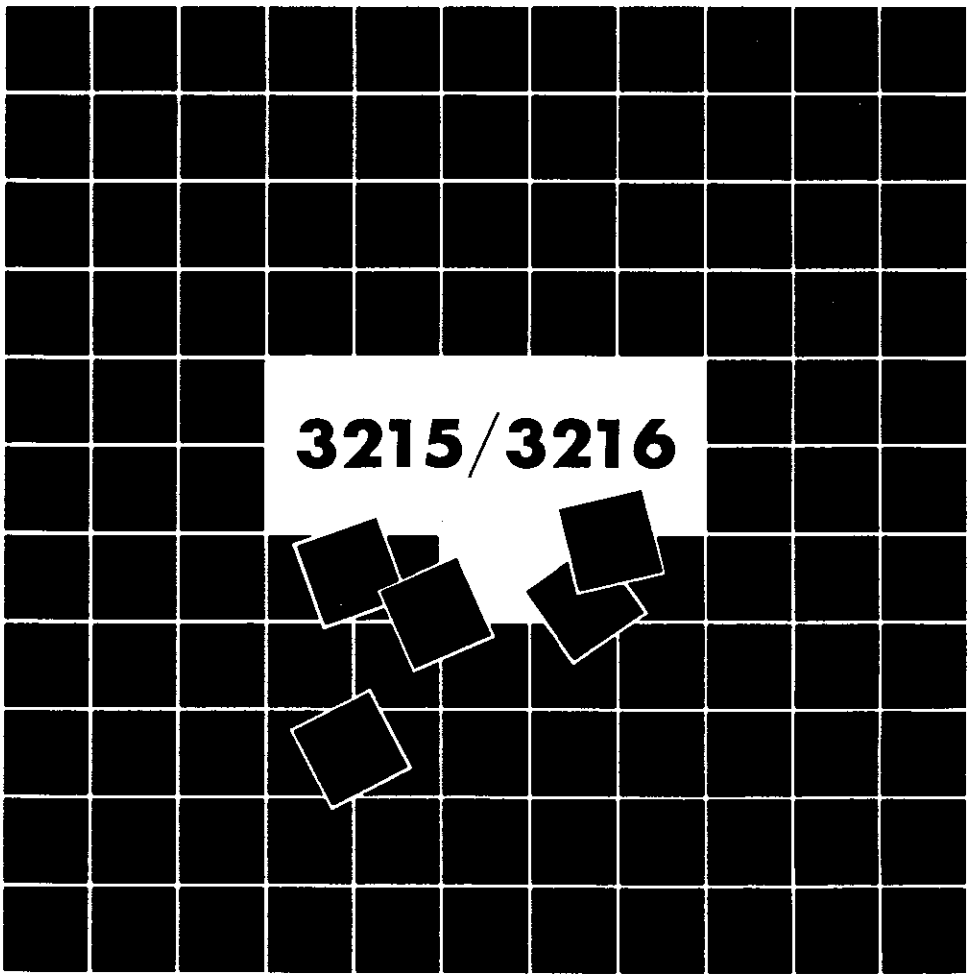
LEADER

STANDARD SIGNAL GENERATOR

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

FOR SAFETY'S SAKE

Thank you for purchasing our product.
Please observe the following safety precautions when operating this instrument.

⚠ WARNING

- Do not remove any cases or covers.
  The high-voltage section inside this instrument can cause electrical shock.
- Do not operate this instrument and connected units in a volatile or flammable atmosphere.
  An explosive can result.
- Do not insert metal objects (e.g., wire, pin) into the vents.
  Otherwise, you may damage the instrument or suffer electrical shock.
- Connect this instrument to the rated power line voltage.
  Excessive voltage can cause fire.
- Do not touch the high-voltage section with hand directly when measuring it.
  You may suffer electrical shock.
- Do not connect this instrument to equipment whose chassis has electrical potential to ground (i.e., transformerless equipment).
  Otherwise, you may damage the instrument or suffer electrical shock.

⚠ CAUTION

- Use only the fuse of correct type and rating for replacement.
  Before replacing the fuse, be sure to turn the power switch off and disconnect the power cord from the mains.

Cautions on operation appear in the instruction manual. Read the manual carefully to ensure correct operation.

Explanation of the Terms

⚠ WARNING ... The WARNING calls attention to abnormal conditions or dangerous practices that could result in personal injury or death.

⚠ CAUTION ... The CAUTION calls attention to abnormal conditions or dangerous practices that could result in damage to the instrument or other property.

TABLE OF CONTENTS

1. GENERAL DESCRIPTION

The model 3215 and 3216 standard signal generators use a synthesizer system for generating CW and FM/AM modulation signals from 100 kHz to 140 MHz.

The model 3216 contains an FM stereo modulator.

2. FEATURES

(1) Highly stable signals are provided since the oscillation frequency is locked to the reference frequency.
(2) The output level can be set from −20 dBμ to 126 dBμ (0 dBμ = 1 μV, 50Ω open circuit) in 0.1 dB steps.
(3) Frequency, output level, and modulation data can be stored as a set in the internal memory, which is capable of up to 100 presettings.
by a battery.
(4) The frequency, output level, and modulation can be set by key operation.
(5) Remote control of all front panel switches (without power switch) is possible from the 24-pin connector on the rear panel.
(6) A GPIB interface (listener) is available as an option.

3. SPECIFICATIONS

(1) Frequency

Range:	100 kHz to 140 MHz
Resolution:	100 Hz (100 kHz to 29.9999 MHz) 1 kHz (30 MHz to 140 MHz)
Setting:	Numerical keys, or rotary encoder and digit-select key
Accuracy:	Within $\pm 5 \times 10^{-5}$ ($\geqq$ 500 kHz) $\pm 5 \times 10^{-5}$ +1 digit (< 500 kHz)
Display:	6 digits

(2) Output

Range:	−20 to 126 dBμ (0 dBμ = 1 μV open circuit)
Resolution:	0.1 dB
Setting:	Numerical keys, or rotary encoder and digit-select key
Reference level accuracy:	Within ±1 dB (at 126 dBμ output)

Attenuator accuracy:	Within ±1.5 dB (≧0 dBμ) Within ±2 dB (<0 dBμ)
Impedance:	50Ω, VSWR : less than 1.3
Spurious output:	Harmonic: –30 dBc Non-harmonic: –50 dBc
Display:	4 digits

(3) Modulation

A. FM

Frequency deviation:	0 to 99.9 kHz (1 MHz or greater) 0 to 10% of CW (1 MHz or less)
Display:	3 digits
Resolution:	0.1 kHz
Modulation accuracy:	Within ±(10% of the setting value+1 kHz)
Distortion factor:	Less than 0.05% (10.7 MHz±1 MHz, 76 to 108 MHz) Less than 0.1% (other frequencies) (AF1 kHz, 75 kHz deviation, demodulation band 50 Hz to 15 kHz, de-emphasis 50 μs)
Residual FM	73 dB or greater S/N for 75 kHz deviation **(Frequency ≦ 110 MHz)** (Demodulation band 50 Hz to 15 kHz, de-emphasis 50 μs) However, this excludes frequency which are more than 30 MHz and 80 MHz÷n ±20 kHz (n is an integer.)

B. **FM stereo** (applicable only to Model 3216)

a. Pilot signal

Frequency deviation:	0 to 10.0 kHz
Display:	3 digits
Resolution:	0.1 kHz
Modulation accuracy:	±(10% of setting value+0.5 kHz)
Frequency:	19 kHz±1 Hz
b. Separation:	55 dB or greater (AF1 kHz, 75 kHz deviation, 76 to 108 MHz)
c. Modes:	MAIN, SUB, L, R

C. AM

Depth:	0 to 80.0% (500 to 1600 kHz) 0 to 60.0% (other frequencies)
Display:	3 digits
Resolution:	0.1%
Modulation accuracy:	±(10% of the setting value+1) %

Distortion factor: Less than 0.5%(150 kHz to 2 MHz)
Less than 1.5%(other frezuencies)
(AF1 kHz 30% modulation, demodulation band 5 Hz to 15 kHz)

Residual AM: 55 dB or greater S/N for 30% modulation
(150 kHz to 2 MHz)
(Demodulation band 50 Hz to 15 kHz)

D.Internal modulation frequency: 400 Hz, 1 kHz ± 5%

E.External modulation

Input impedance: 10 kΩ

Reference input voltage: 1.0 Vrms

Frequency range: FM: 20 Hz to 100 kHz
AM: 20 Hz to 10 kHz (≥300 kHz)*
*When the carrier frequency is <300 kHz, the modulation frequency must be 1/30 of the carrier frequency.

Frequency response: Within ± 1 dB(1 kHz reference)

(4)Preset

Frequency, modulation, and output level data can be stored as a set in the internal memory, which is capable of up to 100 such presettings.

(5) Others

Environmental conditions

Operating: Temperature:0 to 40 ℃
Humidity:85 %RH or less(without Condensation)

Spec Guaranteed: Temperature:10 to 35 ℃

Operating Environment: Indoor use

Operating Altitude: up to 2,000 m

Overvoltage Category: II

Pollution degree: 2

Power requirements: 100,120,220,and 240 VAC ± 10 ℃
(250 VAC max.)

