

KENWOOD

FM-STEREO/FM-AM SIGNAL GENERATOR

SG-5110

INSTRUCTION MANUAL

KENWOOD CORPORATION

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1. OUTLINE and FEATURES

The SG-5110 is an FM-STEREO, FM-AM standard signal generator that covers the frequency band from 100kHz to 110MHz. The output level can be set in 1dB steps from $-20\text{dB}\mu$ to $100\text{dB}\mu$.

All set values are easily input by using numeric keys or the rotary encoder.

The set contents can be memorized in up to 100 addresses.

Control is also possible via the RT-100 remote controller (optional) and GP-IB (factory option) allowing the unit to be used effectively for both design and manufacturing purposes.

- Covers the frequency range from 100kHz to 110MHz in a superb stable and accurate way.
- Superb setting resolution of 100Hz up to 34.9999MHz and 1 kHz in the range above 35MHz.
- Contents of frequency, modulation, output level settings can be stored in up to 100 addresses making it easy to recall the settings when required.
- ΔF function allows one-touch deviation measuring.
- Setting is facilitated by either direct setting using numeric keys or by normal setting using cursor and rotary encoder.
- Selectable modulation signal. Select between internal oscillator or externally input signal.
- Operational ease secured by function to preset frequently used output levels and second function selectable, preset standard modulation.
- Provided the optional RT-100 remote controller is connected, control from a distance becomes possible.
- Designed for automation of measuring via GP-IB function (factory option).

2. SPECIFICATIONS

2-1 CARRIER FREQUENCY

Possible frequency range : 100kHz~110MHz
Display : 7 digits
Resolution : 100Hz (100kHz~34.9999MHz)
1kHz (above 35MHz)
Reference signal Accuracy : $\pm 5 \times 10^{-5}$

2-2 RF OUTPUT

Output level range : -20dB μ ~100dB μ open ended
-133dBm~-13dBm terminal
EMF dB μ \longleftrightarrow dBm selector switch : Yes
Display : 3 digits
Resolution : 1dB
Reference level accuracy : ± 1 dB (at 100dB μ output)
Attenuator accuracy : ± 1 dB (0dB μ ~100dB μ)
 ± 2 dB (-20dB μ ~0dB μ)
Signal source impedance : 50 Ω , VSWR 1.2 or less
Spurious output : below -30dBc or less
Residual FM component : 70dB or more
(Deviation: ratio for 75kHz,
Band: 50Hz~15kHz)
de-emphasis 50 μ s RF: 76MHz~110MHz
Residual AM component : 50dB or more
(Modulation: 30%, Band: 50Hz~15kHz)
RF: 30MHz~100MHz
However, the harmonic components of
the 80MHz band is excluded.

2-3 FM MODULATION

Frequency deviation : 0~100kHz (RF: 1MHz~110MHz)
RF frequency $\times 10\%$ (RF: less than 1MHz)
Display : 3 digits

Resolution : 0.1kHz
 Accuracy : Maximum display value $\pm 10\%$
 (RF: 1MHz~110MHz, AF: 1kHz)
 Internal modulation frequency : 400Hz, 1kHz $\pm 3\%$
 Distortion factor : 0.05% or less (RF: 10.7MHz, 76MHz~110MHz)
 (Demodulation range: 50Hz ~15kHz
 AF: 1 kHz,
 75 kHz deviation: de-emphasis 50 μ s)

External modulation
 Frequency characteristic : 20Hz~100kHz ± 1 dB (1kHz reference)
 (RF: 10.7MHz, 76MHz~110MHz)
 Input impedance : Approximately 10k Ω unbalanced
 Input voltage : Approximately 3 Vp-p

2-4 AM MODULATION

Modulation percentage : 0~60%
 Display : 3 digits
 Resolution : 0.1%
 Accuracy : \leq (display value ± 5) % (RF: 100kHz~30MHz)
 Internal modulation frequency : 400Hz, 1 kHz $\pm 3\%$
 External modulation frequency : 50Hz~10kHz ± 1 dB (1kHz reference)
 Distortion factor : 0.5% or less (RF: 200kHz~30MHz)
 (Demodulation range: 50Hz~15kHz
 AF: 1kHz Modulation percentage: 30%)
 However, the harmonic components of
 the 80MHz band is excluded.

2-5 STEREO SIGNAL

Separation : Approx. 55dB (400Hz~1kHz)
 Pilot signal frequency : 19kHz ± 2 Hz
 Internal modulation frequency : 400Hz, 1kHz $\pm 3\%$
 External modulation frequency : 50Hz~15kHz ± 1 dB (1kHz reference)
 (RF: 10.7MHz, 76MHz~110MHz)

2-6 ADDITIONAL

Preset key settings	: Stereo modulation percentage: 30%, 100%
	AM : 30%
	FM : 3.5kHz, 22.5kHz, 75kHz
	OUTPUT level : 4 levels
Memory	: 100 points
Optional functions	: Remote control
Dimensions	: 100 (H) × 430 (W) × 380 (D) mm
Weight	: Approximately: 12kg
Operating environment	: Ambient temperature: 10~35°C Relative humidity : below 85%
Voltage (AC)	: 100V/120V/220V/240V±10% (MAX. 250V AC) 50/60Hz
Power consumption	: Approximately 28W
Supplied accessories	: Power cord 1, instruction manual 1, Output cable 1, Replacement fuse 1

3. PANEL EXPLANATION

3-1 FRONT PANEL

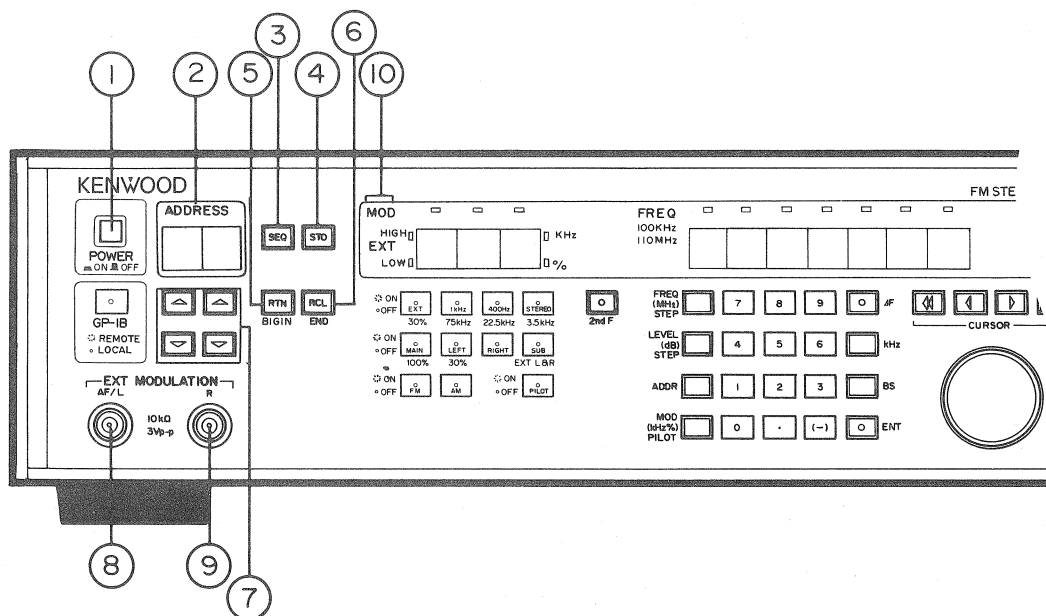


Fig. 1

① POWER ON /OFF switch

Press the switch to turn power ON. Press again to turn power OFF.

