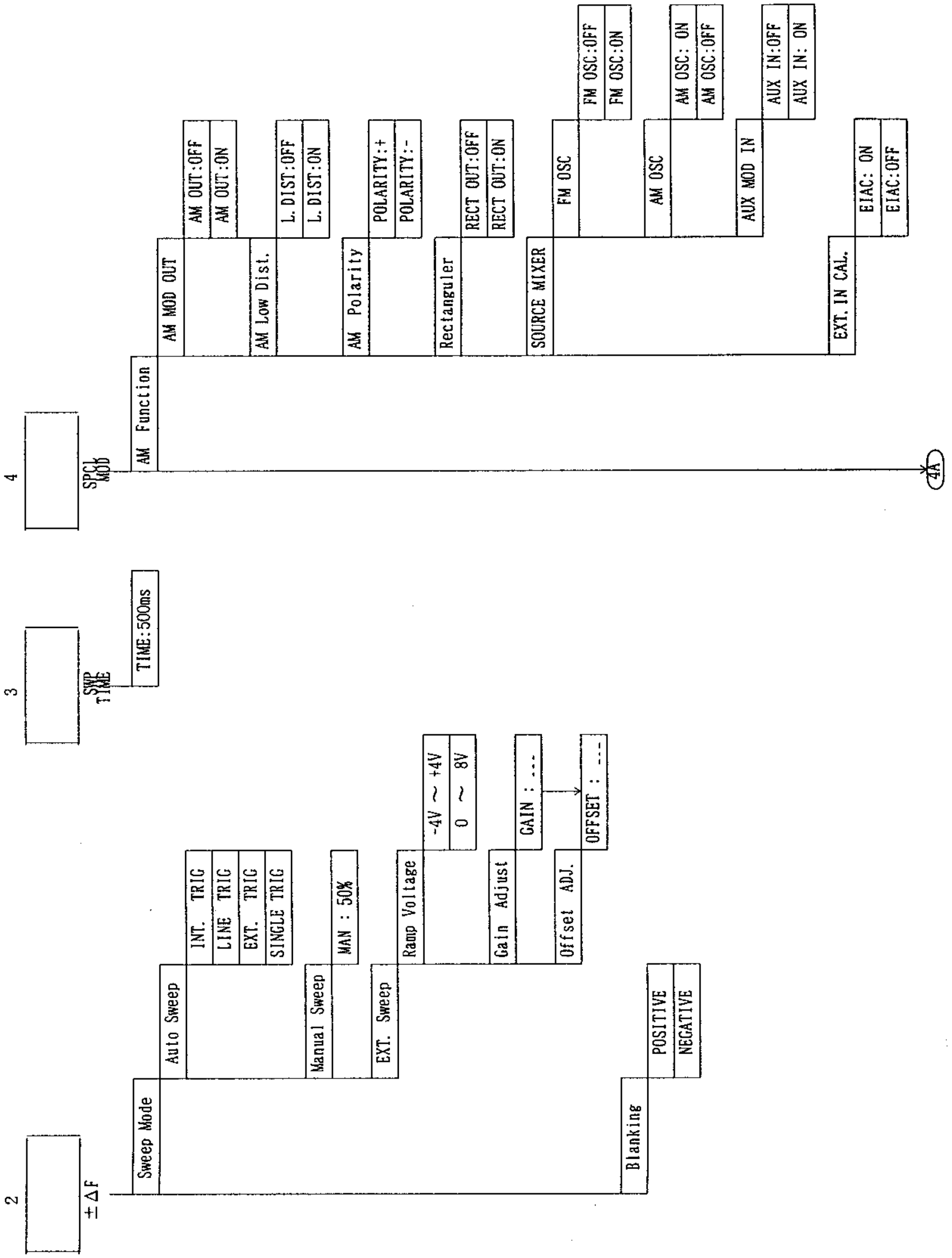
FUNCTION	GPIB CODE
SHIFT	SH
ON	SHON
OFF	SHOF
Panel Lock	SHDNB

