

ID NUMBERS

This manual applies directly to the products with ID numbers suffixed 122.

For additional information on ID numbers, refer to paragraph 1-2 ID NUMBER in CHAPTER I.

SIGNAL GENERATOR

VP-8192A / 8193A / 8194A

CHAPTER I GENERAL

1-1 INTRODUCTION

This instruction manual consists of the following sections:

CHAPTER I GENERAL

Provides a general description and feature of the signal generator.

CHAPTER II SPECIFICATIONS

Gives the specifications of this instrument.

CHAPTER III INSTALLATION

Describes electrical and mechanical preparations to be made to use the instrument and safety precautions. Be sure to read this section before operating the instrument.

CHAPTER IV NAMES AND FUNCTIONS OF THE OPERATIONAL PARTS

Describes names and functions of each operation part of the instrument.

CHAPTER V OPERATION

Explains each function on the panel and the operation procedures of the signal generator.

CHAPTER VI GP-IB INTERFACE

This chapter describes in detail how to use the GP-IB interface to operate this product.

CHAPTER VII RS-232-C INTERFACE

Describes the RS-232-C interface function of the instrument.

CHAPTER VIII EXTERNAL CONTROL INTERFACE

Describes the external control interface function unique to the instrument.

CHAPTER IX MAINTENANCE

Describes the daily maintenance procedure.

1-2 ID NUMBER

This instrument has a ten-character ID number on its rear panel. The first seven characters are assigned uniquely for each product. The last three figures comprise the ID suffix which is the same for all identical products and changes only when a change is made.

OPT.	MOD.
ID.	

Figure 1-1 ID Label

1-3 DESCRIPTION

This series of signal generators generates CW, FM, AM, and mixed FM/AM modulation signals in the range of 100 kHz to 140 MHz, and provides the remote control function.

The standard model of the series VP-8192A features the FM and AM monophonic modulation function. Besides to this standard function, the models VP-8193A and VP-8194A have a built-in FM stereo modulator based on the FM stereo broadcasting system. Additionally the model VP-8194A has built-in RDS and ARI modulators that are widely used in Europe.

A frequency in the range of 70 MHz to 140 MHz is a directly generated fundamental wave. Using this wave, signals are generated with the heterodyne down conversion method in the range of 100 kHz to 35 MHz, or with the 1/2 frequency division method in the range of 35 MHz to 70 MHz.

This series of instruments may be defined as synthesized signal generators. They generate a precise RF frequency that is always phase-locked to the built-in reference crystal oscillator. The frequency resolution is 100 Hz.

The ΔF function can be used to directly read out increment or decrement from a predetermined reference frequency value. Also setting a variable step amount allows a frequency to be changed at a desired step amount.

An output level can be set in the range of -20 dB μ V [emf] to 126 dB μ V [emf] with the setting resolution of 0.1 dB. The attenuator section for output control is provided with a semiconductor to prolong the life of the instrument except when there is a relay switch at 106 dB μ V [emf].

The Δ dB function can be used to directly read out increment or decrement from a predetermined reference output level. Also setting a variable step amount allows an output level to be changed at a desired step amount.

This series of instruments provide modulation of FM and AM, and also mixed AM/FM modulation by combining internal and external modulation signals.

The models VP-8193A and VP-8194A generate composite stereo modulation signals from the built-in stereo modulator to provide modulation based on the FM stereo broadcasting system.

Besides, the model VP-8194A has built-in modulators for signals of RDS (Radio Data System) that is used as a digital data transmission method in FM stereo broadcasting in European countries or RBDS (Radio Broadcast Data System) that is used in the United States, and for signals of ARI (Autofahrer Rundfunk Information) that is used as a traffic information identity signal in European countries. Thus this instrument can provide modulation waves multiplexed with composite stereo modulation signals in FM stereo modulation.

For further information on stereo modulators, RDS signals, and ARI signals, see the paragraph "1-5 FUNCTION."

These instruments have the assorted preset memory function, which stores up to 100 sets of parameters for a frequency, output level, modulation status, and external control output signal in memories. The stored parameters can be recalled as necessary.

Battery backup is available so that the state set with the panel operation is retained even after the power is turned off.

These features and functions allows this series of signal generators to be used to automate production and inspection lines for AM/FM receivers, communication equipment and components, as well as to generate measuring signals for maintenance, research and development.

1-4 FEATURES

Given below are main features of the instrument.

1-4-1 Features common to the three instruments

(1) Wide band and high output level

The instrument provides the high output level of 126 dB μ V [emf] in the wide frequency range of 100 kHz to 140 MHz.