② ADDRESS Display

Indicates the address.

③ SEQ Key

Press this key to select sequential recall mode (during this mode “.” is displayed in the lower right corner of the address display). Press the key again to return to normal mode.

In the sequential recall mode, the contents set in the address are output without further processing.

④ STO (store) Key

If this key is pressed together with the ENT key ⑩ after the frequency, level, and modulation setting, the set values are stored in the memory of

the displayed address.

⑤ RTN (return)/BEGIN Key

RTN : Due to the address rotation function, the unit returns to the begin address.

BEGIN : When the 2nd F key ⑳ is pressed and second function mode activated, the begin address can be set by pressing this key.

⑥ RCL (recall)/END Key

RCL : If this key is pressed during normal mode, the data stored in the memory of the currently displayed address is output.

END : When the 2nd F key ⑳ is pressed and second function mode activated, the end address can be set when this key is pressed.

⑦ Address Setting Keys

Use the keys to increase or decrease the address in 1 or 10-step increments or decrements. Use the keys on the left for 10-step changes and use those on the right for 1-step increase or decrease. The address can be set in 100 steps from 0~99.

⑧ EXT MODULATION AF/L Input Terminal

Input terminal for external modulation signal for AM, FM signals. In the case of stereo modulation, the left side signal is input here. Input level is 3 Vp-p, input impedance 10k Ω , maximum input voltage is 10V (DC+AC peak).

⑨ EXT MODULATION R Input Terminal

In the case of stereo modulation, the right side signal is input here. Input level is 3 Vp-p, input impedance 10k Ω , maximum input voltage is 10V (DC+ACpeak).

⑩ EXT HIGH/LOW Indicators

The HIGH and LOW indicators indicate whether the input level of the external modulation signal is too high or too low. The value displayed at the modulation display when both HIGH and LOW are turned off, becomes the modulation value.

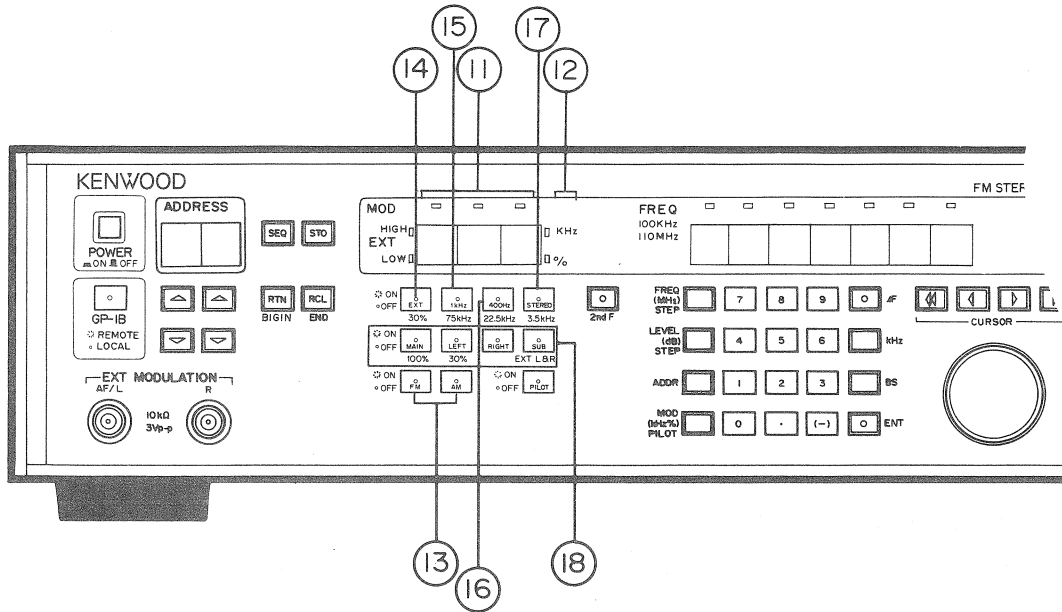


Fig. 2

⑪ MODULATION Display

3-digit indication of AM/FM and FM-STEREO modulation.

⑫ FM/AM Modulation Unit Indicators

AM and FM-STEREO modulation are showed in %. FM frequency deviation is indicated by kHz.

⑬ FM/AM Modulation Keys

Keys to turn ON/OFF FM and AM modulation.

⑭ EXT/30% Key

EXT : Press this key when an external modulation signal is to be used.

30% : When the 2nd F key ⑳ is pressed and second function mode activated, AM modulation is set to 30% when this key is pressed.

⑮ 1kHz/75kHz Key

1kHz : The modulation source becomes the 1 kHz internal modulation signal.

75kHz : When the 2nd F key ⑳ is pressed and second function mode activated, the FM frequency deviation is set to 75kHz when this key is pressed.

⑩ 400Hz/22.5 kHz Key

400Hz : The modulation source becomes the 400Hz internal modulation signal.

22.5kHz : When the 2nd F key ⑩ is pressed and second function mode activated, the FM frequency deviation is set to 22.5 kHz when this key is pressed.

⑪ STEREO/3.5 kHz Key

STEREO : Press this key for FM-STEREO modulation.

3.5kHz : When the 2nd F key ⑩ is pressed and second function mode activated, the FM frequency deviation is set to 3.5 kHz when this key is pressed.

⑫ FM-STEREO Modulation Source Setting Keys

Used for setting the modulation source for FM-STEREO modulation.

MAIN/100% : Press to select MAIN modulation mode.

LEFT/30% : Press to select LEFT modulation mode.

RIGHT : Press to select RIGHT modulation mode.

SUB/EXT L&R : Press to select SUB modulation mode.