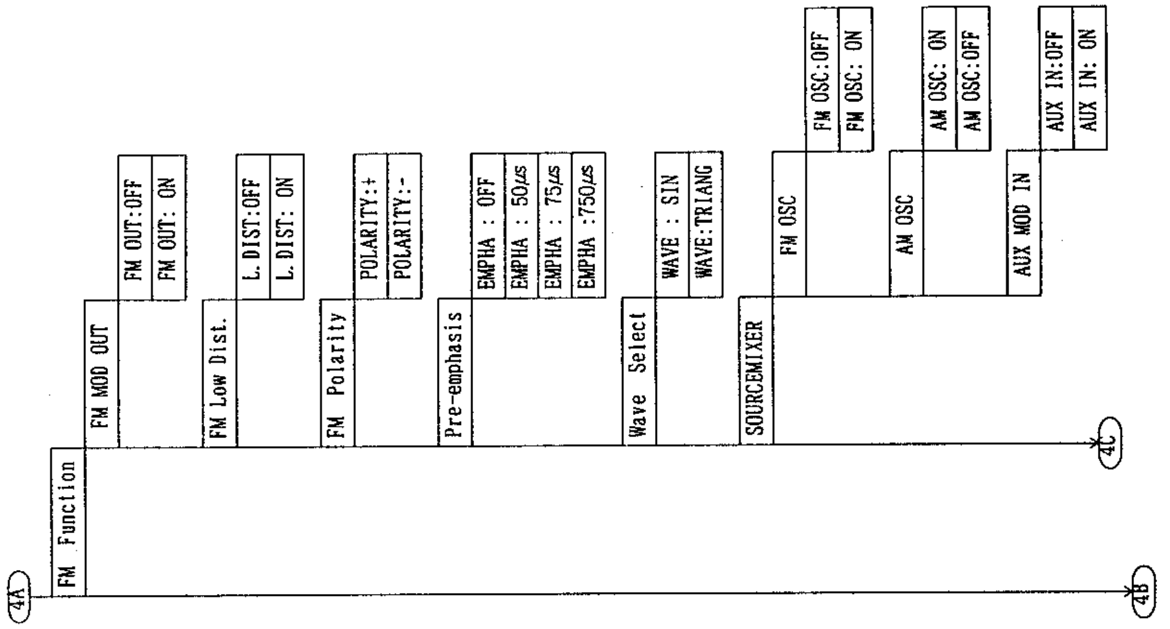
Table A2 - 12 List of GPIB Commands Incompatible with Certain Functions

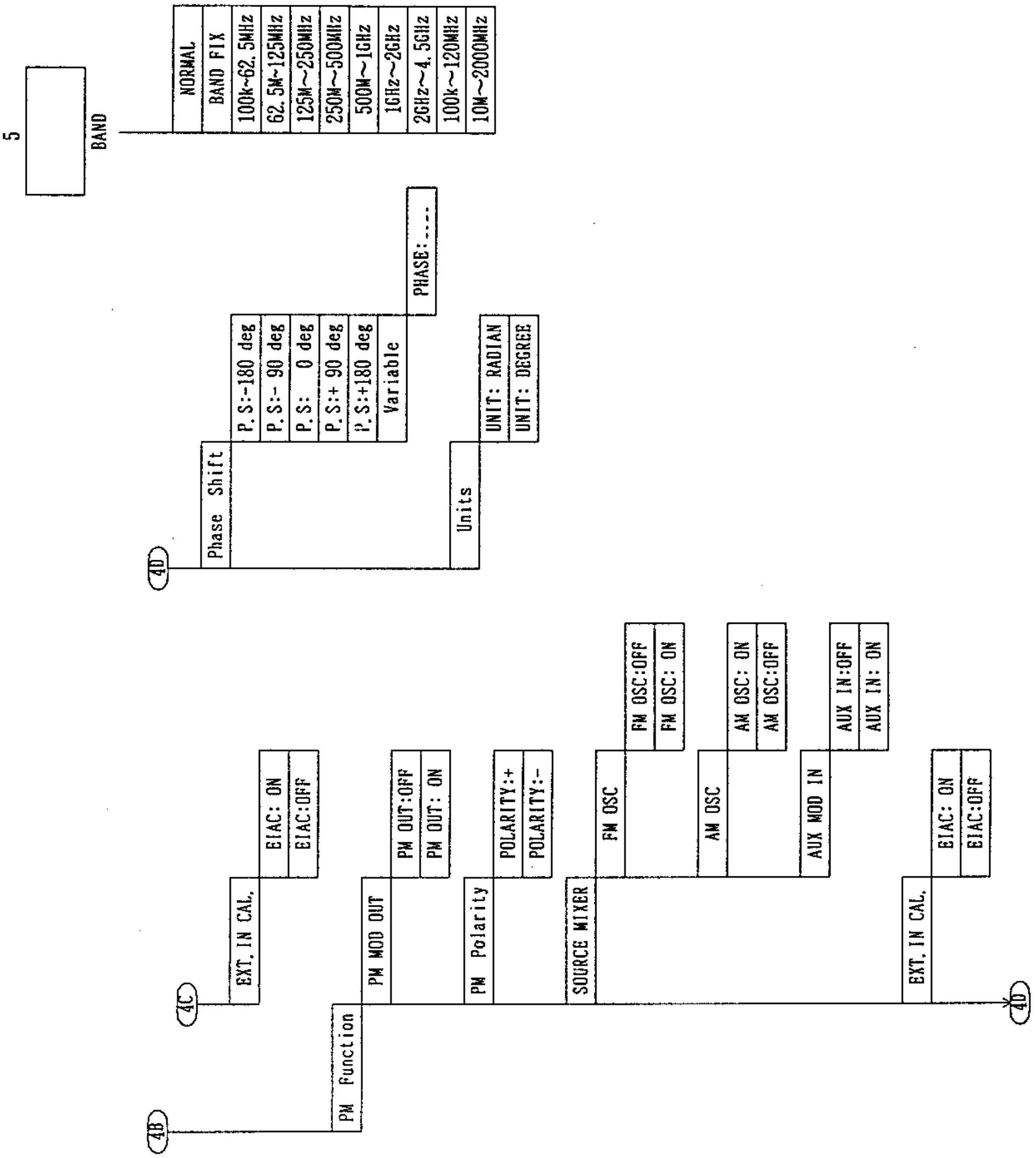
Function	Incompatible command
AM	PL, RECTON, LVSB
FM	PM, WFA, WFB, WFC, BPON, PSHA, PSHB, PSHD, PSHE, PSHF, PSON, SA, DF
PM	FM, WFA, WFB, WFC, BPON, PSHA, PSHB, PSHD, PSHE, PSHF, PSON, SA, DF
PL (Pulse)	AM, LVSA, LVSB
BPON (BPSK)	FM, PM, PSHA, PSHB, PSHD, PSHE, PSHF, WFA, WFB, WFC, PSON, SA, SB, DF, RECTON
PSHA (Phase, Shift)	FM, PM, BPON, WFA, WFB, WFC, PSON, SA, SB, DF
PSON (P. SWP)	FM, PM, BPON, PSHA, PSHB, PSHD, PSHE, PSHF, WFA, WFB, WFC, SA, SB, DF, LVSB
WFA, WFB (WIDE FM1, 2)	PM, FM, BPON, PSHA, PSHB, PSHD, PSHE, PSHF, WFC, PSON
WFC (WIDE FM3)	FM, PM, BPON, PSHA, PSHB, PSHD, PSHE, PSHF, WFA, WFB, PSON, SA, SB, LVSB, DF
SA	FM, PM, BPON, PSHA, PSHB, PSHD, PSHE, PSHF, WFC, PSON, LVSB
SB	BPON, PSHA, WFC, PSON PSHA, PSHB, PSHD, PSHE, PSHF, LVSA
LVSA	AM, PL, WFC, SB
LVSB	AM, PL, PSHA, PSHB, PSHD, PSHE, PSHF, WFC, PSON, SA, DF
DF	FM, PM, BPON, WFC, PSHA, PSHB, PSHD, PSHE, PSHF, PSON, LVSB