(2) High stability

An RF output-signal is always phase-locked to the built-in crystal oscillator and kept in $\pm 5 \times 10^{-6}$ stability.

(3) Long life

Use of a semiconductor in the attenuator varying RF output signals allows for long life of the instrument.

(4) Δ F and Δ dB direct reading functions

The Δ F function displays the relative value of an RF frequency as an increment and decrement from a given reference value. The Δ dB function displays the relative value of an output level as an increment and decrement from a given reference value.

(5) Assorted preset memory

The instrument stores up to 100 sets of parameters for a frequency, output level and modulation status. The stored parameters can be recalled as desired.

(6) Modification of output signal parameters

The instrument modifies any digit of the parameters for an RF frequency, output level and modulation status with the rotary knob.

(7) Remote control

The instrument is equipped with the GP-IB, RS-232-C and external control interfaces at standard.

(8) Weather band output (option)

RF outputs ranging from 162,000 to 163,000 MHz can be added. (available for FM monophonic modulation only)

1-4-2 Features applied to VP-8193A and VP-8194A

(1) Built-in stereo modulator

A built-in FM stereo modulator is available. Thus this instrument alone can generate a stereo modulation wave which is used to test and measure a receiver for FM stereo broadcasting.

(2) DDS oscillator for internal modulation (option)

In addition to the RC oscillator, the instrument is equipped with the built-in DDS which enables the setting of 1 Hz resolution in the range of 20 Hz to 20 kHz. This is used for measuring the frequency characteristics of a receiver.

1-4-3 Features applied to VP-8194A only

RDS and ARI signal sources

The instrument has a built-in RDS or RBDS signal source and ARI signal source. With these signal sources, the instrument alone can generate modulation waves that are to be used to test and measure FM multiplex broadcasting receivers.

1-5 FUNCTION

1-5-1 FM stereo modulator (VP-8193A / 8194A only)

(1) FM stereo broadcasting

As outlined in Figure 1-2, a broadcasting using the carrier suppression AM / FM system is generally called an FM stereo broadcasting. This system was established by FCC (Federal Communications Commission) and EUB (European Broadcasting Union), and is now submitted to the Radio Regulatory Council of the Post and Telecommunications Ministry.

Though established by FCC originally, the SCA (Subsidiary Communications Authorization) indicated by a dotted line in the figure is considered by EBU as a traffic information signal. This frequency range is called the second sub-channel in Japan.

The instrument contains the functions of both a stereo modulator and signal generator, as shown in Figure 1-2.