When the 2nd F key ⑩ is pressed and second function mode activated, these keys have the following functions:

MAIN/100% : The FM-STEREO modulation is set to 100%.

LEFT/30% : The FM-STEREO modulation is set to 30%.

SUB/EXT L&R : When the external modulation signal is used during FM-STEREO modulation, press this key when L and R side signals are input separately.

* In the case of the SG-5110, 30% at the time of FM-STEREO modulation should be thought of as 67.5kHz deviation = 100%.

Accordingly, $30\% = 67.5\text{kHz} \times 0.3 = 20.25\text{kHz}$.

Since the pilot signal is 7.5kHz, the frequency deviation becomes $20.25\text{kHz} + 7.5\text{kHz} = 27.75\text{kHz}$. When the modulation is expressed in %, the result becomes $27.75 \div 75 \times 100 = 37\%$.

* The RIGHT key has no second function.

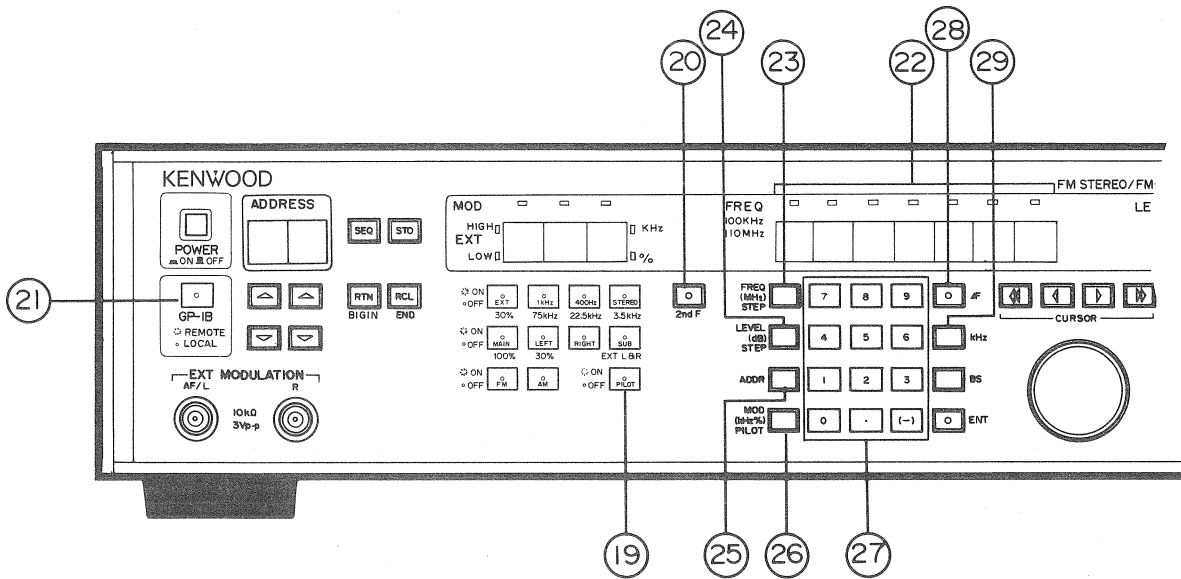


Fig. 3

⑱ PILOT ON/OFF key

Key to turn ON/OFF the pilot signal for FM-STEREO modulation.

⑳ 2nd F Key

When this key is pressed, the unit operates according to the functions indicated by red letters below the keys interconnected with this key.

㉑ LCL (remote/local) key

This key only works with units having built-in GP-IB functions.

㉒ FREQUENCY Display

Displays the frequency.

㉓ FREQ (MHz)/STEP key

FREQ (MHz): For directly setting the frequency by using the numeric keys ㉗, The frequency unit can be changed as follows. When the FREQ (MHz) key is pressed and the ENT key ㉕ is pressed after the frequency has been entered by using the numeric keys, the unit becomes MHz. Conversely, when the kHz key ㉙ is pressed, the unit becomes kHz. If this key is pressed again before either the ENT key or kHz key is pressed, the frequency setting returns

to the one valid before the input.

STEP : When you want to step up or step down the frequency at a certain interval, set the interval as follows. Press the 2nd F key ⑳. Press this STEP key and input the step value of the frequency by using the numeric keys. Finally press the ENT key ㉑.

㉔ LEVEL (dB)/STEP key

LEVEL (dB): Used when the numeric keys are used for directly setting the RF output level. The setting procedure is the same as for the FREQ (MHz) key ㉓ setting.

The set unit is dB μ when "dB μ " lights on the level unit display and dBm when "dBm" lights.

STEP : When you want to step up or step down the level at a certain interval, set the interval as follows. Press the 2nd F key ⑳, then press this STEP key and input the step value of the LEVEL by using the numeric keys. Finally press the ENT key ㉑.

㉕ ADDR (address) key

Used when the numeric keys are used for direct setting of the address. The setting procedure is the same as for the FREQ key ㉓ setting.

㉖ MOD (modulation)/PILOT key

Used when the numeric keys are used for direct setting of the modulation. The setting procedure is the same as for the FREQ key ㉓ setting.

㉗ Numeric Keys

Used when setting data. When a numeric key alone is pressed, the last digit of the address changes.

㉘ Δ F Key

Used for measuring the deviation. Press the key once more to cancel this function.

㉙ kHz Key

When the frequency setting should be kHz, press this button instead of the ENT key ㉑.

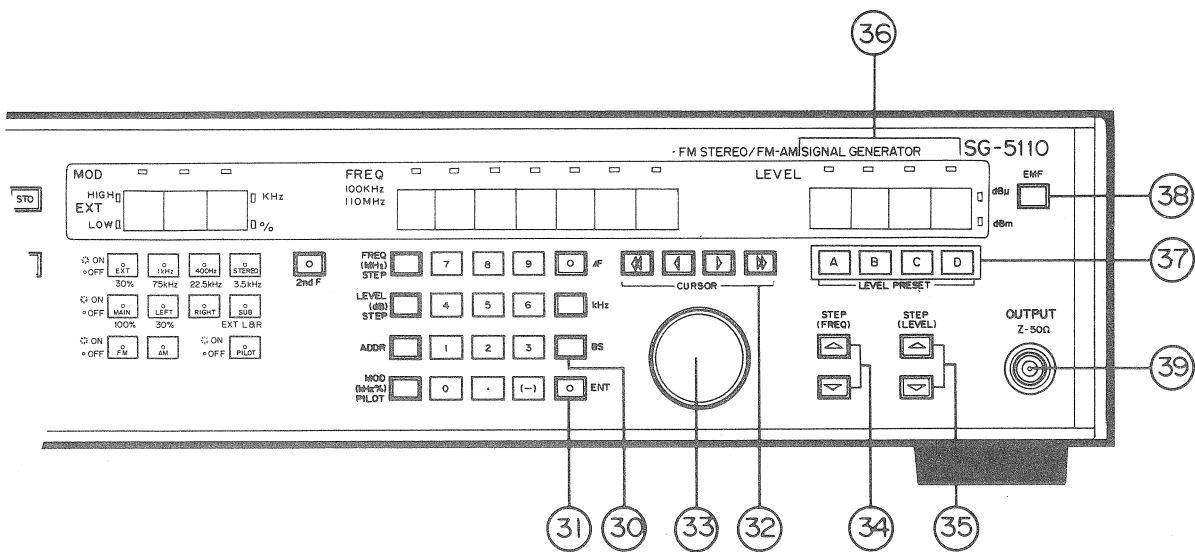


Fig. 4

③① BS key

If a wrong value is input, the digits can be cleared one by one starting from the last input by pressing this key.