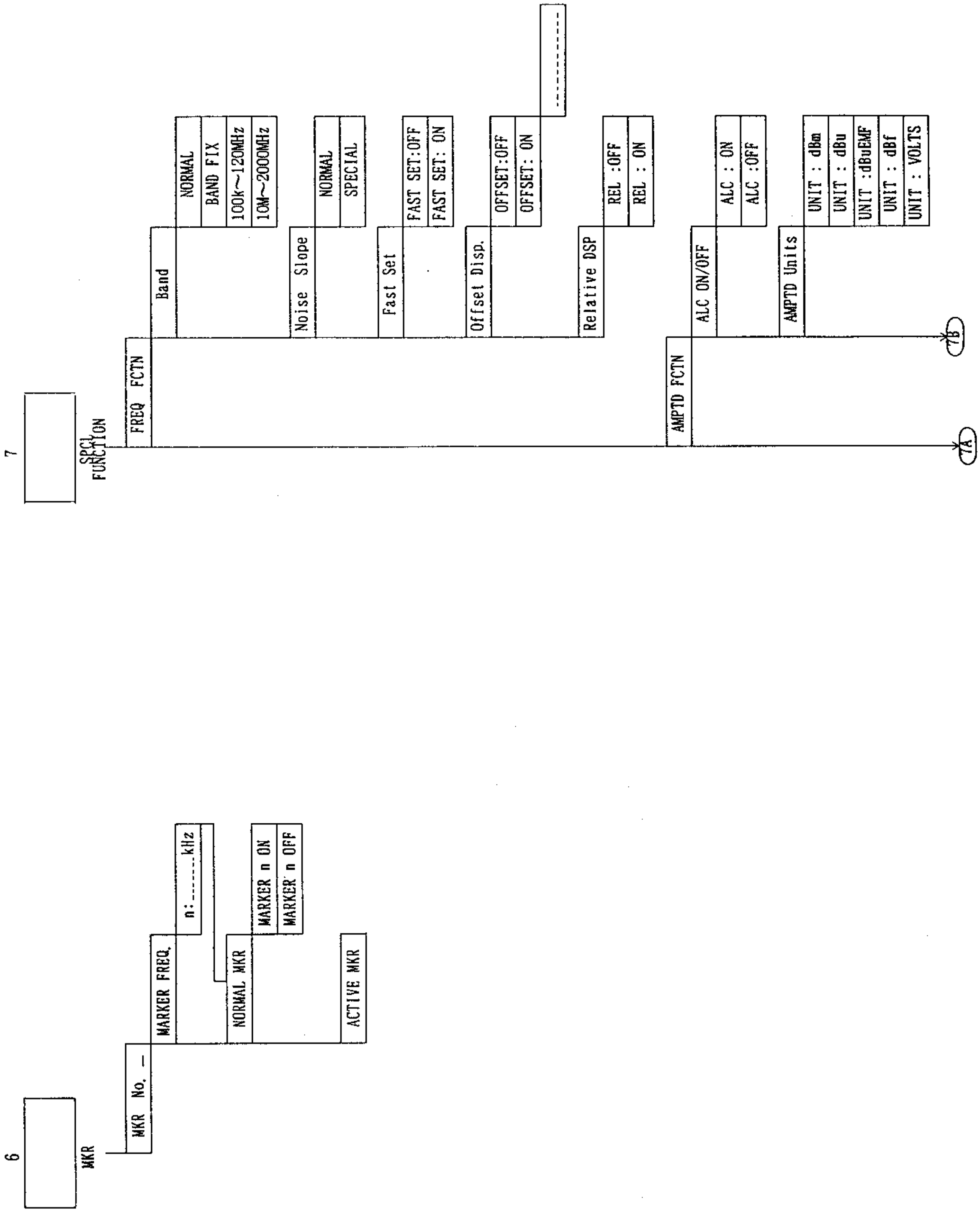
A3 OPERATIONAL MAP FOR FUNCTIONS OF R4262