Power consumption: Approx.35 VA(model 3215), 40 VA(model 3216)

Dimensions and Weight: 426(W) × 99(H) × 300(D) mm, Approx.7.5 kg

Accessories: BNC-BNC cable(3D-2V, 50 Ω ,1 m) 1
Power cord 1
Fuse 1
Instruction manual 1

4. NOTES ON USE

⚠ Caution

(1) Power supply voltage

The power supply voltage should be within ± 10% of the specified rating. At voltage below −10% of the rating, the instrument may not operate properly. On the other hand, voltages above +10% of the rating may damage the power supply section. Before using the instrument, check the voltage range and the fuse rating which are indicated on the rear panel.

Table 4-1 Fuse Data

Rating voltage	Voltage range (±10%)	Fuse rating	Leader part number
100V	90 to 110V	0.63A Time lag	436 3755 003
120V	108 to 132V		
220V	198 to 242V	0.315A Time lag	436 3740 000
240V	216 to 250V		

(2) Precautions when not using the instrument for a long time

The data written to the memory of the model 3215/3216 is backed up for about one month even when the instrument is not used, but the memory contents cannot be guaranteed if the unit is left unused for a longer time.

When the unit is to be left unused for more than one month, supply the instrument with power for more than 8 hours before program writing.

(3) Input/output cable connections

Care must be taken so that an external voltage is not applied to the output connector of the instrument. If the cable comes in contact with a DC power, the internal attenuator may be damaged.

In addition, care must be taken that an excessively large signal of more than 5 Vp-p is not applied to the external modulation input connector. When the DC component of the applied signal is ±2 V or higher, eliminate the DC component with a capacitor.

5. PANEL DESCRIPTION

In this instruction manual, circled numbers indicate controls and displays. A description of each part is given below.

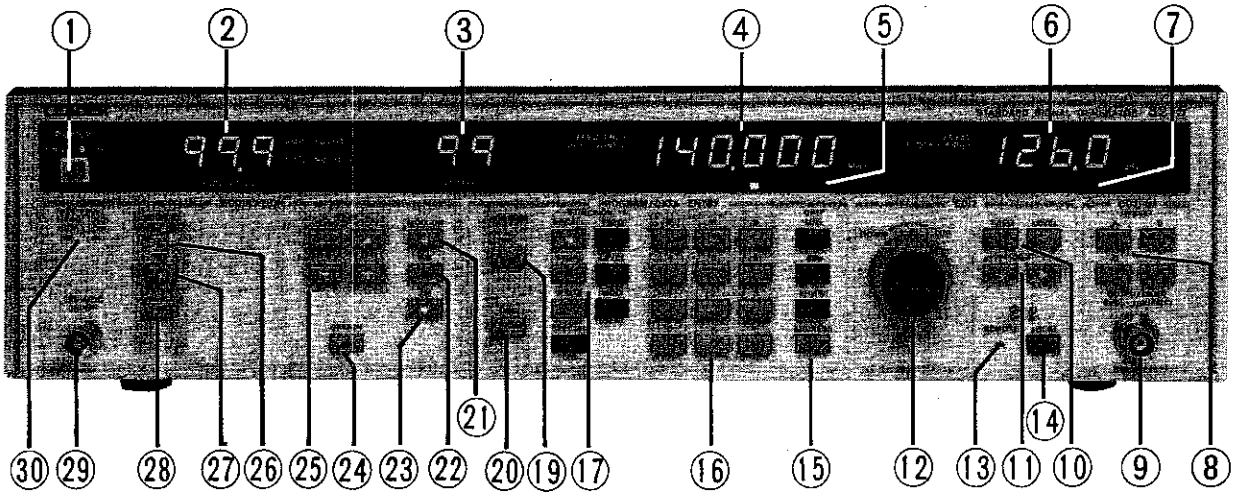


Fig. 5-1 model 3215 Front Panel

5.1 Display section

① **POWER switch**

Power is ON when pushed in ▬, and OFF when pressed again to the pushed out ▮ position. when the power is switched on, the data existing prior to the switch-off state will be set (reappearing the final settings).

② **MODULATION display**

Displays the modulation factor in 3 digits. The maximum deviation for FM is 99.9 kHz and the maximum depth for AM is 60.0%.

③ **ADDRESS display**

Displays the address of the internal memory (0 – 99) when the instrument is the RECALL mode or the STORE mode.

④ **FREQUENCY display**

Displays the frequency in 6 digits. The minimum resolution is 100 Hz for frequencies between 0.1 and 29.9999 MHz, and 1 kHz for frequencies between 30 and 140 MHz.

⑤ **Cursor LED**

Indicates the digits that can vary the frequency with the FREQ key and ⑪ DIGIT keys ([←] , [→]) of the EDIT section.

⑥ **OUTPUT display**

Displays the output level in 4 digits. Output level has a resolution of 0.1 dB from −20 to 126 dBμ.

⑦ **Cursor LED**

Indicates the digits that can vary the output level with the LEVEL key and ⑪ DIGIT keys ([←] , [→]) of the EDIT section.

5.2 Output section

⑧ **PRESET (A, B, C, D) keys**

Provided to make presettings of four values (A, B, C, and D) of output levels for which used frequently and recall them as required. Refer to Section 7.3 "Output level presetting".

⑨ **OUTPUT connector**

A BNC type connector is used for the RF output connector. The output impedance is 50Ω.

5.3 Edit section

⑩ **FREQ and LEVEL keys**

Specify the frequency or the output level. The corresponding cursor LED ⑤ or ⑦ will light up.

⑪ **DIGIT keys ([←] , [→])**

Indicates the digits which vary the frequency or the output level.

⑫ **EDIT rotary switch**

Permits variation of the digits indicated by the cursor LED of the frequency or output level.

5.4 GPIB section

⑬ **REMOTE LED**

Lighting of the LED when the GPIB mode is in use indicates the REMOTE mode. The GPIB interface is an option.

⑭ **LOCAL key**

When in the GPIB mode, shifts from the REMOTE mode to the LOCAL mode. The ⑬ REMOTE LED is off in the LOCAL mode.

5.5 Program and data entry section

⑮ **UNIT keys**

Pressed when setting the various data with the ⑰ FUNCTION keys (excepting the STORE key). Data input is completed with these keys.

⑯ **DATA keys**

The 0 to 9 figures, decimal point and minus sign are provided. When an incorrect setting has been made, press the same ⑰ FUNCTION key once again and make the correct setting.

⑰ **FUNCTION keys**

· FREQ key

Used to set the frequency. The frequency is set as follows:

[FREQ] → [1] → [4] → [0] → [MHz] ..... set to 140 MHz

Pressing the MHz key will complete the frequency setting.

· LEVEL key

Used to set the output level. The output level is set as follows:

[LEVEL] → [1] → [2] → [6] → [dBμ] ..... set to 126 dBμ

Pressing the dBμ key will complete the setting of the output level.

· MOD key

Used to set the modulation factor or deviation.

(A) In the AM mode:

[MOD] → [6] → [0] → [%] . . . . . set to 60%

(B) In the FM mode:

[MOD] → [9] → [9] → [.] → [9] → [kHz] . . . . . set to 99.9 kHz

The % and kHz key are in common. Pressing this key will complete the setting of the modulation factor or deviation. However, when the RF frequency is lower than 1 MHz, the maximum frequency deviation will be 1/10 of the set frequency.

· PILOT key (model 3216 only)

Used to set the pilot modulation factor. (See Fig. 5-3)

[PILOT] → [7] → [.] → [5] → [kHz] . . . . . set to 7.5 kHz

Pressing the kHz key will complete the setting of the pilot modulation factor. This key is effective only in the FM mode.

· RECALL key

The LED lights up to indicate the RECALL mode. At this time the contents of the memory can be read directly by address specification with the ⑯ DATA keys.

[RECALL] → [5] → [6] → [ADDRESS] . . . . . read the contents of address 56

The operation is the reciprocal of the STORE key.

· STORE key

The LED lights up to indicate the STORE mode. At this time the control setting of the front panel can be written directly to the memory address with the ⑯ DATA keys.

[STORE] → [3] → [2] → [WRITE] . . . . write the above data to address 32

· WRITE key

At STORE mode, the panel settings are stored to a memory of the address which is indicated on the front panel when the WRITE key is pressed.

The address will be an inerement of +1 by pressing the key once.

· MANUAL mode

The MANUAL mode is indicated when the LEDs of both the RECALL and STORE keys are off.

· SPECIAL key

This can be used for setting the BEGIN address, END address, etc. For details see Section 9. "Operation of the SPECIAL key".

⑲ **INC key**

Only effective in the RECALL mode, this key increments the address by 1 to read the contents.

⑳ **DEC key**

Only effective in the RECALL mode, this key decrements the address by 1 to read the contents.

5.6 Modulation section

㉑ **MOD ON key**

Switches the modulation signal on and off. Lighting of the ② MODULATION display indicates the on state.

㉒ **AM key**

Sets the modulation mode to AM. Lighting of the LED indicates the AM mode.