③② ENT key

When the set value has been input by using the numeric keys, the final setting including the set value unit is completed by pressing this ENT key. If the ENT key is not pressed, the key's LED continues flashing. If no key is pressed during the time the LED flashes, the display value returns to the value valid before the input.

③③ CURSOR key

If the ◀ key or ▶ key is pressed, the cursor moves one step to the left or right. If the ◀◀ key or ▶▶ key is pressed, the cursor moves between the MODULATION, FREQUENCY and LEVEL displays.

③④ Rotary Encoder

Depending on the position of the cursor, the rotary encoder can be used to decrease or increase the displayed MODULATION, FREQUENCY and LEVEL values.

③④ STEP (FREQ) Key

Used to decrease or increase the frequency.

③⑤ STEP (LEVEL) Key

Used to decrease or increase the output level.

③⑥ LEVEL Display

Indicates the output level.

③⑦ LEVEL PRESET (A, B, C, D) Keys

Output level memory can be stored in these 4 keys.

③⑧ Output level Unit Indication/Unit Indication Selector Switch

To select the output level unit.

EMF dB μ : Using 1 μ V open voltage as the reference, the output level is expressed as EMF dB μ .

dBm : Using 1 mW, 50 Ω load as the reference, the output level is expressed as dBm.

③⑨ RF output terminal

RF output terminal with an impedance of 50 Ω .

3-2 REAR PANEL

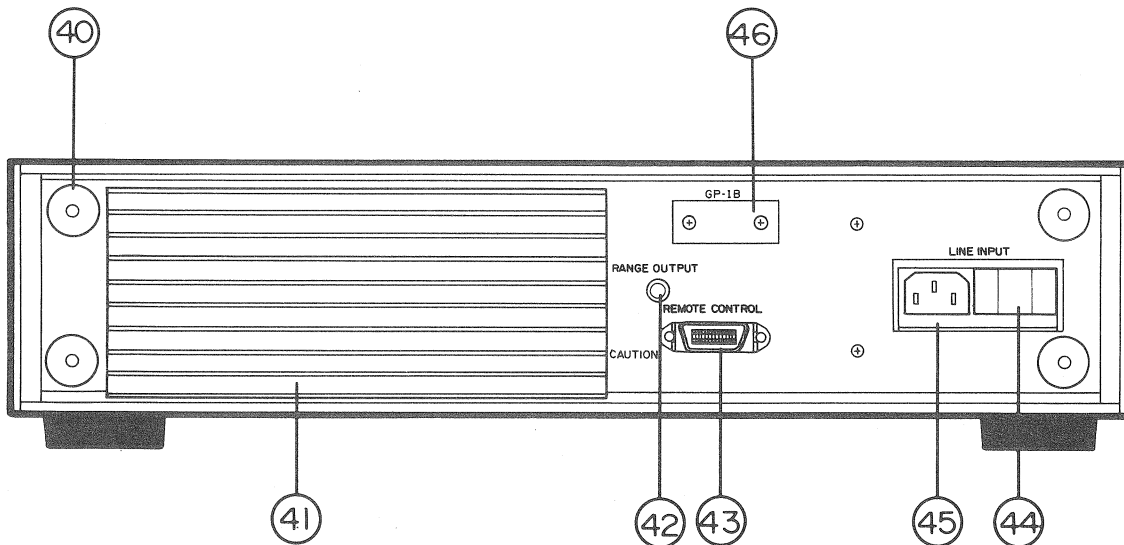


Fig. 5

④ Cord Winder

Wind the AC cord round this winder for storage. It also acts as legs when the unit is stored in a vertical position. However, avoid using the SG-5110 placed in a vertical position.

④ Heat Sink

During continuous operation the heat sink becomes hot. Do not place near objects adversely affected by heat. Place the unit in a well-ventilated location during operation.

④ RANGE OUTPUT Terminal

Can be set by pressing the STO key ④ and the numeric key marked "3". When the frequency display shows 35--1, the output is above the 35 MHz range and the voltage +5V. When the display shows 35--0, the level is above the 35 MHz range and 0V is output.

④ REMOTE CONTROL Terminal

Terminal for remote control of the functions indicated on the front panel. Connect the optional RT-100 remote controller to this terminal.

④ Voltage Selector/Fuse Holder

Voltage selector: The voltage setting when shipped from the factory is indicated by a circled mark in the SET column of the ratings plate located on top of this combined voltage selector and fuse holder. Make sure that the AC mains outlet provides a voltage that meets the power requirements of this unit before connecting the power cord to the mains.

Refer to the "MAINTAINANCE" section in this manual if the voltage of this unit is to be changed.

Fuse holder : The unit's AC mains protection fuse is placed in the holder. In areas with 100V, 120V power supply, a 0.5A glass tube slow blow fuse should be used. In areas with 220V, 240V power supply, a 0.3A glass tube slow blow fuse should be used. Refer to the "MAINTAINANCE" section if the fuse has to be replaced.

⑤ AC Inlet

Receptacle for AC power cord. Use the power cord provided with this unit.

⑥ Optional concealing panel

A panel used to conceal the mounting hole for the GP-IB (factory option) connection terminal is provided.

4. OPERATING PROCEDURES

The unit outputs the set values displayed on the various portions of the display via the RF output terminal. The display consists of 3 portions: MODULATION, FREQUENCY and LEVEL. How to set the various display portions is described below.

4-1 FREQUENCY SETTING

4-1-1 NORMAL SETTING

Enter the value by using the CURSOR key ⑳ and rotary encoder ㉓.