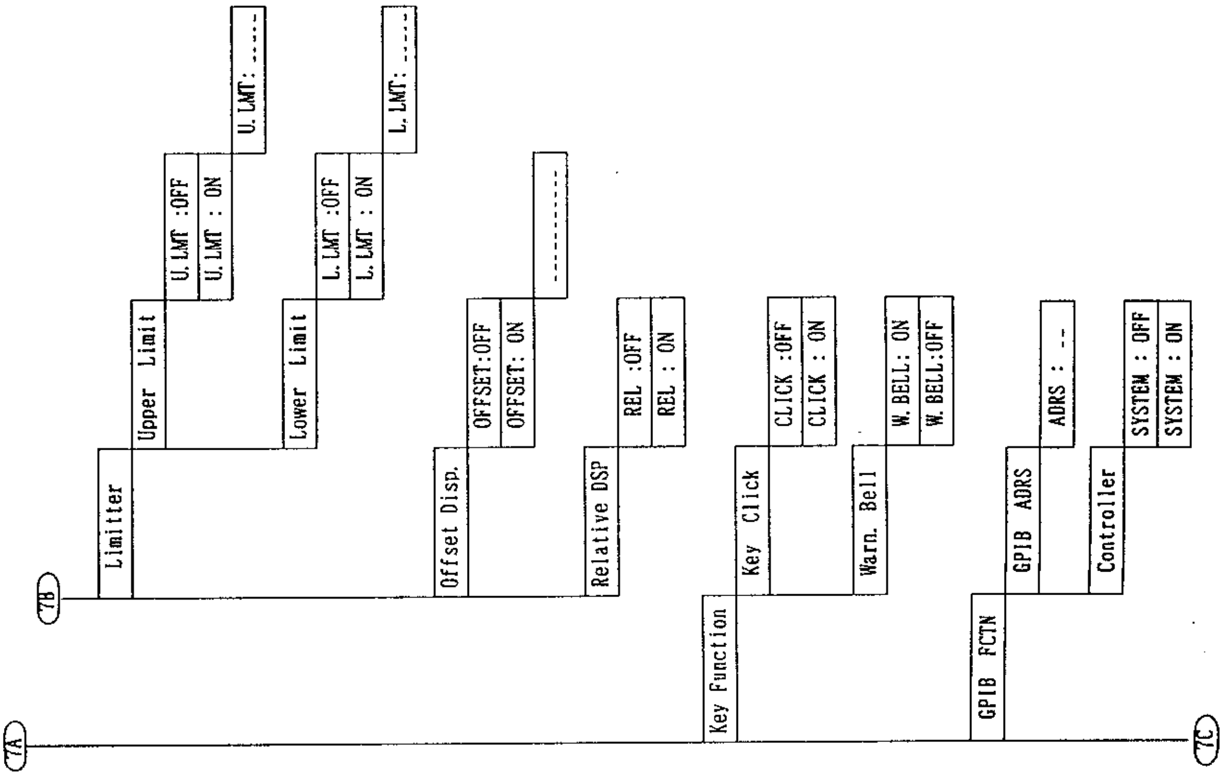


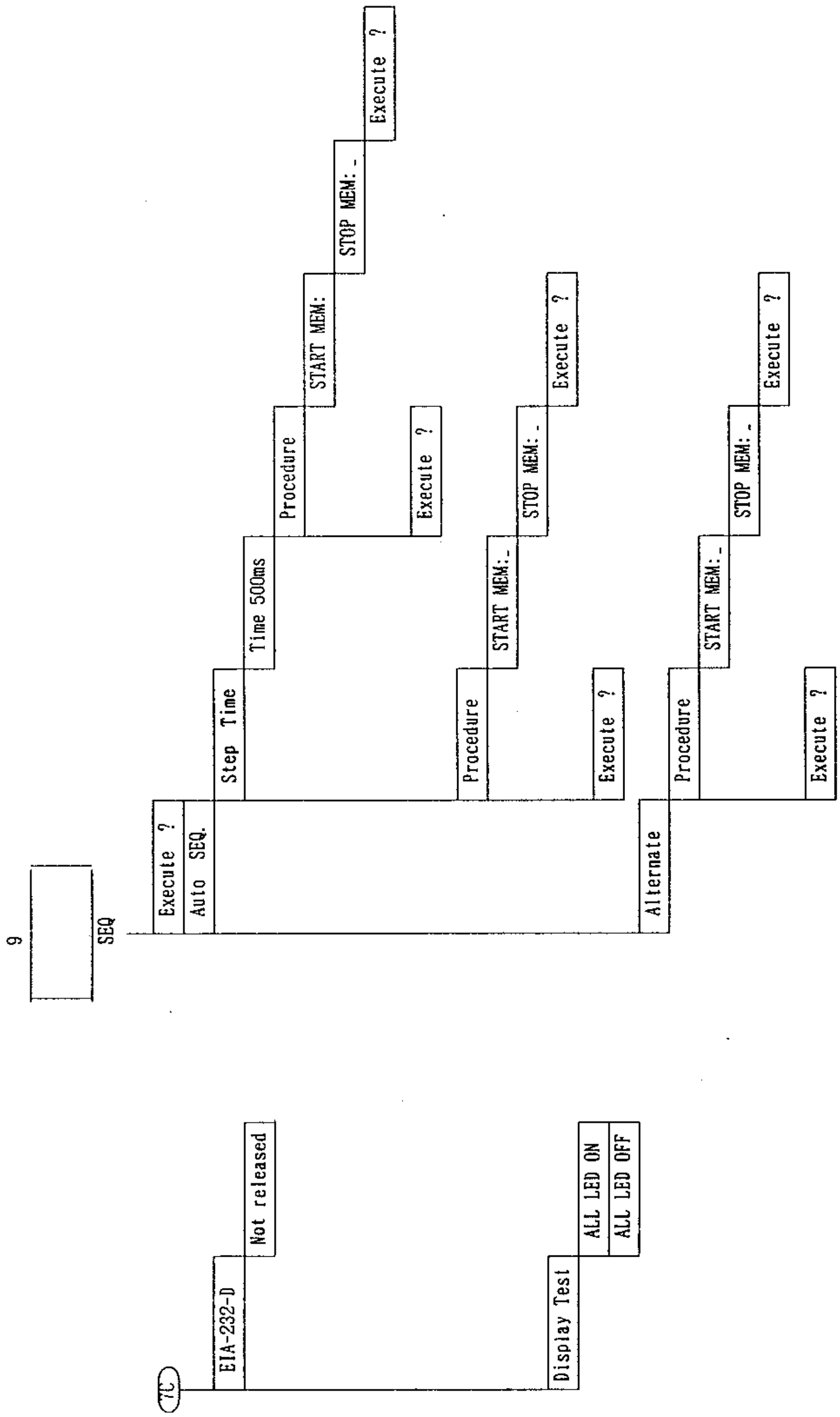

2
±ΔF
Sweep Mode
Auto Sweep
INT. TRIG
LINE TRIG
EXT. TRIG
SINGLE TRIG
Manual Sweep
MAN : 50%
EXT. Sweep
Ramp Voltage
-4V ~ +4V
0 ~ 8V
Gain Adjust
GAIN : ...
Offset ADJ.
OFFSET : ...
Blanking
POSITIVE
NEGATIVE
3
SWP TIME
TIME:500ms
4
SPCL MOD
AM Function
AM MOD OUT
AM OUT:OFF
AM OUT:ON
AM Low Dist.
L.DIST:OFF
L.DIST:ON
AM Polarity
POLARITY:+
POLARITY:-
Rectanguler
RECT OUT:OFF
RECT OUT:ON
SOURCE MIXER
FM OSC
FM OSC:OFF
FM OSC:ON
AM OSC
AM OSC: ON
AM OSC:OFF
AUX MOD IN
AUX IN:OFF
AUX IN: ON
EXT. IN CAL.
EIAC: ON
EIAC:OFF
4A


4A
FM Function
FM MOD OUT
FM OUT:OFF
FM OUT: ON
FM Low Dist.
L.DIST:OFF
L.DIST: ON
FM Polarity
POLARITY:+
POLARITY:-
Pre-emphasis
EMPHA : OFF
EMPHA : 50μs
EMPHA : 75μs
EMPHA :750μs
Wave Select
WAVE : SIN
WAVE:TRIANG
SOURCEMIXER
FM OSC
FM OSC:OFF
FM OSC: ON
AM OSC
AM OSC: ON
AM OSC:OFF
AUX MOD IN
AUX IN:OFF
AUX IN: ON
4C
4B