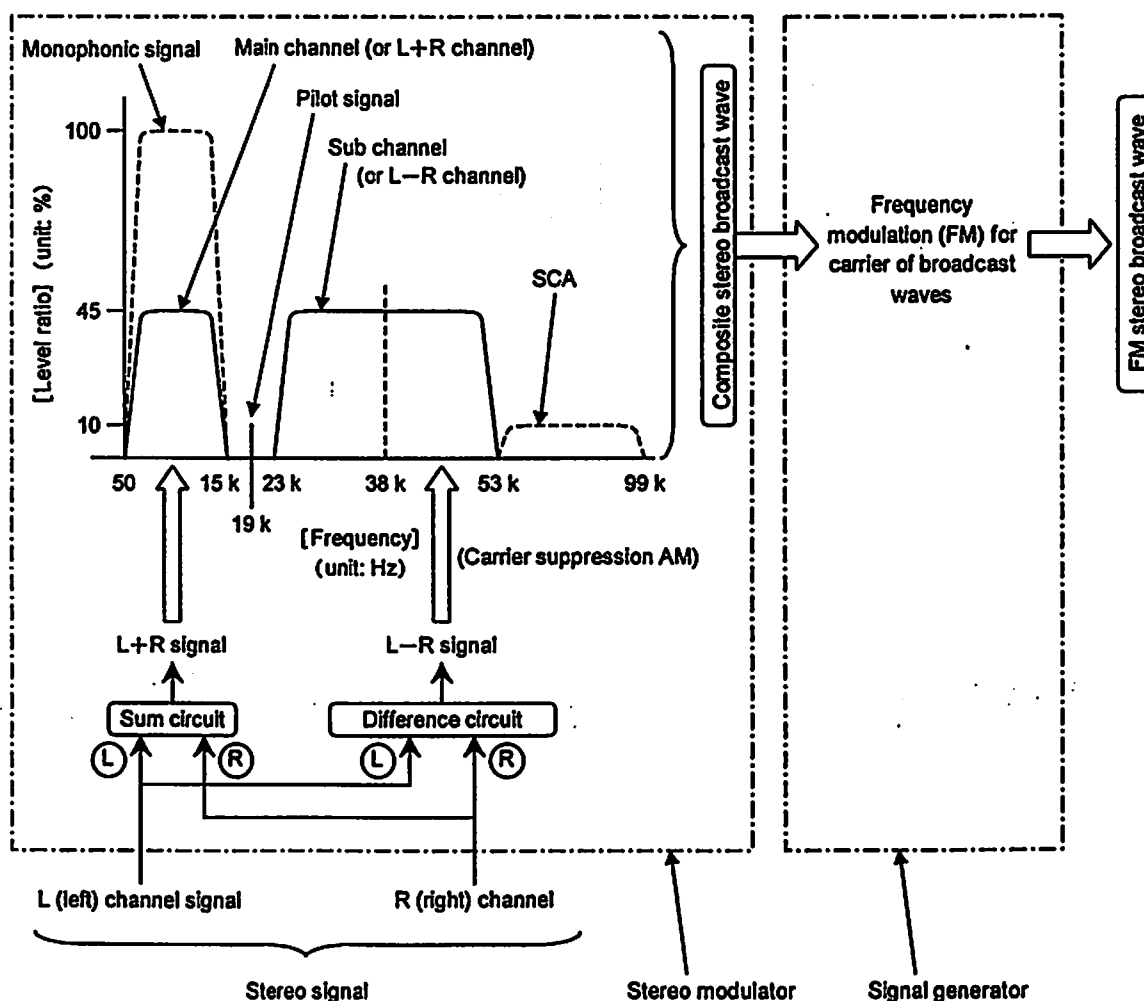


Figure 1-2 Outline of FM stereo broadcasting

(2) Modulation mode

Six types of modulation modes are available.

(a) Modulation off

Both the main- and sub-channel signals are turned off.

(b) Monophonic

Without stereo modulation, only a main-channel signal is generated. The PILOT signal is turned off.

As a test tone, an internal AF signal or an externally supplied sine wave ranging from 20 Hz to 100 kHz can be used.

(c) L=R mode

The same test tone is applied to both L and R inputs shown in the figure 1-2 at the same phase to generate a composite stereo signal. The resultant signal composes for the main-channel signal component only.

As a test tone, an internal AF signal or an externally supplied sine wave ranging from 20 Hz to 15 kHz can be used.

(d) L mode

A test tone is applied only to the L input in the figure 1-2 to generate a composite stereo signal. The resultant signal composes of the main- and sub-channel signal components with the same level. When demodulated in a stereo receiver, the signal appears only at the L channel.

As a test tone, an internal AF signal or an externally supplied sine wave ranging from 20 Hz to 15 kHz can be used.

(e) R mode

A test tone is applied only to the R input in Figure 1-2 to generate a composite stereo signal. The resultant signal composes of the main- and sub-channel signal components with the same level. When demodulated in a stereo receiver, the signal appears only at the R channel.

As a test tone, an internal AF signal or an externally supplied sine wave ranging from 20 Hz to 15 kHz can be used.

(f) L=-R mode

The same test tone is applied to both L and R inputs in Figure 1-2 at the reversed phase to generate a composite stereo signal. The resultant signal composes of the sub-channel signal component only.

As a test tone, an internal AF signal or an externally supplied sine wave ranging from 20 Hz to 15 kHz can be used.

(3) PILOT signal

The 19 kHz PILOT signal can be turned on / off independently and used to specify a signal level ratio. When the modulation mode is set to monophonic, however, this signal is turned off.

(4) Pre-emphasis

The instrument provides the main- and sub-channel with the pre-emphasis feature. The time constant can be selected out of 25 μ s, 50 μ s and 75 μ s.

The pre-emphasis feature of this instrument shows the same level for pre-emphasis on and pre-emphasis off in the flat zone below 400 Hz. Thus increasing the frequency of a test tone causes both main- and sub-channel signal to be saturated. When turning the pre-emphasis feature on, be sure to specify the deviation between a main- and sub-channel signal so that they are not saturated.

(5) SCA input

The instrument is equipped with an SCA input terminal. An input signal applied to the SCA input terminal is multiplexed with a composite stereo signal. An SCA input signal equals the level ratio or 10 % at about 0.56 V [P-P].

1-5-2 RDS signal (VP-8194A only)

The model VP-8194A can generate RDS signals that are defined in CENELEC EN 50067 and broadcasted in European countries, and RBDS signals that are defined in NRSC/NAB and broadcasted in the United States.