㉓ **FM key**

Sets the modulation mode to FM. Lighting of the LED indicates the FM mode.

㉔ **OPTION key**

For details see Section 9. "Operation of the SPECIAL key".

㉕ **MOD EDIT keys**

FM: Vary the modulation factor in 1 kHz and 0.1 kHz steps.

AM: Vary the modulation factor in 1% and 0.1% steps.

㉖ **INT FREQ LEDs**

Indicate the internal modulation frequency. Each press of the INT key selects the modulation frequency alternately between 400 Hz and 1 kHz.

400Hz → 1 kHz

㉗ **INT key**

Sets the modulation mode to internal modulation. Lighting of the LED indicates this state. The internal modulation frequency is switched with each press of this key. The ㉖ INT FREQ LEDs indicate the state. The operation is the reciprocal of the ㉘ EXT AF key.

㉘ **EXT AF key**

Sets the modulation mode to external modulation. Lighting of the LED indicates this state. The reference voltage of the external modulation signal is 1 Vrms. When this level is correct, both of the ㉚ EXT LEVEL LEDs will go off.

㉙ **EXT MOD connector**

This is the AF signal input connector for external modulation. The input impedance is 10 kΩ. The input level should be monitored with the ㉚ EXT LEVEL LEDs.

㉚ **EXT LEVEL LEDs**

These LEDs are used for monitoring the level of the external modulation signal. Both LEDs will be off to indicate an appropriate level when the signal is within 1 V ±35 mV (rms).

The HIGH LED will light when the level is too high and the LOW LED will light when the level is too low.

5.7 Rear panel

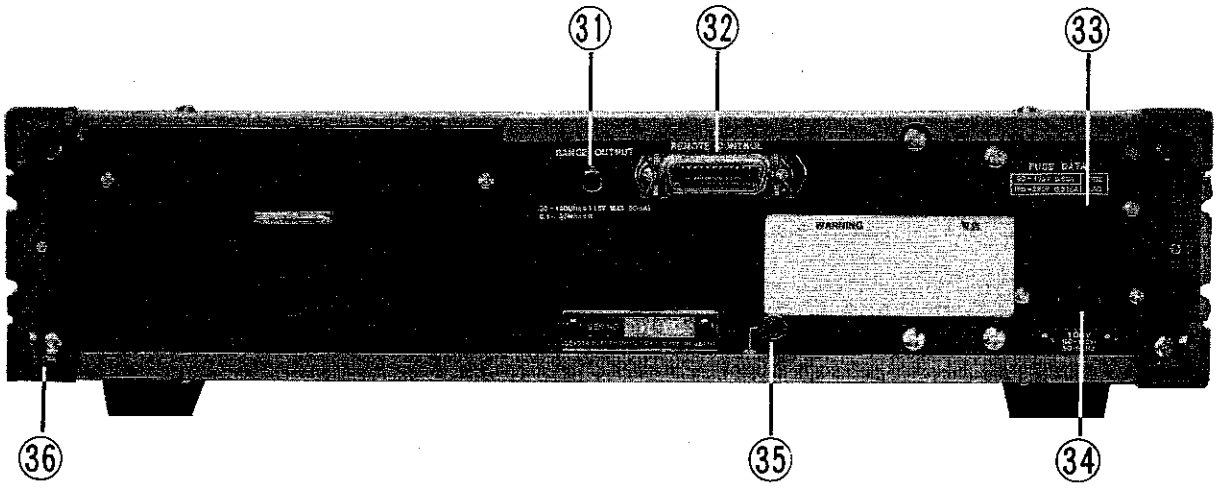


Fig. 5-2

㉛ **RANGE OUTPUT**

This connector controls the LSS-5011 output selector. Attention should be given to the rating when the RANGE OUTPUT is used for another application. At 30 to 140 MHz the rating is 5 V, 50 mA (SOURCE).

㉜ **REMOTE CONTROL**

This connector is for use with the remote control. The model 3216-01 remote controller is available as an option for use with model 3215 and 3216.

㉝ **Fuse**

Refer to the print above the fuse holder for fuse data details. For fuse replacement, remove the fuse holder cap by turning it in the counterclockwise with a cross-head screwdriver.

㉞ **Inlet**

This connector is for power supply input. Make sure that the power supply voltage is within ±10% of the rating value.

㉟ **GND terminal**

The ground terminal is connected to the chassis of the instrument.

㊱ **Cord winder**

The power cord can be wound around the cord winder.

5.8 Stereo modulation section (model 3216 only)

The sections that differ with model 3215 are shown in Fig. 5-3

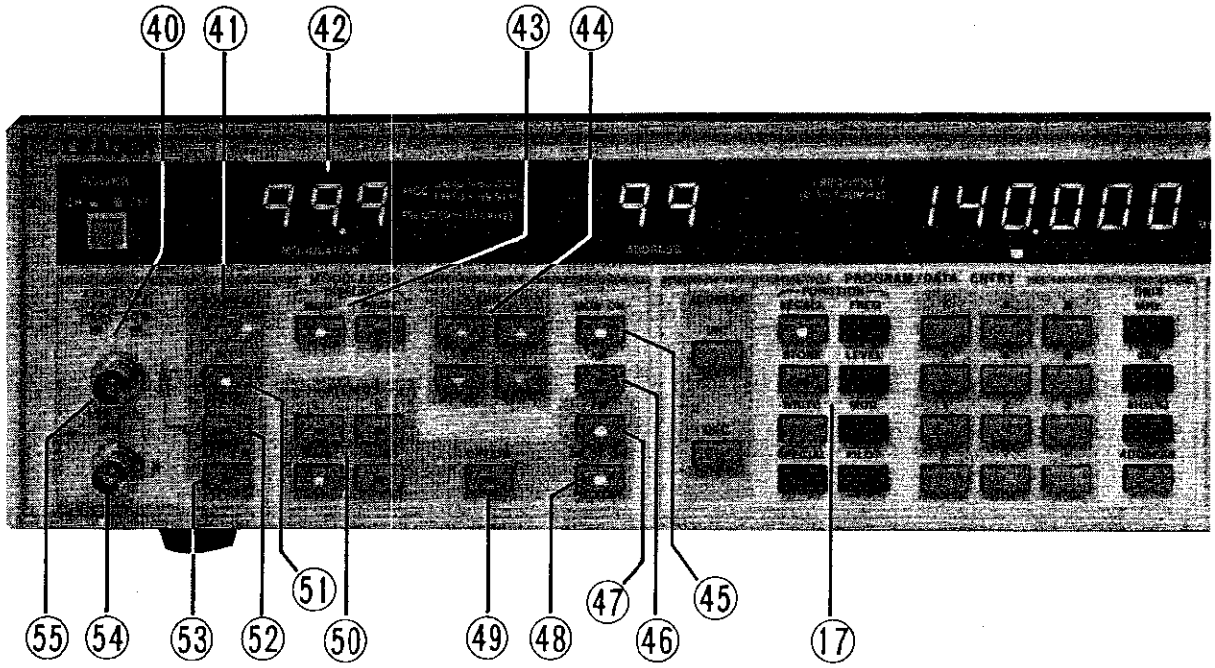


Fig. 5-3

(40) EXT LEVEL LEDs

These LEDs are used for monitoring the level of the (55) L or AF input connector for external modulation. Both LEDs will be off to indicate an appropriate level when the signal is within 1 V ±35 mV (rms).

The HIGH LED will light when the level is too high and the LOW LED will light when the level is too low.

(41) INT FREQ LEDs

Indicate the internal modulation frequency. Each press of the (51) INT key selects the modulation frequency alternately between 400 Hz and 1 kHz.

400 Hz → 1 kHz

(42) MODULATION display

Display the modulation factor in 3 digits. The maximum deviation of FM is 99.9 kHz, the maximum deviation of the pilot is 10.0 kHz, and the maximum modulation factor of AM is 60.0%.

(43) DISPLAY keys

- Permit selection the data (MOD or PILOT) shown on the (42) MODULATION display. This state is shown by LED. The (44) MOD EDIT keys can also be changed to correspond with this selection.
- Indication that the (42) MODULATION display is displaying the AM modulation factor or the FM frequency deviation when the MOD LED is lit. The FM frequency deviation indicates the total deviation including the pilot signal.
- Indicate the (42) MODULATION display is displaying the frequency deviation by the pilot signal when the PILOT LED is lit.

㊹ **MOD EDIT keys**

Permit changing the modulation factor up [↑] and down [↓] in 1.0 kHz/% and 0.1 kHz/% steps.

㊺ **MOD ON key**

Switches the AF MOD signal on and off. Lighting of the LED indicates the on state.

㊻ **AM key**

Sets the modulation mode to AM. Lighting of the LED indicates this state.

㊼ **FM key**

Sets the modulation mode to FM. Lighting of the LED indicates this state.

㊽ **PILOT ON key**

Switches the pilot signal on and off. Lighting of the LED indicates the on state.

㊾ **OPTION key**

For details refer to Section 9. "Operation of the SPECIAL key".

㊿ **STEREO MODE keys**

Mode selection is permitted with the MAIN, SUB, L, and R keys. Lighting of the LEDs indicate the mode.