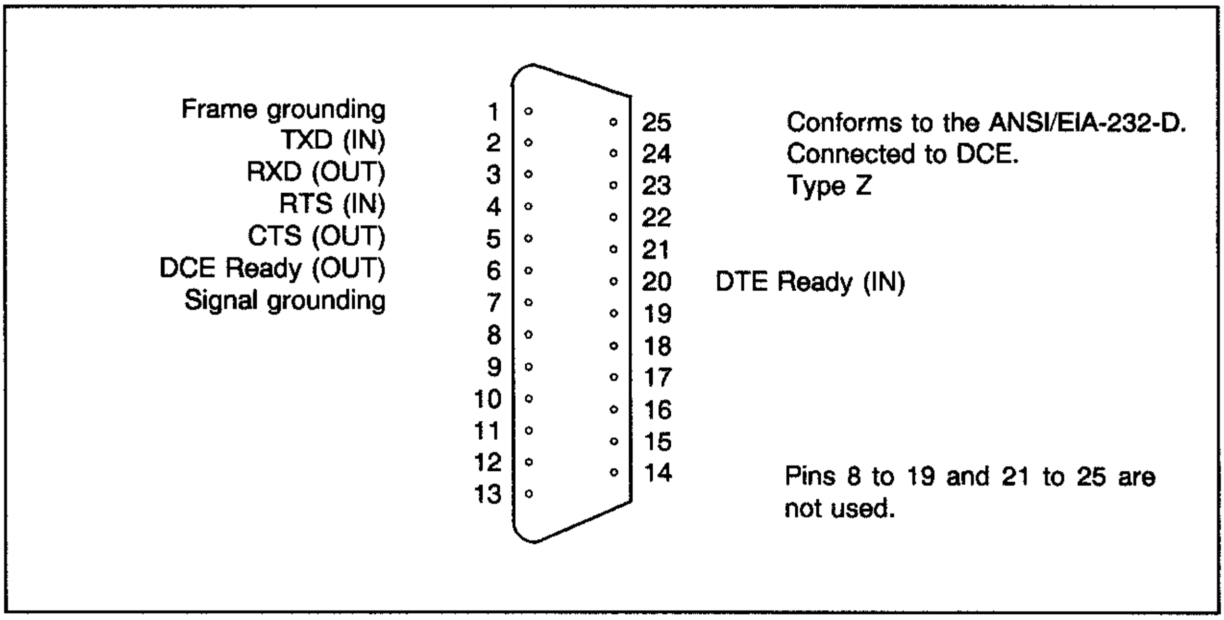

5
BAND
NORMAL
BAND FIX
100k~62.5MHz
62.5M~125MHz
125M~250MHz
250M~500MHz
500M~1GHz
1GHz~2GHz
2GHz~4.5GHz
100k~120MHz
10M~2000MHz
4D
Phase Shift
P.S:-180 deg
P.S:- 90 deg
P.S: 0 deg
P.S:+ 90 deg
P.S:+180 deg
Variable
PHASE:_._ _
Units
UNIT: RADIAN
UNIT: DEGREE
4C
EXT. IN CAL.
EIAC: ON
EIAC:OFF
4B
PM Function
PM MOD OUT
PM OUT:OFF
PM OUT: ON
PM Polarity
POLARITY:+
POLARITY:-
SOURCE MIXER
FM OSC
FM OSC:OFF
FM OSC: ON
AM OSC
AM OSC: ON
AM OSC:OFF
AUX MOD IN
AUX IN:OFF
AUX IN: ON
EXT. IN CAL.
EIAC: ON
EIAC:OFF
4D


7
SPCL FUNCTION
FREQ FCTN
Band
NORMAL
BAND FIX
100k~120MHz
10M~2000MHz
Noise Slope
NORMAL
SPECIAL
Fast Set
FAST SET:OFF
FAST SET: ON
Offset Disp.
OFFSET:OFF
OFFSET: ON
Relative DSP
REL :OFF
REL : ON
AMPTD FCTN
ALC ON/OFF
ALC : ON
ALC :OFF
AMPTD Units
UNIT : dBm
UNIT : dBu
UNIT :dBuEMF
UNIT : dBf
UNIT : VOLTS
7B
7A
6
MKR
MKR No. _
MARKER FREQ.
n: kHz
NORMAL MKR
MARKER n ON
MARKER n OFF
ACTIVE MKR


7B
Limitter
Upper Limit
U.LMT :OFF
U.LMT : ON
U.LMT: -----
Lower Limit
L.LMT :OFF
L.LMT : ON
L.LMT: -----
Offset Disp.
OFFSET:OFF
OFFSET: ON
Relative DSP
REL :OFF
REL : ON
7A
Key Function
Key Click
CLICK :OFF
CLICK : ON
Warn. Bell
W.BELL: ON
W.BELL:OFF
GPIB FCTN
GPIB ADRS
ADRS : --
Controller
SYSTEM : OFF
SYSTEM : ON
7C


9
SEQ
Execute ?
Auto SEQ.
Step Time
Time 500ms
Procedure
START MEM:
STOP MEM: _
Execute ?
Execute ?
Procedure
START MEM:_
STOP MEM: _
Execute ?
Execute ?
Alternate
Procedure
START MEM:_
STOP MEM: _
Execute ?
Execute ?
7C
EIA-232-D
Not released
Display Test
ALL LED ON
ALL LED OFF

A4 EIA-232-D



Input/output signal level :

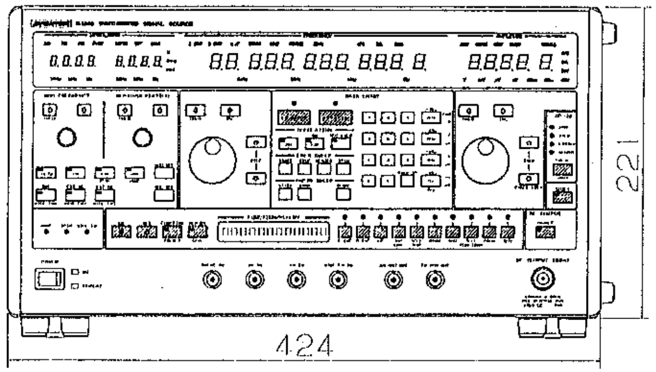
The level of an input signal for the EIA-232-D is −3V to +25V in the Marking (1) state and +3V to +25V in the Spacing (0) state. The level of an output signal for the EIA-232-D is ±12V.