- 1) When the ◀◀ or ▶▶ key is pressed, the cursor that lights in the upper portion of the display shifts between the MODULATION, FREQUENCY and LEVEL portions. Move the cursor to the portion where the frequency digits are displayed.
- 2) Press the ◀ or ▶ key to move the cursor to the digit you want to set.
- 3) When the rotary encoder is rotated, the digit under the cursor starts changing. Set to desired value.
- 4) Repeat steps 2) and 3) until the desired frequency is set.

* It is not possible to enter a value that is outside the rated frequency range of the unit (100 kHz~110MHz).

4-1-2 DIRECT SETTING

The set value is entered by using the FREQ (MHz) key ㉔, the numeric keys ㉕, and the ENT key ㉖ or the kHz key ㉗.

- 1) When the FREQ key ㉔ is pressed, the digits shown on the frequency display are erased and the ENT key's LED flashes.

2) While the LED is flashing, enter the desired frequency value by using the numeric keys. If a wrong digit is entered, press the BS key ③⑩ to erase the digits one by one starting from the last input. Then enter the correct value.

3) Select the frequency unit. If the ENT key is pressed after the frequency has been input, and while the LED is flashing, the unit becomes MHz. If the kHz key is pressed instead of the ENT key, the unit becomes kHz.

* During direct setting, keys other than the numeric keys on the front panel do not function.

* If neither the ENT key nor kHz key is pressed after the frequency has been input and while the LED is flashing, the set value returns to the value valid before the input when the FREQ (MHz) key ②③ is pressed again. If a frequency that exceeds the ratings of this unit is entered, the set value also returns to the value valid before the input.

NOTE

Both in case of normal setting and direct setting, setting resolution is 100 Hz up to 34.9999MHz, and 1 kHz above 35MHz.

Example: Using direct setting to set the frequency to 23.456.7MHz.

KEY OPERATION	FREQUENCY DISPLAY	REMARKS
	110.000.0	Indicates frequency before setting
FREQ key		Frequency setting stand-by
Numeric key 2	2	
Numeric key 3	23	
Numeric key 5	235	Wrong input
BS key	23	Input correction
Numeric key .	23.	
Numeric key 4	23.4	
Numeric key 5	23.45	
Numeric key 6	23.456	
Numeric key 7	23.4567	Setting completed
ENT key	23.456.7	Unit setting/output

4-1-3 STEP SETTING

In addition to the methods described in 4-1-1 and 4-1-2, the STEP (FREQ) key ㉔ can also be used to set the frequency. This method changes the frequency in steps (intervals). The step value is set during the second function mode.

- 1) Press the 2nd F key ㉒ to enter the second function mode.
- 2) When the FREQ (MHz) key ㉓ is pressed, the ENT key's LED flashes and the frequency display indicates the previously set step value.
- 3) While the ENT key's LED is flashing, use the numeric keys to enter the desired step value. If a wrong digit is entered, press the BS key ㉑ to erase the digits one by one starting from the last input. Then enter the correct value.
- 4) Select the step value unit. If the ENT key is pressed after the step value has been input and while the LED is flashing, the unit becomes MHz. If the kHz key is pressed instead of the ENT key, the unit becomes kHz. The display changes from indicating the step value to showing the

frequency.

The step value setting range is 1kHz~50MHz. If this range is overstepped, the display changes to frequency display and the step value returns to the value valid before the new input.

If neither the ENT key nor kHz key is pressed after the frequency has been input and while the LED is flashing, the value shown on the display returns to the frequency value displayed before the step value was input when the FREQ (MHz) key ②③ is pressed again.

- 5) When the ENT key or kHz key is pressed, the value of the frequency display changes from step value to frequency indication and this value is output.
- 6) When the STEP (FREQ) key ④ is pressed, the frequency display increases or decreases in accordance with the set step interval and the frequency value is output.

4-2 OUTPUT LEVEL SETTING

4-2-1 NORMAL SETTING

As in the case of frequency setting, the CURSOR key ② and the rotary encoder ③ are used to enter the set value.

- 1) Press the ◀◀ or ▶▶ key to move the cursor to the LEVEL display portion.
- 2) Press the ◀ or ▶ key to move the cursor to the digit you want to set.
- 3) When the rotary encoder is rotated, the digit under the cursor starts changing. Set to desired value.
- 4) Repeat steps 2) and 3) until the desired output level value is set.
- 5) Level units are either EMF dB μ or dBm. Select either one by using the unit selector switch ④.

* The unit's ratings allow setting within $-20\sim 100\text{dB}\mu$ in the case of $\text{EMF dB}\mu$ and $-133\sim -13\text{dBm}$ in the case of dBm . If these ranges are exceeded, setting becomes impossible.

4-2-2 DIRECT SETTING

The set value can be input by using the LEVEL (dB) key ②④, the numeric keys ②⑦, and the ENT key ③①.

- 1) When the LEVEL key ②④ is pressed, digits are erased from the LEVEL display and the ENT key's LED flashes.
- 2) While the ENT key's LED is flashing, use the numeric keys to enter the desired level value. If a wrong digit is entered, press the BS key ③② to erase the digits one by one starting from the last input. Then enter the correct value.
- 3) When the level value has been set, press the ENT key. When the ENT key is pressed, the output level value displayed on the display is output.
- 4) Select either $\text{EMF dB}\mu$ or dBm as output level unit by using the unit display selector switch ③⑧.

* If a level value exceeding the range of the unit's ratings is entered, the level display value will return to the level value valid before the input.

* During direct setting, keys other than the numeric keys on the front panel do not function.

* If the ENT key is not pressed after the setting and while its LED is flashing, the set value returns to the value valid before the input when the LEVEL key ②④ is pressed again.

4-2-3 DISPLAY UNIT CHANGE

To change the level unit, press the display unit selector switch ③⑧. The level display's value changes according to the unit selected. Refer to the

following formula for unit change.

$$(dB\mu) = (dBm) + 107$$

However, in the case of dB μ this unit displays an open end level (EMF dB μ), and in case of dBm the display shows as 50 Ω termination.

Accordingly, in the case of this unit

$$EMF\ dB\mu\ (\text{displayed level}) = (dBm) + 113$$

In this instruction manual, the dB μ unit always denotes EMF dB μ .

Example: Setting the output level to 100 dB μ by direct setting.

KEY OPERATION	LEVEL DISPLAY	REMARKS
	-133 (dBm)	Indicates the level before setting.
EMF dB μ /dBm	-20 (dB μ)	Unit change
LEVEL key		
Numeric key 1	1	
Numeric key 0	10	
Numeric key 5	105	Wrong input
BS key	10	Input correction
Numeric key 0	100	
ENT key	100	Setting completed.

4-2-4 STEP SETTING

As in the case of frequency setting, the level setting can also be done by changing the level in steps.