Monaural modulation: press the MAIN key and set the ㊽ PILOT ON key to OFF.

(51) **INT key**

Sets the modulation mode to internal modulation. Lighting of the LED indicates this state. The internal modulation frequency is switched each time key is pressed.

(52) **EXT AF key**

Sets the modulation mode to external modulation. Lighting of the LED indicates this state. Apply the external audio signal to the (55) L or AF input connector. The input level should be monitored with the ㊵ EXT LEVEL LEDs.

(53) **EXT L, R key**

In the external modulation mode, stereo signals of music so on are connected to the (55) L or AF input connector and the (54) R input connector.

When 1 Vrms signals are applied to the L and R channels in phase, the MAIN frequency deviation becomes 75.0 kHz (with a pilot of 7.5 kHz).

(54) **R input connector**

This is the R channel input connector when the external modulation mode is set to EXT L, R. The input impedance is 10kΩ.

(55) **L or AF input connector**

This is the L channel input connector when the external modulation mode is set to (53) EXT L, R. It becomes the audio signal input connector when the EXT AF is on. The input impedance is 10kΩ.

6. BASIC OPERATION

The method of operation using the MANUAL mode is described in this section.

Reference should also be made to this section as required for portions of Section 7. "MEMORY OPERATION" describing data input of frequency, output and modulation.

Settings by the DATA keys are performed in the order of [FUNCTION] → [DATA] → [UNIT] .

Choose one parameter from the FUNCTION group and after setting the value with the DATA keys, press the UNIT key to complete the input. Table 6-1 shows the correspondence between the FUNCTION keys and the UNIT keys.

Table 6-1

FUNCTION KEY	UNIT KEY
FREQ	kHz, MHz
LEVEL	dBμ
AM	%
FM	kHz
RECALL	ADDRESS
STORE	WRITE

Note: When an input is made in excess of the setting range, the input data become invalid and the data displayed immediately prior to the key input are again displayed.

6.1 Frequency setting

The positions related to operation are shown in Fig. 6-1.

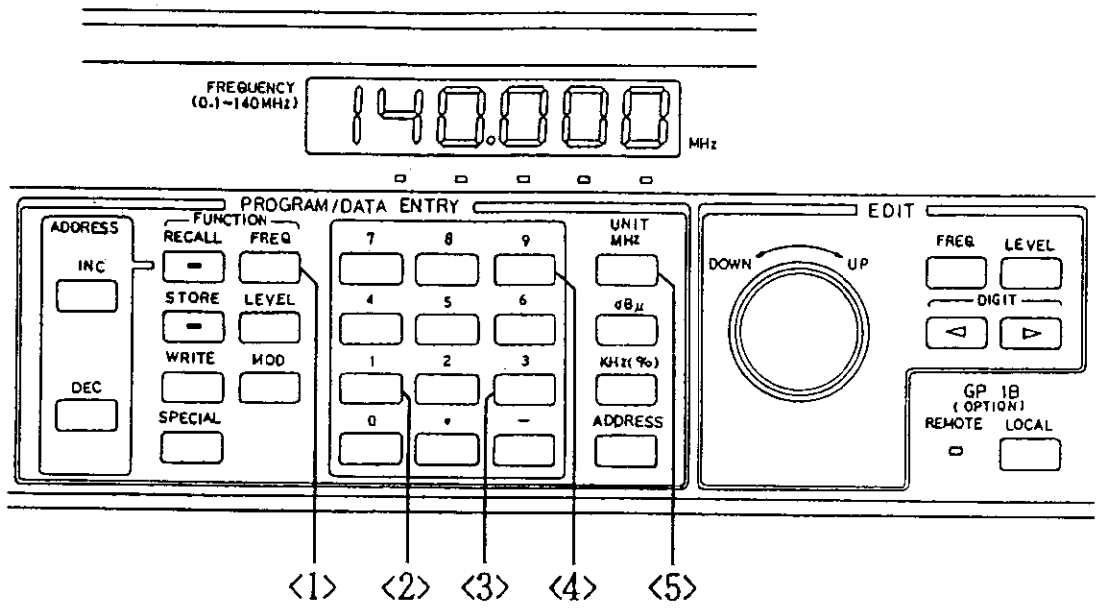


Fig. 6-1

The following methods are available for setting the frequency.

A. **Method using the DATA keys**

Input is made in the order of [FREQ] → [DATA] → [UNIT].

Here an example is given of setting the frequency to 139 MHz. The order of the key operations is indicated by the bracketted numbers < > of Fig. 6-1.

(1) Press the FREQ key. <1>

(2) Key in 139 consecutively using the DATA keys. There is no need to key in zeros when they continue in the lower digits. <2>, <3>, <4>

(3) Press the MHz key. <5>

The FREQ display will be as shown in Fig. 6-2.

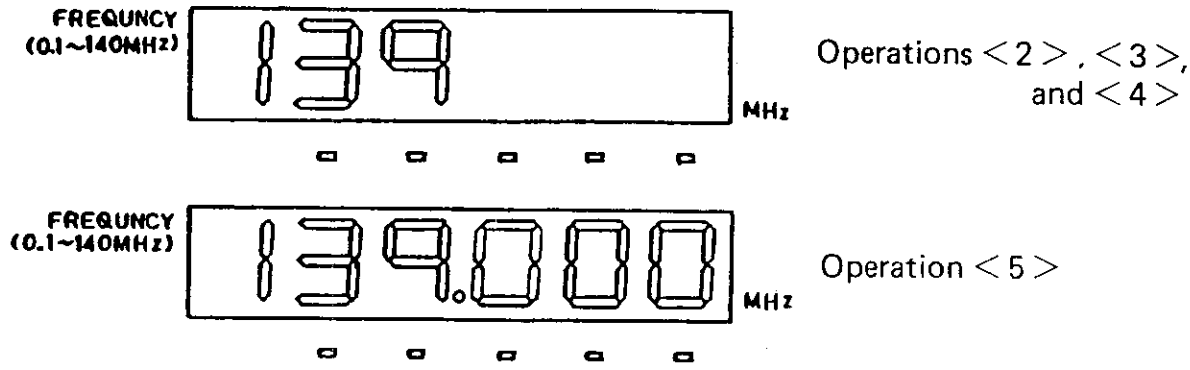


Fig. 6-2

B. **Method using the EDIT rotary switch**

(1) Specify the digit to be changed using the (11) DIGIT SELECT keys. The most significant digit cannot be specified. The (5) cursor LED move to the right with the [→] key and to the left with the [←] key.

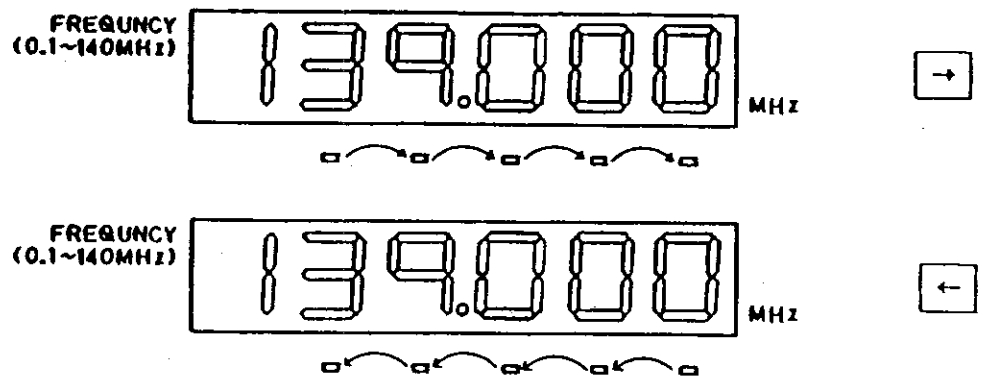


Fig. 6-3

(2) Make the required frequency setting using the (12) EDIT rotary switch. Raising and lowering of the digit is done automatically.

6.2 Output level setting

Portions related to this operation are shown in Fig. 6-4.