Except for a little difference in usage because of different broadcasting areas, the RDS signals and RBDS signals are same in modulation method, transmission method, and data structure. Thus in the rest of this manual, it is assumed that the RDS signals include the RBDS signals unless otherwise specified.

Listed below are the general specifications of RDS signals.

Table 1-1 Outline of RDS signals

Item	Specification
Sub carrier frequency	57 kHz
FM deviation	± 2 kHz
Modulation method	BPSK (Bi-Phase Shift Keying)
Coding method	Differential coding
Data rate	1 187.5 bps
Bandwidth	57 kHz ± 2.4 kHz (100 % cosign roll-off)

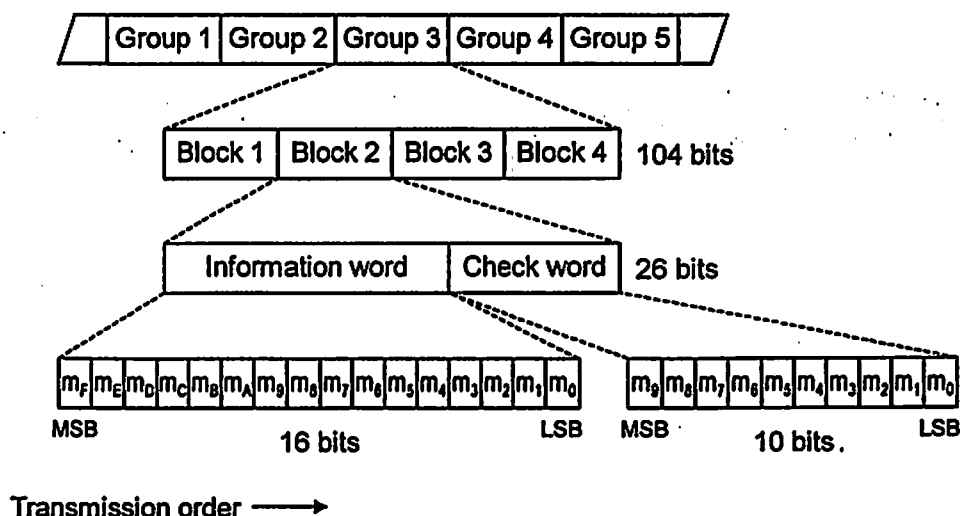


Figure 1-3 RDS data structure

1-5-3 RDS data editor (VP-8194A only)

The model VP-8194A is supplied with the RDS data editor software for creating and editing data of RDS signals. The RDS data editor software runs on Microsoft Windows.

The RDS data editor automatically creates RDS data from entered sequence data and code data. The created RDS data can be downloaded in the internal memory of VP-8194A and used as its modulation output signals.

1-5-4 ARI signal (VP-8194A only)

The model VP-8194A has the built-in generators of ARI signals that are defined in CENELEC EN 50067 and broadcasted in European countries. The instrument can provide both ARI signals and RDS signals. Listed below are the general specifications of ARI signals.

Table 1-2 Outline of ARI signals

Item	Specification
Sub carrier	SK* ¹
Frequency	57 kHz
FM deviation	±4 kHz (only ARI) ±3.5 kHz (both RDS/ARI)
Modulation method	AM
Announcement signal	DK* ²
Modulation frequency	125 Hz (57 kHz / 456)
AM degree	30 %
Area signal	BK* ³
Modulation frequency	A : 23.75 Hz (57 kHz / 2 400) B : 28.27 Hz (57 kHz / 2 016) C : 34.93 Hz (57 kHz / 1 632) D : 39.58 Hz (57 kHz / 1 440) E : 45.67 Hz (57 kHz / 1 248) F : 53.98 Hz (57 kHz / 1 056)
AM degree	60 %

*1 : Senderkennung, Transmitter Identification Code

*2 : Durchsagekennung, Announcement Identification Code

*3 : Bereichskennung, Area Identification Code

1-5-5 Preset function

This function stores an RF frequency, output level, modulation status (such as AM / FM, INT / EXT signal, modulation mode, modulation degree, on / off and external control output signal) and stereo status in a set in the memory, and recalls the set at a time as desired.

Once recalled, any parameter can be modified at will. The generator accommodates up to 100 sets of parameters.

1-5-6 Auto sequence

This function sequentially recalls the assorted preset memory contents at a desired time interval.

1-5-7 GP-IB control

Shown below is the GP-IB interface function of these instruments.