For the setting procedure, refer to the Section "4-1-3 Step Setting". However, instead of the FREQ (MHz) key mentioned in the instructions, the LEVEL (dB) key should be used and output level value should be substituted for frequency value.

The range in which step setting is possible is 1 to 20 dB.

4-2-5 LEVEL PRESET FUNCTION

This unit allows up to 4 preset output levels to be stored in the LEVEL PRESET keys ③ for easy recall.

- 1) After the output level setting is completed and while the ENT key's

LED flashin press the STO key ④; then press either of the LEVEL PRESET keys A, B, C, or D. After the displayed level value has flashed once, the output level value is stored in the memory of the selected LEVEL PRESET key.

If the LEVEL PRESET key is not pressed after the setting and while ENT LED is flashing the set value returns to the value valid before the setting.

- 2) To recall the stored output level value, just press the LEVEL PRESET key. The stored level value is output.

* However, the level display unit (dB μ , dBm) cannot be stored.

4-3 MODULATION SETTING

The modulation is decided by setting the following 3 elements:

- (1) Modulation selection (FM, AM, FM-STEREO, or all OFF)
- (2) Modulation source selection (EXT, INT 1 kHz/400 Hz)
- (3) Modulation setting (FM: 0~100kHz, AM: 0~60%,
FM-STEREO: 0~105% (Including 15% of the pilot signal component))

4-3-1 FM MODULATION SETTING

Carry out the following preparations before setting.

- 1) Press the FM modulation key ⑬.

While the FM key lights, once again press the FM key to set the modulation to OFF. In the FM modulation mode the "kHz" LED lights in the upper right corner of the MODULATION display.

- 2) Now select the modulation source.

To input an external modulation signal, press the EXT key ⑭. To use the internal modulation signal, press either the 1kHz key ⑮ or the 400 Hz key ⑯.

4-3-1-1 Normal Setting

As in the case of frequency setting, the CURSOR key ⑳ and rotary encoder ㉓ are used to input the set value.

- 1) Press the ◀◀ or ▶▶ key to move the cursor to the MODULATION display portion.
- 2) Press the ◀ or ▶ key to move the cursor to the digit you want to set.
- 3) When the rotary encoder is rotated, the digit under the cursor starts changing. Set to desired value.
- 4) Repeat steps 2) and 3) until the desired modulation value is set.

* Input values exceeding the FM MODULATION ratings (0~100kHz) cannot be set.

4-3-1-2 Direct Setting

The value can be set by using the MOD (kHz, %) key ㉖, the numeric keys ㉗ and the ENT key ㉙.

- 1) When the MOD key ㉖ is pressed, digits are erased from the MODULATION display and the ENT key's LED flashes.
- 2) While the ENT key's LED is flashing, use the numeric keys to enter the desired modulation value. If a wrong digit is entered, press the BS key ㉚ to erase the digits one by one starting from the last input. Then enter, then correct value.
- 3) When the modulation value has been input, press the ENT key. When the ENT key is pressed, the output level value displayed on the display is set.

* If a modulation set value exceeding the range of the unit's ratings is entered, the modulation display value will return to the modulation value valid before the input.

* During direct setting, keys other than the numeric keys on the front panel do not function.

* If the ENT key is not pressed after the set value has been input and while the LED is flashing, the set value returns to the value valid before the input when the MOD key ⑳ is pressed again.

* Settings below 0.1kHz will be set to 0.1kHz.

Example: Setting FM modulation to 75.0kHz by direct setting.

KEY OPERATION	MODULATION DISPLAY	REMARKS
	22.5	Indication of MODULATION before setting.
MOD key		MODULATION setting preparation
Numeric key 7	7	
Numeric key 5	75	
Numeric key .	75.	
Numeric key 3	75.3	Wrong input
BS key	75.	Input correction
Numeric key 0	75.0	
ENT key	75.0	Setting completed

4-3-1-3 Preset Setting

Standard modulation values (indicated by red figures under each key) have been preset and memorized in the second function keys.

- 1) Press the 2nd F key ㉔ to enter second function mode.
- 2) Select the desired modulation value (75kHz, 22.5kHz, 3.5kHz) by pressing either the 1kHz/75kHz key ㉕, 400Hz/22.5kHz key ㉖ or the STEREO/3.5kHz key ㉗.

4-3-2 FM-STEREO MODULATION SETTING

Carry out the following preparations prior to the setting.

- 1) Press the STEREO key ⑰ until the key's LED lights. (Depending on the previous setting, the LED may not light after the first pressing. In this case, press the key again.)
- 2) When the STEREO key's LED lights, the mode becomes FM-STEREO modulation mode. In the lower right corner of the MODULATION display "%" (LED) lights up.
When the STEREO key is pressed once more while the key's LED lights, the STEREO key's LED goes out and the mode becomes FM modulation mode.
- 3) Select the modulation source.
To input an external modulation signal, press the EXT key ⑭. To use the internal modulation signal, press either the 1 kHz key ⑮ or the 400Hz key ⑯.

4-3-2-1 Normal Setting

Use the same procedure as for FM modulation setting.

Refer to Section 4-3-1-1.

4-3-2-2 Direct Setting

Use the same procedure as for FM modulation setting.

Refer to Section 4-3-1-2.

* While the PILOT key's LED lights, the displayed value includes the pilot signal. When the PILOT key ⑱ is pressed to turn OFF the pilot signal, the stereo modulation value is displayed.

* Input values exceeding the STEREO MODULATION ratings (0~105%) cannot be set. The setting resolution for both normal and direct setting is 0.1% up to 99.9%.

4-3-2-3 Preset Setting

Use the same procedure as for FM modulation setting.

Refer to Section 4-3-1-3.

This feature makes it easy to set FM-STEREO modulation to 30% or 100%.

4-3-3 PILOT LEVEL SETTING

This feature functions only during FM-STEREO modulation.

Make sure the LED of the PILOT key ⑱ lights.

- 1) When the 2nd F key ⑳ and the MOD/PILOT key ㉔ are pressed, the current set pilot level is displayed on the MODULATION display and the ENT key's LED flashes.
- 2) If the pilot level is to be changed, enter the desired value by using the numeric keys while the ENT key's LED lights. Finally press the ENT key.
- 3) When the ENT key is pressed, the pilot level changes to the new level and the display changes from showing the pilot level to modulation display.
- 4) If the preset FM-STEREO modulation (30%, 100%) has been selected by using the 2nd F key ㉔, the pilot level is automatically set to 10%.

* The pilot level setting range is 0~15%. If values exceeding this level are input, the level returns to the value displayed before the setting.