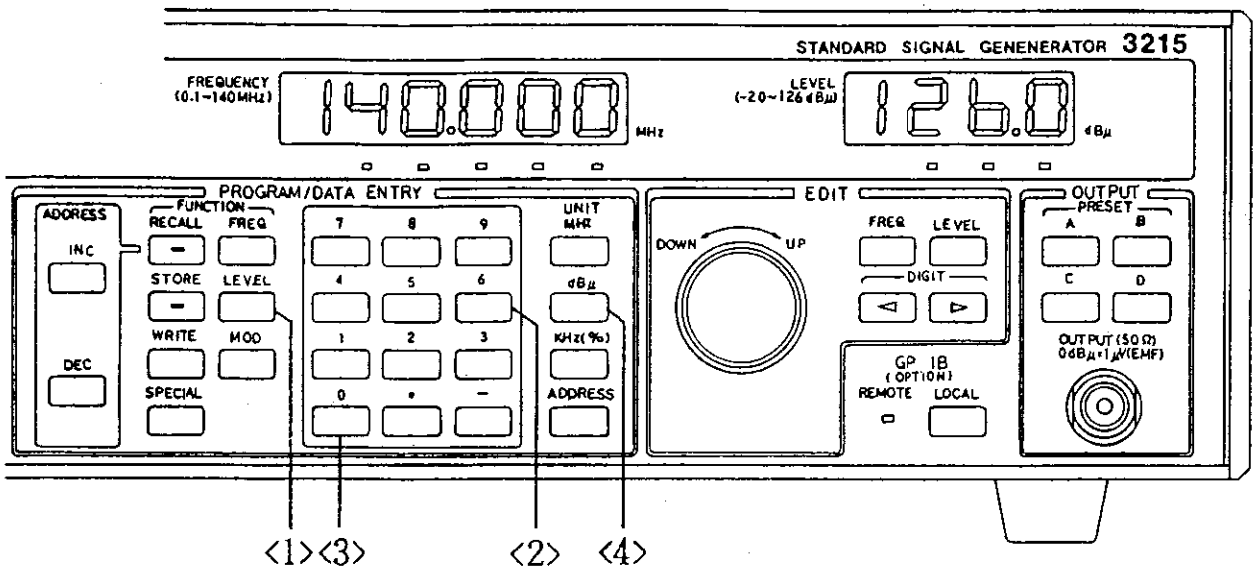


Fig. 6-4

A. Method using the DATA keys

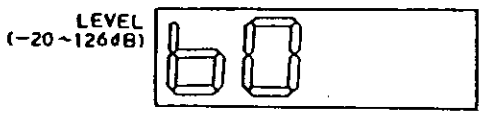
Here an example is given of setting the level to 60 dBμ. The order of the key operations is indicated by the bracketted < > number of Fig. 6-4.

(1) Press the LEVEL key. <1>

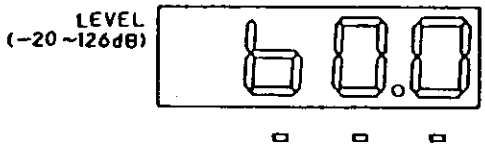
(2) Key in 60 consecutively using the DATA keys. <2>, <3>

(3) Press the dBμ key. <4>

The LEVEL display will be shown as in Fig. 6-5.



Operations <2> and <3>



Operation <4>

Fig. 6-5

B. Method using the EDIT rotary switch

(1) Specify the digit to be changed using the (11) DIGIT SELECT keys. The most significant digit cannot be specified. The (7) cursor LED will move to the right with the [→] key and to the left with the [←] key.

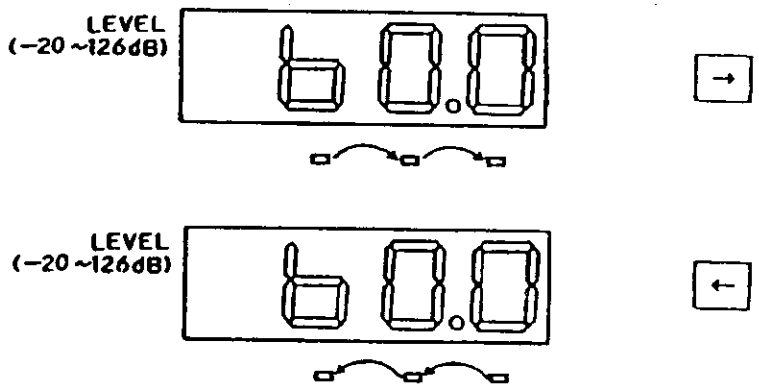


Fig. 6-6

(2) Make the required output level setting using the ⑫ EDIT rotary switch. Raising and lowering of the digit is done automatically. When the upper digits are zero, they will be blanked out.

6.3 Modulation setting

Portions related to this operation are shown in Fig. 6-7.

A. Method using the DATA keys

Here an example is given of setting the FM deviation to 75 kHz. The order of the key operations is indicated by the bracketted < >number of Fig. 6-7.

Note that when the RF frequency is at a frequency of less than 1 MHz, the actual frequency deviation is 1/10 of the set frequency deviation.

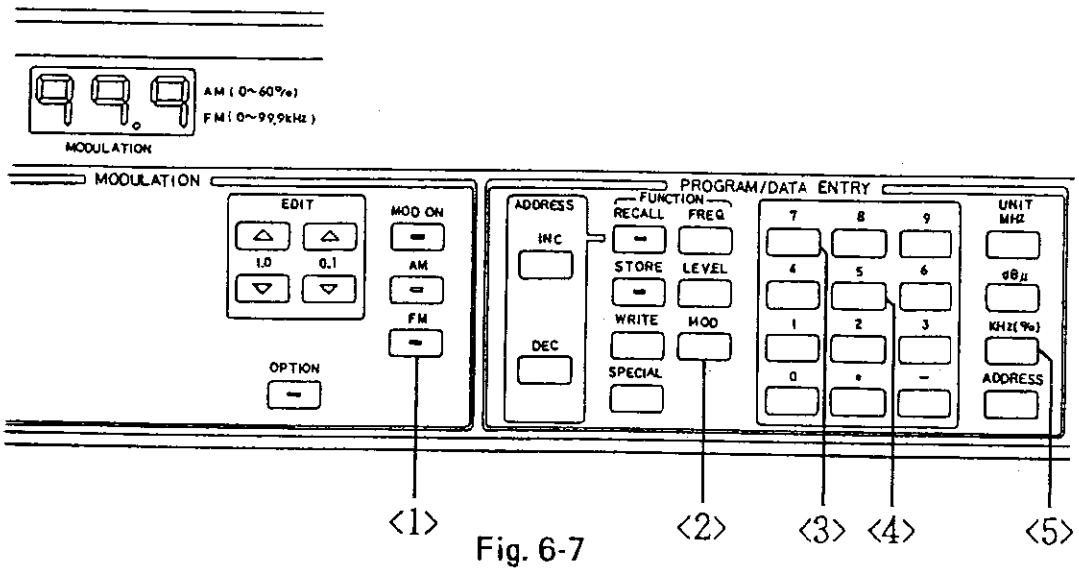
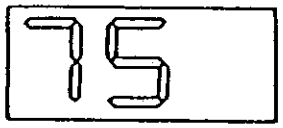
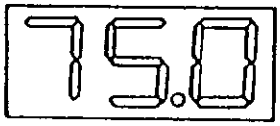


Fig. 6-7

(1) Press the ㉓ FM key. < 1 >
(2) Press the ㉑ MOD key. < 2 >
(3) Key in 75 consecutively using the ⑯ DATA keys. < 3 >, < 4 >
(4) Press the kHz key. < 5 >
The display will be as shown in Fig. 6-8.



Operations <3> and <4>



Operation <5>

Fig. 6-8

B. Method using the MOD EDIT keys

FM: Vary the frequency deviation in 1 kHz and 0.1 kHz steps.

AM: Vary the depth in 1% and 0.1% steps.

C. Modulation mode setting

The following five types of output signals are selected by setting the modulation mode:

(1) CW (continuous wave)
(2) Internal modulation FM signal
(3) External modulation FM signal
(4) Internal modulation AM signal
(5) External modulation AM signal

A description of the setting method for the above five types of signals follows.

C. 1 CW (continuous wave)

(1) Set the ㉑ MOD ON key to OFF (and the ② MODULATION display will go off).

C. 2 Internal modulation FM signal

(1) Set the ㉑ MOD ON key to ON (and the ② MODULATION display will go on).
(2) Set the ㉓ FM key to on.
(3) Press the ㉗ INT key.
(4) Select the required internal modulation frequency with the ㉗ INT key.
(5) Make a setting to the required deviation using the ⑯ DATA keys or the ㉕ MOD EDIT keys.

C. 3 External modulaltion FM signal

(1) Set the ㉑ MOD ON key to on.
(2) Set the ㉓ FM key to on.
(3) Press the ㉘ EXT AF key.

(4) Apply the external modulation signal to the ㉙ EXT MOD connector. The reference input voltage is 1 Vrms. Adjust the level so that both ㉚ EXT LEVEL LEDs go off.

(5) Make a setting to the required deviation using the ⑯ DATA keys or the ㉕ MOD EDIT keys.

C. 4 Internal modulation AM signal

(1) Set the ㉑ MOD ON key to on.

(2) Set the ㉒ AM key to on.

(3) Press the ㉗ INT key.

(4) Select the required internal modulation frequency with the ㉗ INT key.

(5) Make a setting to the required deviation using the ⑯ DATA keys or the ㉕ MOD EDIT keys.

C. 5 External modulation AM signal

(1) Set the ㉑ MOD ON key to on.

(2) Set the ㉒ AM key to on.

(3) Press the ㉘ EXT AF key.

(4) Apply the external modulation signal to the ㉙ EXT MOD connector. The reference input voltage is 1 Vrms. Adjust the level so that both ㉚ EXT LEVEL LEDs go off.

(5) Make a setting to the required deviation using the ⑯ DATA keys or the ㉕ MOD EDIT keys.

6.4 Stereo modulation setting (model 3216 only)

Portions related to this operation are shown in Fig. 6-9. The selection of the type of output signal is made with these controls.