Input/output impedance

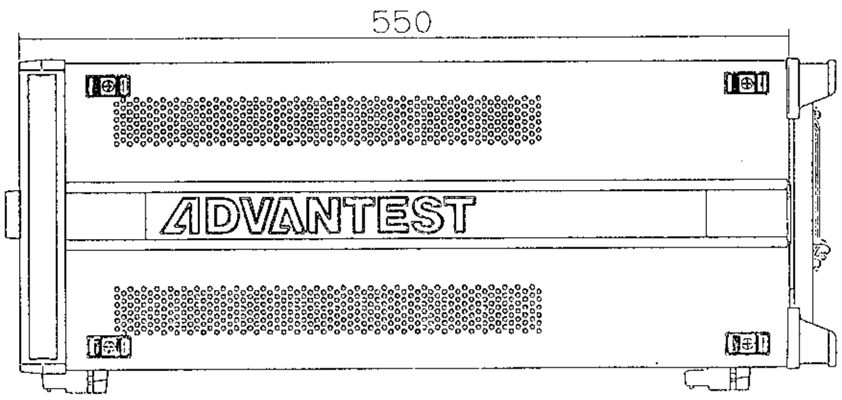
Input impedance : 3 to 7 kΩ

Output impedance : 300Ω

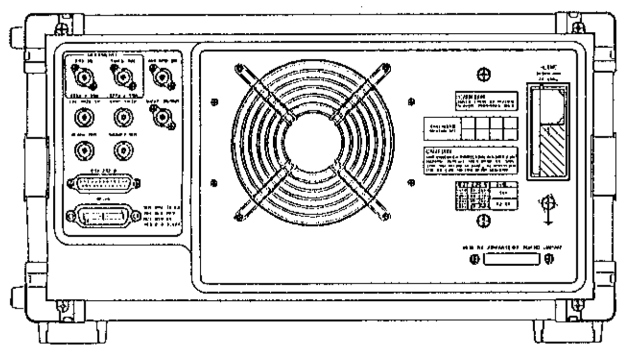
Applicable connector : D-sub 25-pin male connector