* The pilot level setting resolution is 1%. When setting values including decimal points are input, the display shown before the setting was made reappears.

4-3-4 AM MODULATION SETTING

Carry out the following preparations before the setting.

- 1) Press the AM key ⑬. When the key is pressed, its LED lights up and the "%" (LED) lights in the lower right corner of the MODULATION display.

When the AM key is pressed once more while the key's LED lights, modulation is set to OFF.

2) Select the modulation source.

To input an external modulation signal, press the EXT key ⑭. To use the internal modulation signal, press either the 1kHz key ⑮ or the 400Hz key ⑯.

4-3-4-1 Normal Setting

Use the same procedure as for FM modulation setting.

Refer to Section 4-3-1-1.

4-3-4-2 Direct Setting

Use the same procedure as for FM modulation setting.

Refer to Section 4-3-1-2.

* Input values exceeding the AM MODULATION ratings (0~60%) cannot be set.

The setting resolution for both normal and direct setting is 0.1%.

4-3-4-3 Preset Setting

Use the same procedure as for FM modulation setting.

Refer to Section 4-3-1-3.

This feature makes it easy to set AM modulation to 30%.

4-4 ADDRESS SETTING

The MODULATION, FREQUENCY, LEVEL settings can be memorized in the addresses 0-99.

The address setting procedure is as follows.

4-4-1 NORMAL SETTING

Using the address setting keys (▲, ▼) ⑦, increase or decrease the digits indicating tens or ones in the ADDRESS display② to set the desired address.

* When setting the address, after exceeding a certain address the display

may return to the previous address. This is because the address rotation function is working. Details are explained later, but the function of this feature is to rotate (repeat) addresses within a certain range.

When the address rotation function is working, the address setting procedure is as follows. If, for instances, the address rotation's begin address is 0 and the end address is set to 8, the following should be done when address 9 is memorized:

- 1) Set the address digit indicating tens to 1.
- 2) Change the address digit indicating ones from 8 to 9. Now the address setting is 19.
- 3) Change the address digit indicating tens from 1 to 0. Now the address setting is 9.

Set the address 9 using the method above or the 4-4-2 direct setting.

4-4-2 DIRECT SETTING

- 1) When the ADDR key ②⑤ is pressed, the ADDRESS display is cleared and the LED of the ENT key ③① flashes.
- 2) Using the numeric keys ②⑦, enter the desired address.
- 3) Press the ENT key after the address has been input.

Example: Setting ADDRESS 11

KEY OPERATION	ADDRESS DISPLAY	REMARKS
	33	Address previous to setting
ADDRESS KEY		ADDRESS setting preparation
Numeric key 1	1	
Numeric key 2	12	Wrong input
BS key	1	Input correction
Numeric key 1	11	
ENT key	11	Setting completed

In the case of sequential recall mode (".") is displayed in the lower

right corner of the ADDRESS display), everything memorized in each address is output just by increasing or decreasing the address.

4-5 ADDRESS MEMORIZATION

- 1) Set the address to be memorized. (Refer to Section 4-4)
- 2) Set frequency, level, and modulation. (Refer to Sections 4-1~4-3)
- 3) Press the STO key ④. When the STO key is pressed, the LED of the ENT key ⑩ flashes.
- 4) Press the ENT key while the key's LED flashes.
If the ENT key is not pressed while the LED flashes, the address cannot be memorized. In this case press the STO key again and then press the ENT key.

* The contents set by using the ΔF function cannot be stored.

4-6 ADDITIONAL FUNCTIONS

4-6-1 ΔF FUNCTIONS

The ΔF function is for observing the variation of the frequency (frequency deviation). It is a useful feature for measuring a receiver's bandwidth, etc.

- 1) Setting reference frequency.
- 2) When the ΔF key ⑳ is pressed, the key's LED lights and the FREQUENCY display shows 0.000.0.
- 3) Set the necessary frequency deviation by using normal setting.

* Setting is possible within the ranges a) and b).

a) $100\text{kHz} \leq (\text{reference frequency} - \text{frequency deviation set value})$

b) $110\text{MHz} \geq (\text{reference frequency} + \text{frequency deviation set value})$

c) Frequency deviation set value: $\pm 10\text{MHz Max.}$

* When frequency deviation set value once has been set, this set value is added (or subtracted from) the reference frequency. Accordingly, note that the reference frequency changes.

* Do not enter recall mode during execution of the ΔF function, as the function may not work correctly.

4-6-2 ADDRESS ROTATION FUNCTION

This function rotates (repeats) addresses within the interval determined by the set BEGIN address and the END address. Input the set information according to address order and recall by this order, so when the set address (END) is reached, the function automatically returns to the first address (BEGIN).

Example : Set the rotation function to work in the interval between address 1 and address 15.

- 1) Input (store) the necessary set information in addresses from address 1 to address 15.
- 2) Return to address 1.
- 3) Press the 2nd F key.
- 4) When the RTN/BEGIN key $\textcircled{5}$ is pressed, the address display flashes momentarily to indicate that address 1 has been set as the BEGIN address.
- 5) Set the address to 15.
- 6) Press the 2nd F key.
- 7) When the RCL/END key is pressed, the address display flashes momentarily to indicate that address 15 has been set as the END address.
- 8) To return to the BEGIN address during consecutive address increment, press the RCL key.

* If you want to set the address independently of the BEGIN and END addresses, enter the figure by using the direct setting method.

* When the address rotation function is not used, set the BEGIN address to 00 and the end address to 99.

* When you want to change the address rotation range, it is not possible to set the BEGIN address higher than the set END address value. Neither is it possible to set the END address lower than the set BEGIN address. In these cases, use the following procedure.

- 1) When setting the BEGIN address higher than the END address, first set a new END address. Then set the new BEGIN address.
- 2) When setting the END address lower than the BEGIN address, first set a new BEGIN address. Then set the new END address.

4-6-3 SECOND FUNCTIONS

The functions indicated in red under or next to the keys on the front panel operates when the 2nd F key ⑳ is pressed and the second function mode is activated. For details on each of the second functions, refer to Section 3 "Explanation of the Front Panel" and Section 4 "Operating procedures".

4-6-4 SPECIAL FUNCTION OF STO KEY

When the STO key ④ is pressed followed by the numeric key "3", the output of the rear panel's RANGE OUTPUT terminal can be altered.

When the carrier frequency displayed on the FREQUENCY display is 35--1, the output in the range above 35MHz becomes +5V. Below 35MHz the output becomes 0V. When the carrier frequency displayed on the FREQUENCY display is 35--0, the output in the range above 35MHz becomes 0V. In the range below 35MHz the output becomes +5V.