(1) CW (continuous wave)

(2) Stereo modulation FM signal
   a. L (left signal)
   b. R (right signal)
   c. SUB (sub-channel signal)
   d. MAIN (main-channel signal)
   e. EXT (external signal)

(3) Monaural modulation FM signal
   a. Internal modulation FM signal
   b. External modulation FM signal

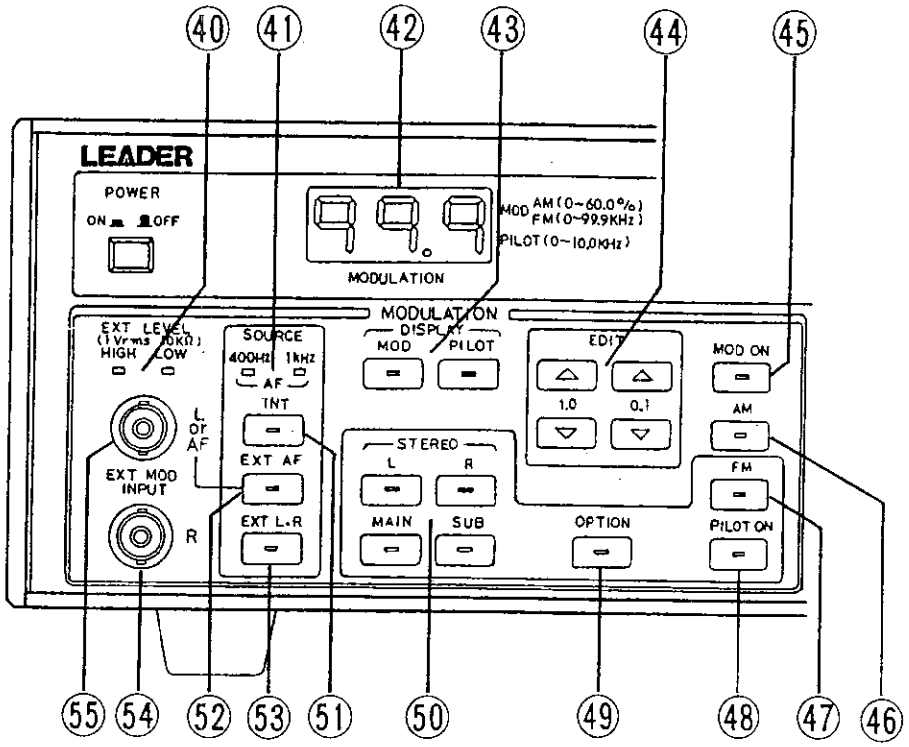


Fig. 6-9

6.4.1 CW (continuous wave)

(1) Set the (45) MOD ON key and the (48) PILOT ON key to off.

6.4.2 Stereo modulation FM signal

With the deviation by the pilot set to 7.5 kHz, perform the other settings according to the following procedure.

a. L (left signal)

(1) Set the (45) MOD ON key to on.
(2) Set the (47) FM key to on.
(3) Set the MOD display with the (43) DISPLAY key.
(4) Make an adjustment to the required deviation using the (44) MOD EDIT keys.
(5) Set the (48) PILOT ON key to on.
(6) Set the MOD display with the (43) DISPLAY key.
(7) Make an adjustment to the required deviation using the (16) DATA keys or the (44) MOD EDIT keys.
(8) Modulate with the left signal using the (50) L key.
(9) Set 400 Hz or 1 kHz using the (51) INT key.

b. R (right signal)

Step (8) of the above a. L (left signal) description is changed to the following:

(8) Modulate with the right signal using the ⑤⓪ R key.

c. SUB (sub-channel signal)

Step (8) of the above a. L (left signal) description is changed to the following:

(8) Modulate with the sub-channel signal using the ⑤⓪ SUB key.

d. MAIN (main-channel signal)

Step (8) of the above a. L (left signal) description is changed to the following:

(8) Modulate with the main-channel signal using the ⑤⓪ MAIN key.

e. EXT (external signal)

e-1 External modulation by EXT audio signal

(1) Set the MOD ON state using the ④⑤ MOD ON key.

(2) Set the MOD display using the ④③ DISPLAY key.

(3) Set external modulation using the ⑤② EXT AF key.

(4) Connect an external audio signal to the ⑤⑤ L or AF input connector. Adjust while monitoring the input level with the ④⓪ EXT LEVEL LEDs. The reference input level is 1 Vrms.

(5) Set the required mode (MAIN, SUB, etc.) using the ⑤⓪ STEREO key.

(6) Adjust to the required deviation using the ①⑥ DATA keys or the ④④ MOD EDIT keys.

(7) Set the ④⑧ PILOT ON key to on.

(8) Set the PILOT display using the ④③ DISPLAY key.

(9) Adjust to the required deviation using the ④④ MOD EDIT keys.

e-2 External modulation using EXT L, R

(1) Set the MOD on state using the ④⑤ MOD ON key.

(2) Set the MOD display using the ④③ DISPLAY key.

(3) Set the external modulation using the ⑤③ EXT, L, R key.

At this time it will no longer be necessary to switch the stereo mode and so the LEDs which display this will all go off.

(4) Apply a stereo signal to the ⑤⑤ L or AF input connector and the ⑤④ R input connector. When a 1 Vrms in-phase signals are input to the L channel and the R channel, the stereo mode will have a deviation of 67.5 kHz at MAIN.

(5) Set the ④⑧ PILOT ON key to on.

(6) Set the PILOT display using the ④③ DISPLAY key.

6.4.3 Monaural modulation FM signal

a. Internal modulation FM signal

(1) Set the ④⑤ MOD ON key to on.

(2) Set the ④⑧ PILOT ON key to off.

(3) Set the ④⑦ FM key to on.

(4) Set the MOD display using the (43) DISPLAY key.
(5) Set 400 Hz or 1 kHz using the (51) INT key.
(6) Press the (50) MAIN key.
(7) Set to the required deviation using the (44) MOD EDIT keys.

b. External modulation FM signal

(1) Set the (45) MOD ON key to on.
(2) Set the (48) PILOT ON key to off.
(3) Set the (47) FM key to on.
(4) Set the MOD display using the (43) DISPLAY key.
(5) Set the (52) EXT AF key to on.
(6) Connect the external audio signal to the (55) L or AF input connector.
(7) Adjust while monitoring the input level with the (40) EXT LEVEL LEDs. The reference input level is 1 Vrms.
(8) Press the (50) MAIN key.
(9) Adjust to the required deviation using the (44) MOD EDIT keys.

7. MEMORY OPERATION

This unit is equipped with a STORE mode and a RECALL mode. Memory addresses are from 0 to 99.

STORE mode .....means the writing of setting data to a specific address of the internal memory. (The STORE LED lights up.)

RECALL mode .....means the reading of setting data from a specific address of the internal memory. (The RECALL LED lights up.)

In addition, when the power is switched on, the data at the time of power-off will be set. (This is called the reappearance of the final setting.)

7.1 STORE mode

Portions related to this operation are shown in Fig. 7-1. Input is in the order of [Data input] – [STORE] – [DATA] – [WRITE]

[Data input]: In the MANUAL mode, the frequency, output level, and modulation data are input. For details on the input method refer to Sections 6.1 "Frequency setting", 6.2 "Output level setting", and 6.3 "Modulation setting".

[DATA] : The memory address data.

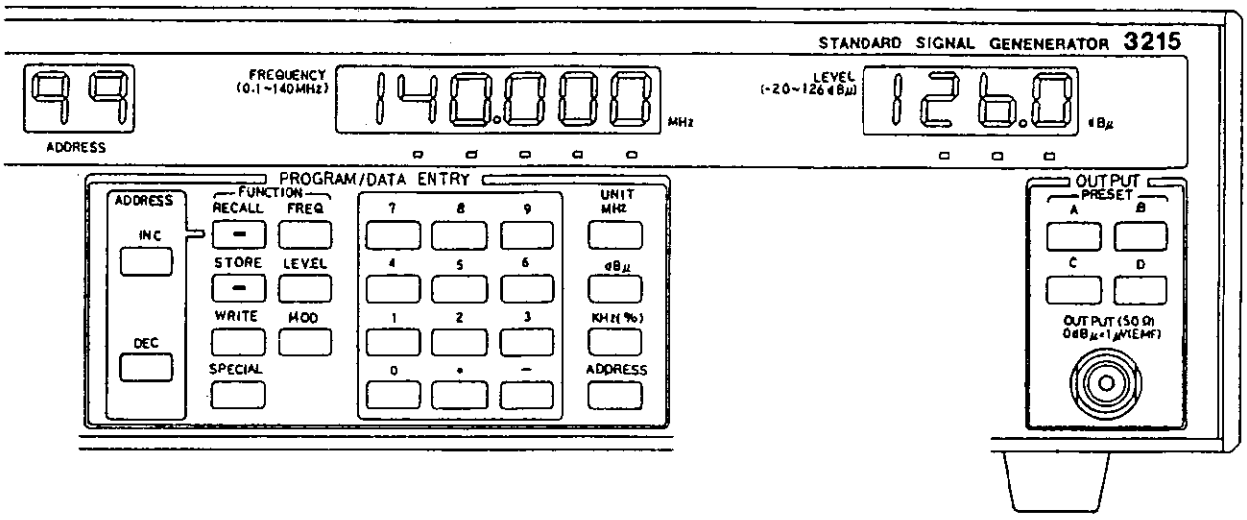


Fig. 7-1

To change from the RECALL or MANUAL modes to the STORE mode, press the ⑰ STORE key so that the STORE LED lights up.