FRONT VIEW



SIDE VIEW

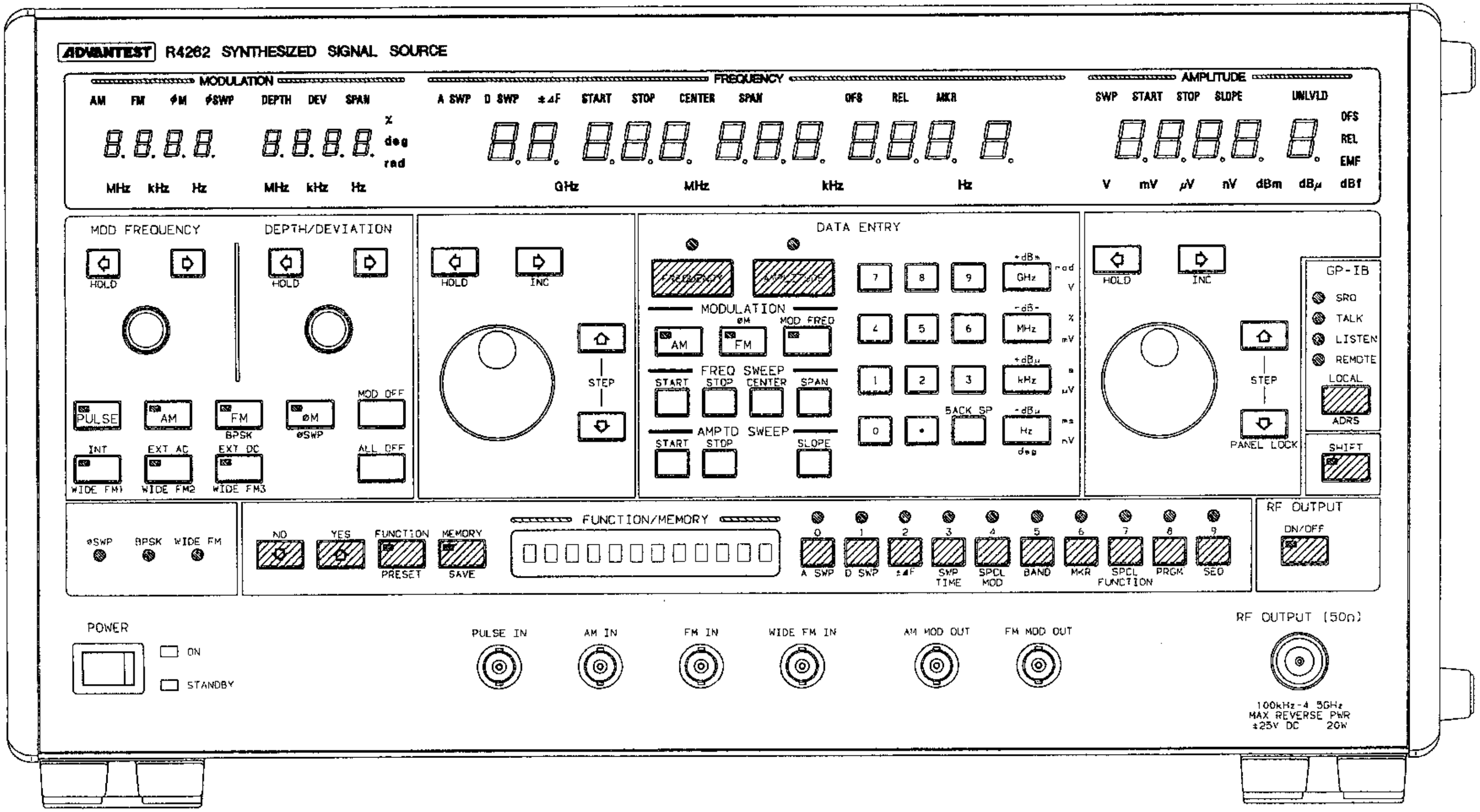


REAR VIEW

Unit:mm

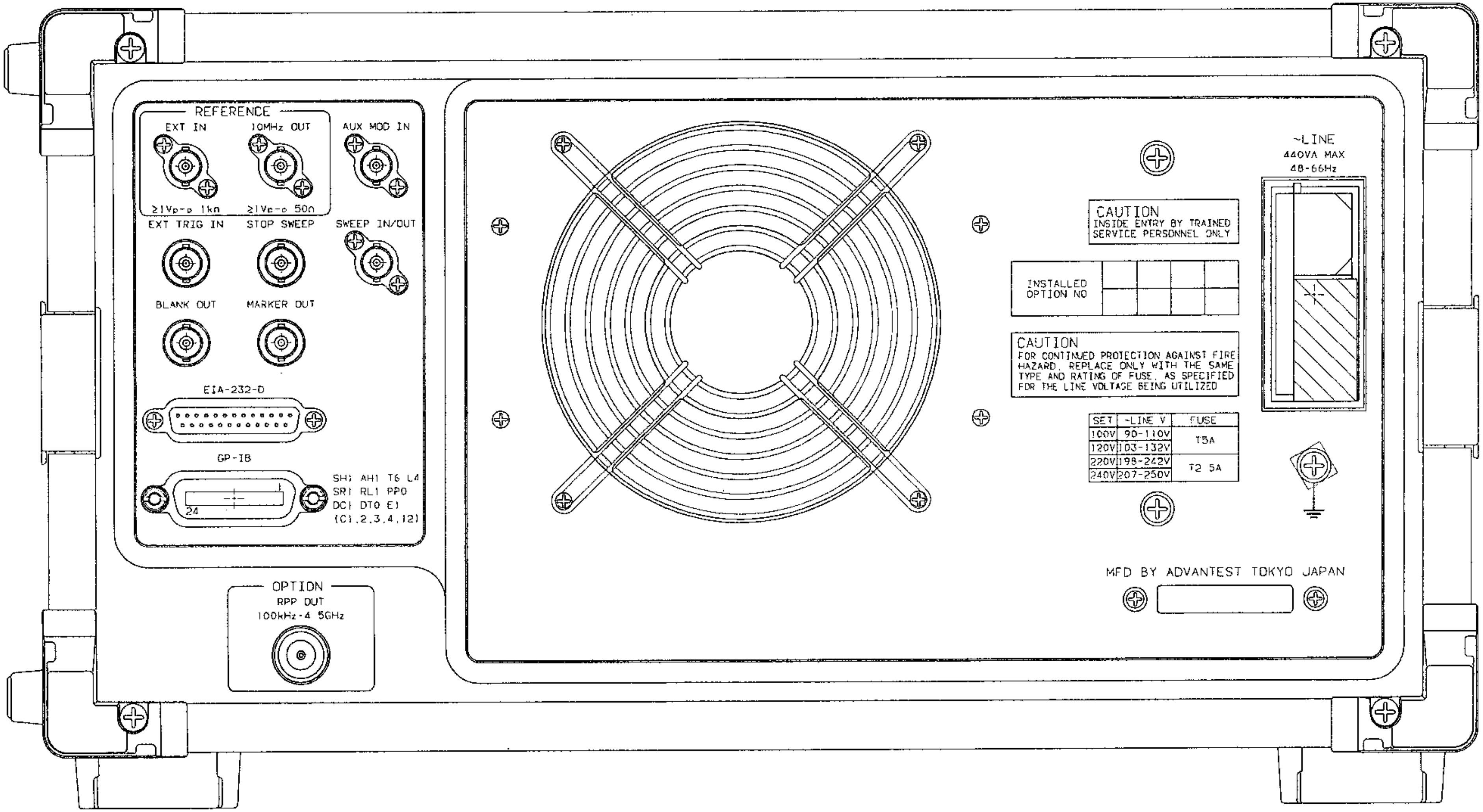
R4262
EXTERNAL VIEW

4262EXT1-903-A



R4262
FRONT VIEW

4262EXT2-903-A



R4262
REAR VIEW

4262EXT3-903-A

ALPHABETICAL INDEX

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   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

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   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

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   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

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Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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