Whenever the STO key and numeric key "3" are pressed, the 35--1 and 35--0 displays alternate. When the necessary logic is displayed, press the ENT key ㉑ to set.

NOTE

If the STO key and the numeric key "1" are pressed, all the contents stored in the RAM will be erased and the unit returns to the initial state.

Be careful with the numeric key operation when the STO key is used.

4-6-5 BACK-UP FUNCTION

Even when the power is turned OFF, the setting status in effect when the power was turned OFF can be stored in the memory for about three weeks.

5. MAINTENANCE

Always turn OFF the power before the following maintenance procedures are carried out.

5-1 FUSE REPLACEMENT

The unit does not work if the fuse is blown. If the fuse is blown, locate the reason. If the reason is related to something outside this unit, remedy before replacing with new fuse. If the problem stems from something in the unit, contact your dealer or distributor.

●When the fuse is blown, replace in accordance with the following procedure. Make absolutely sure to remove the power cord from the AC inlet. If this is not done, fuse replacement is impossible.

The built-in fuse is a 0.5A slow blow fuse in areas with 100V, 120V power supply. In areas with 220V, 240V power supply, a 0.3A slow blow fuse is built-in. Replace with a fuse that conforms to the particular ratings.

- 1) Slide the fuse holder cover (translucent plastic) on the rear panel to the left. (If the power cord has not been removed, the cover cannot be slid.)
- 2) When the cover opens, a black plastic hook marked FUSE PULL can be seen in front of the fuse. When the hook is pulled straight out, the fuse is released from the right-hand clip. (See Fig. 6)
- 3) Remove the blown fuse and place a new fuse in the clip.
- 4) Slide the cover to the right until it reaches the original position.

This completes the fuse replacement.

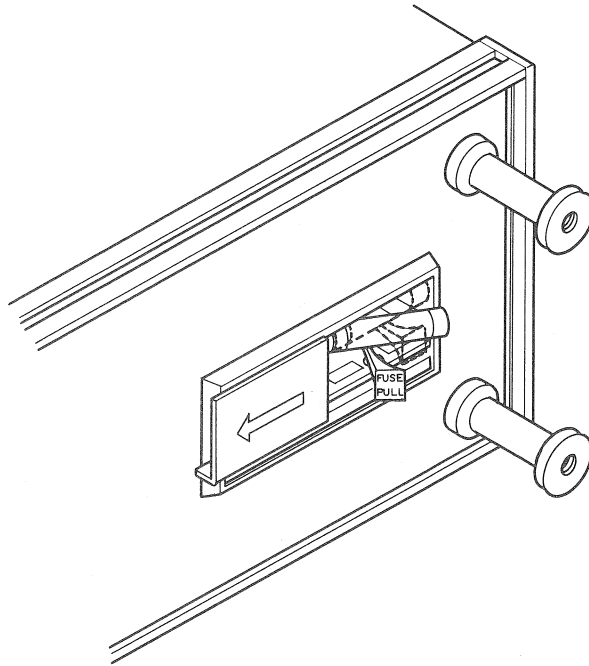


Fig. 6 When the tab (FUSE PULL) has been pulled and the fuse removed

5-2 VOLTAGE CHANGE

The voltage of this unit is set to AC 100V when shipped from the factory. Follow the procedure described below when the voltage setting has to be changed.

- 1) Remove the fuse by following steps 1) and 2) in the preceding Section 5-1 "Fuse Replacement". (If the fuse is not removed, changing the voltage setting is impossible.)
- 2) When the fuse is removed, a print sheet as the one shown in Fig. 7 is seen inserted under the clip. Take out this print sheet.
The current setting is 100V. Accordingly, the print sheet has been inserted so "100" is visible. On the backside, "120V, 240V" is indicated.
- 3) Insert the print sheet so the digits indicating the altered voltage are visible. (Fig. 8)
Securely insert the print sheet as far as it will go.

- 4) If the voltage is changed, it will be necessary to replace the fuse. If the voltage is changed from 100V, 120V to 220V, 240V, the fuse should be changed from 0.5A to 0.3A. If the voltage is changed from 220V, 240V to 100V, 120V, the fuse should be changed from 0.3A to 0.5A. The fuse should be a slow blow fuse.

- 5) Slide the cover to the right to return it to its original position. This completes the voltage change.

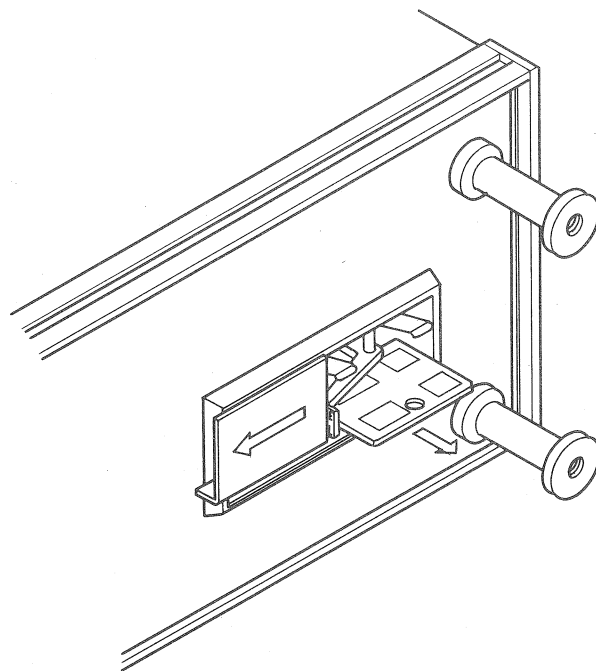


Fig. 7 When the print sheet for indicating voltage change has been pulled out

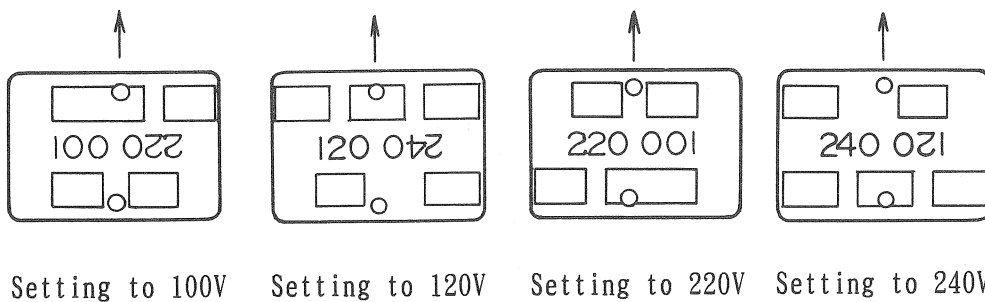


Fig. 8

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