For example, to store data in address 10, perform the following steps:

(1) In the MANUAL mode, set the frequency, output level, and modulation data.

(2) Set the STORE mode.

(3) Key in 10 consecutively using the ⑯ DATA keys. This will be the begin address.

(4) Pressing the ⑰ WRITE key will store the data input in step (1) to address 10. At this time the address will automatically be incremented by 1.

(5) When storing to sequential addresses, the operation can be performed by the input of the data and the WRITE key only.

7.2 RECALL mode

Portions related to this operation are shown in Fig. 7-2. Input in the order of RECALL → DATA → ADDRESS

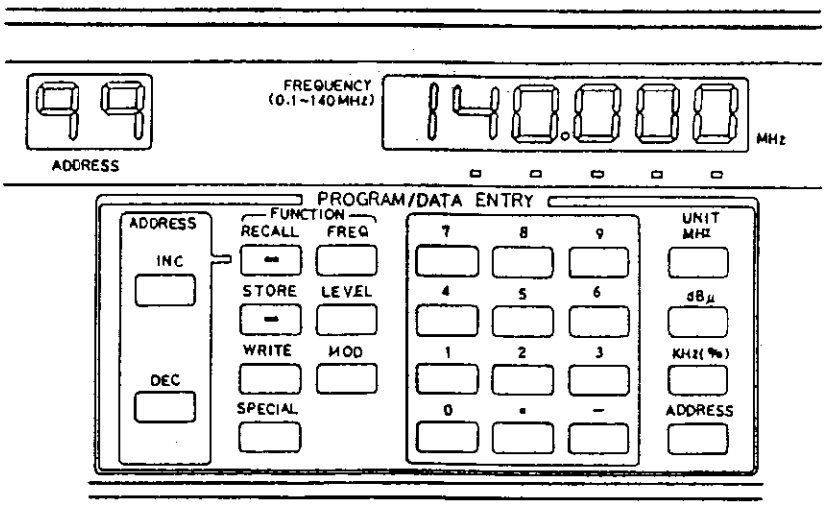


Fig. 7-2

To change from the STORE or MANUAL modes to the RECALL mode, press the ⑰ RECALL key so that the RECALL LED lights up.

For example, to recall data (memory) from address 10, perform the following steps:

(1) Set the RECALL mode.
(2) Key in 10 consecutively using the ⑯ DATA keys.
(3) Pressing the ⑮ ADDRESS key will read the data that has been input to address 10.
(4) Sequential addresses can be shifted and data read out using the ⑲ INC and ⑳ DEC keys.

7.3 Output level presetting

Besides this instrument memory addresses 0 through 99, four address, A, B, C and D, have been provided for output level presetting.

These are convenient for presetting values which receive frequency of use.

Writing is possible in the STORE mode, whereas reading is permitted in the RECALL and MANUAL modes.

The steps for presetting will now be described. As an example, these values will be preset to the various addresses: 120 dBμ to [A], 60 dBμ to [B], 0 dBμ to [C], and −20 dBμ to [D].

(1) Set the STORE mode. (Check that the STORE LED has lit up.)
(2) Set the output level to 120 dBμ. For details, refer to Section 6.2 "Output level setting".
(3) Press PRESET [A].
(4) Set the output level to 60 dBμ.
(5) Press PRESET [B].
(6) Set the output level to 0 dBμ.
(7) Press PRESET [C].
(8) Set the output level to −20 dBμ.
(9) Press PRESET [D]. Now, four different levels have been preset.
(10) Set the RECALL mode or the MANUAL mode.
(11) Press PRESET [A], [B], [C], and [D] to check the presettings.

8. REMOTE CONTROL

The front panel operation, without power switch, of this instrument can all be performed by remote control. The appropriate connector is an AMPHENOL plug 57-30240. The code (hexadecimal) for each control is given in Table 8-1. Remote controller model 3216-01 is available as an option.

The ☐ mark indicates use with model 3216.

Table 8-1

HEX	Key	HEX	Key	HEX	Key	HEX	Key
80	*	90	EXT AF	A0	<7>	B0	<1>
81	MOD (D)	91	L	A1	<8>	B1	<2>
82	PILOT (D)	92	R	A2	<9>	B2	<3>
83	1.0 ↑	93	1.0 ↓	A3	*	B3	→
84	MOD ON	94	FM	A4	FREQ (E)	B4	MHz
85	INC	95	*	A5	PST A	B5	kHz (%)
86	RECALL	96	WRITE	A6	PST B	B6	LOCAL
87	FREQ (F)	97	MOD (F)	A7	*	B7	*
88	INT	98	EXT LR	A8	<4>	B8	<0>
89	*	99	MAIN	A9	<5>	B9	<. >
8A	OPTION	9A	SUB	AA	<6>	BA	<– >
8B	0.1 ↑	9B	0.1 ↓	AB	←	BB	*
8C	AM	9C	PILOT ON	AC	LEVEL(E)	BC	dBμ
8D	*	9D	DEC	AD	PST C	BD	ADDRESS
8E	STORE	9E	SPECIAL	AE	PST D	BE	*
8F	LEVEL (F)	9F	PILOT (F)	AF	*	BF	*

(D) DISPLAY KEY
(F) FUNCTION KEY
(E) EDIT KEY

HEX .....hexadecimal display

The signal names for each of the pins are shown in Fig. 8-2. The input is CMOS level. The data (D0 through D7) are driven by a 3-state bus driver (e.g., 74HC224P) and pin 12 should be set to "low" so that there is not a conflict with the internal data. When set to "high", front panel operation of the instrument is possible.

Table 8-2

Pin No.	Signal Name	Pin No.	Signal Name
1	D0 (LSB)	13	
2	D1	14	
3	D2	15	
4	D3	16	
5	D4	17	
6	D5	18	
7	D6	19	
8	D7 (MSB)	20	
9	} Send DATA	21	GND
10		22	UP
11	+5V	23	DOWN
12	$\overline{\text{RMT}}$/LCL	24	GND

≪CAUTION≫

1. Make sure that pin 12 is set to "low" when using the remote control.
2. The established potential is +5 V and a load of less than 10 mA should be used.
3. Make sure that the division of the input data (8 bits) is done setting D7 (MSB) to "low".
4. Make sure that unnamed pins are left open.

The input data timing diagram is shown in Fig. 8-1. (The codes of Table 8-1 are in the state when D7 is "high".

The 8 bits of data are read at the rise of D7 (MSB).

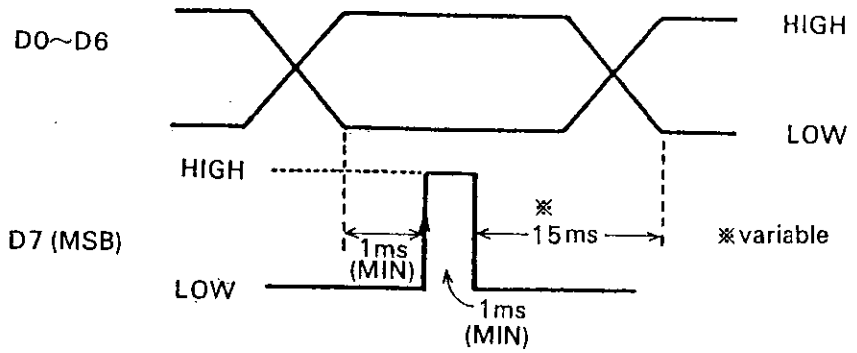


Fig. 8-1

8.1 Miscellaneous

(1) Pin 23 (down) and pin 22 (up) of Table 8-2 are the remote control pins of the ⑫ EDIT rotary switch. Use an open collector for control. Logic is active "low."

The timing diagram is shown in Fig. 8-2.

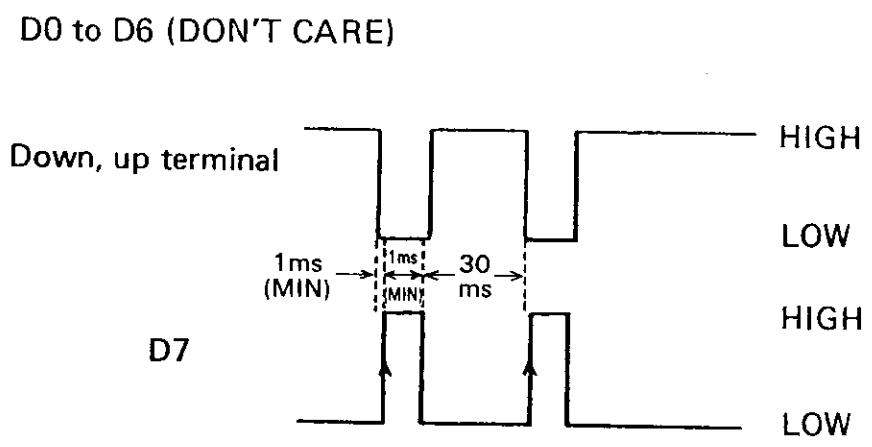


Fig. 8-2

(2) The remote control special key code (called direct RECALL) is HEX (C0 through C7).

The function is exclusive to the RECALL mode and the BCD code of the lower 4 bits of C0 through C7 becomes the offset address. Accordingly, the addresses of the lower 4 bits are added to the BEGIN address. However, addresses that exceed the END address are ignored.

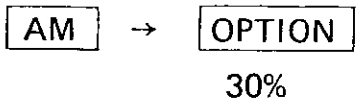
For example,
When BEGIN address = 5
and END address = 99,
the address executed upon the input of HEX (C1) will be
5 + 1 = 6.

9. SPECIAL KEY

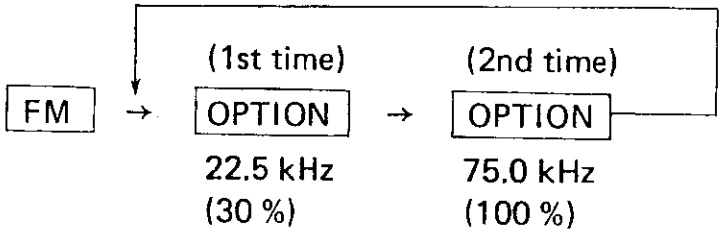
9.1 OPTION key

Pressing this key will provide a forced setting of the modulation factor. The modulation will be switched on even from the off state. The modulation factor for AM is 30% and for FM is 22.5 kHz or 75.0 kHz.
The key operation is as follows:

(1) model 3215
AM

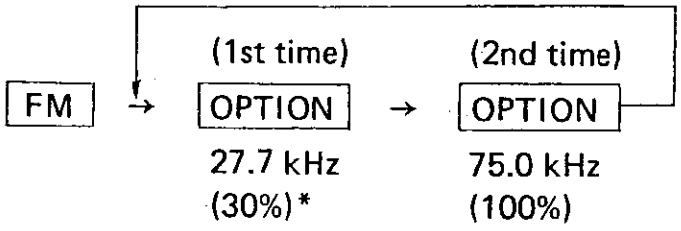


FM



(2) model 3216
At the time of AM and FM (PILOT off), the operation will be the same as model 3215.

FM (PILOT on)
At this time, the pilot deviation will be forced to 7.5 kHz.



*: The 30% deviation at the time of stereo modulation is a deviation of 27.75 kHz, but due to the setting resolution of the instrument it will be 27.7 kHz. (Of this, 7.5 kHz is the pilot deviation.)

9.2 SPECIAL key

The functions shown in Table 9-1 are provided as SPECIAL functions. Pressing the SPECIAL key will display the input DATA (0 through 2) in the frequency display for approx. 0.5 seconds.

Table 9-1

Data	Function
0	BEGIN address setting
1	END address setting
2	Transfer of memory data

9.2.1 BEGIN address setting

The key operation is as follows:

SPECIAL → 0 → DATA → ADDRESS

Portion related to this operation are shown in Fig. 9-1. The steps are shown below with the BEGIN address set to 0. The order of the key operations is indicated by the bracketted < > numbers.

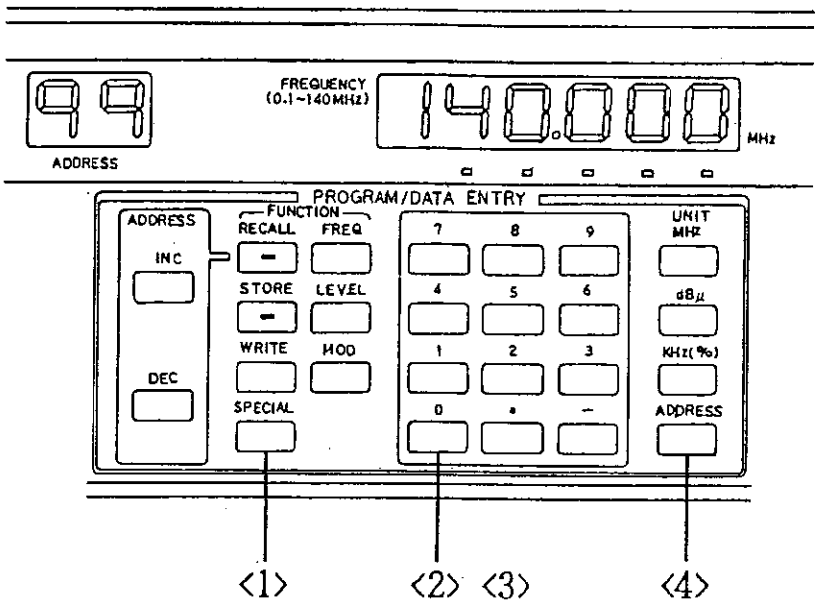


Fig. 9-1

(1) Press the SPECIAL key. <1>
(2) Press the 0 DATA key. This will provide the setting mode of the BEGIN address. <2>
(3) Continuing, input BEGIN address 0. <3>
The DATA that have been input will be displayed in the ADDRESS display.
(4) Press the ADDRESS key. With this, the setting of the BEGIN address is complete. <4>

When step (3) above is omitted and step (4) is performed, the current BEGIN address can be checked. At this time, the address will be displayed for approx. 0.5 seconds in the ADDRESS display.

9.2.2 END address setting

The key operation is as follows:

SPECIAL → 1 → DATA → ADDRESS

The steps are shown for setting the END address to 99.

(1) Press the SPECIAL key.
(2) Press DATA key 1. This will provide the setting mode of the END address.
(3) Continuing, input END address 99. The data that have been input are displayed in the ADDRESS display.
(4) Press the ADDRESS key. This completes the END address setting.

The same as with the BEGIN address, when step (3) above is omitted and step (4) is performed, the current END address can be checked.

9.2.3 Changing the address

When changing the currently set address to a new address, the principle of BEGIN < END must be observed.

Three examples are given in Fig. 9-2 and the modification procedure is shown.

Ⓐ Either BEGIN or END can be set.
Ⓑ Be sure to set END first, then set BEGIN.
Ⓒ Be sure to set BEGIN first, then set END.

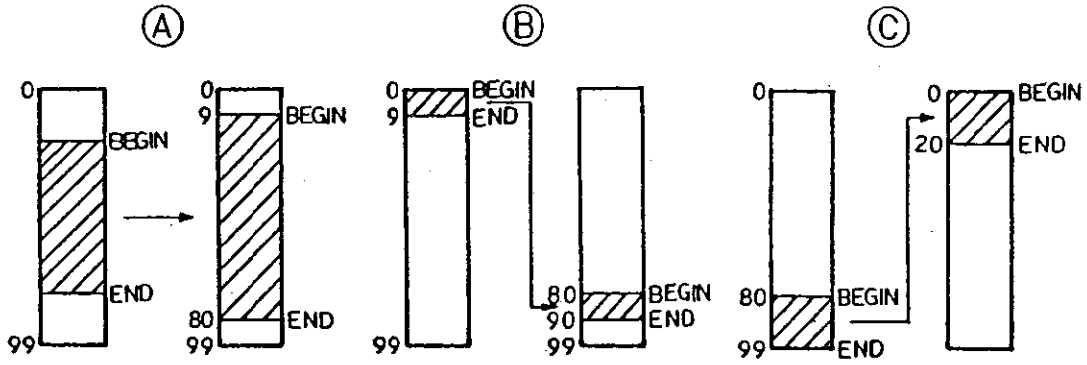


Fig. 9-2

9.2.4 Sending data (memory addresses 0 through 99)

Stored data can be sent between the instruments of the same type.

An example of sending data between two model 3215 is shown below. The REMOTE CONTROL connectors on the rear panel are connected each other. The key operation is performed according to the following procedure.

Sending side	Receiving side
	(1) Press the SPECIAL key.
	(2) Press DATA key 2. (Receive preparation)
(3) Press the SPECIAL key.	
(4) Press DATA key 2. (Sending preparation)	
	(5) Press the DEC key. Both the RECALL and STORE LEDs will light up.
(6) Press the INC key. Both the 400 Hz and 1 kHz LEDs will light up and the sending of data will begin.	

The transfer of the data will be complete in about 5 seconds and the display will return to the condition that existed prior to entering this mode.

When data do not come from the sending side while in the receiving state ([SPECIAL] → [2] → [DEC]), an escape from this state is possible by pressing another key.

10. MAINTENANCE

The model 3215 and 3216 are designed to provide stable performance when used properly. If the instrument requires adjustment or calibration after extended use, be sure to contact your local Leader agent.

LEADER ELECTRONICS CORP.

2-6-33 Tsunashima-Higashi, Kohoku-ku, Yokohama 223-8505, Japan
PHONE: 81-45-541-2123 FAX: 81-45-541-2823

LEADER INSTRUMENTS CORP.

6484 Commerce Drive, Cypress, California 90630 U.S.A.
PHONE: 1-714-527-9300 FAX: 1-714-527-7490

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FUSE Corrigenda

Notes on Fuse

The spare fuse listed as a standard accessory in this instruction manual is not supplied for this product. Contact your local Leader agent for the fuse.

LEADER ELECTRONICS CORP.

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