Table1-3 GP-IB interface functions

Function	Code	Description
Source handshake	SH1	Complete capability
Acceptor handshake	AH1	Complete capability
Talker	T7	Basic talker, talker release by MLA, talk only
Listener	L3	Basic listener, listener release by MTA, listen only
Service request	SR0	No capability
Remote / local	RL1	Complete capability
Parallel poll	PP0	No capability
Device clear	DC1	Complete capability
Device trigger	DT0	No capability
Controller	C0	No capability

1-5-8 RS-232-C interface

Shown below is the RS-232-C interface of these instruments.

Table 1-4 RS-232-C interface

Item	Specification
Baud rate	38 400 bps
Character length	8 bits
Parity	EVEN
Flow control	Xon / Xoff
Stop bit	1 bit

1-5-9 External control Interface

Shown below are the external control interface functions of these instruments.

- (1) Remote sequential recall
- (2) Remote modify
- (3) Remote direct recall
- (4) Control output
- (5) Print out of memory contents
- (6) Data read
- (7) Relay drive output

CHAPTER II SPECIFICATIONS

2-1 ELECTRICAL PERFORMANCE

■ Frequency		
Item	Specification	Condition & Remark
Range	0.1 MHz to 140 MHz	
Resolution	100 Hz	
Frequency band	Band 1: 0.100 0 MHz to 35.000 0 MHz Band 2: 35.000 1 MHz to 70.000 0 MHz Band 3: 70.000 1 MHz to 140.000 0 MHz	
Accuracy	$\pm 5 \times 10^{-6}$	
Internal reference oscillator temperature effect	$\pm 5 \times 10^{-6}$	

■ Output level		
Item	Specification	Condition & Remark
Range	-20 dB μ V [emf] to 126 dB μ V [emf]	
Resolution	0.1 dB	
Accuracy	± 1.5 dB (Output level ≥ 0 dB μ V [emf]) ± 2.0 dB (Output level < 0 dB μ V [emf])	
Output impedance	50 Ω	
VSWR	≤ 1.3 (Output level ≤ 101 dB μ V)	
Attenuator contact	Semiconductor	

■ Spectral purity		
Item	Specification	Condition & Remark
Spurious output signals		
Harmonics (2nd, 3rd)	≤ -30 dBc	
Non-harmonics	≤ -50 dBc (Band 2 to 3) ≤ -40 dBc (Band 1: $0.1 \text{ MHz} \leq f_s \leq 35 \text{ MHz}$) ≤ -30 dBc (Band 1 : $f_s \geq 35.000 1 \text{ MHz}$)	At a point of 10 kHz or more from the carrier f_s : Spurious output frequency
Residual modulation		
FM component	≥ 76 dB (10.7 MHz ± 1 MHz, 76 MHz to 108 MHz) ≥ 73 dB (Band 1 to 3 : 0.3 MHz to 140 MHz)	Represented as S/N ratio in reference to 75 kHz deviation with the modulation frequency of 1 kHz. Post detection bandwidth: 50 Hz to 15 kHz De-emphasis: 50 μ s

■ Spectral purity (Cont'd)		
Item	Specification	Condition & Remark
AM component	≥ 55 dB (Band 1: 0.4 MHz to 1.7 MHz) ≥ 50 dB (Band 1 to 3: 0.15 MHz to 140 MHz)	Represented as an S/N ratio in reference to 30 % modulation with the modulation frequency of 1 kHz. (Beat components are excluded.) Post detection bandwidth: 50 Hz to 15 kHz

■ Modulation		
Item	Specification	Condition & Remark
RC oscillator		
Frequency	400 Hz, 1 kHz	
Accuracy	Within ± 3 %	
External modulation input impedance	Approx. 10 k Ω	
External modulation input voltage	Approx. 1 V [peak]	

■ Amplitude modulation (AM)		
Item	Specification	Condition & Remark
Guaranteed performance range	Frequency ≥ 0.15 MHz	
Modulation degree range	0 % to 80 %	
Modulation degree indication range	0 % to 100 %	
Resolution	0.5 % (0 % to 100 %)	
Accuracy	$\pm(\text{Set value} \times 0.1 + 1)$ % (Band 1: 0.4 MHz to 1.7 MHz) $\pm(\text{Set value} \times 0.1 + 2)$ % (Band 1 to 3: 0.15 MHz to 140 MHz)	Represented as a modulation degree at the 1 kHz modulation frequency. The maximum set value is 80 %.
Distortion factor	[Band 1: 0.4 MHz to 1.7 MHz] ≤ 0.5 % (0 % to 30 % AM) ≤ 1.5 % (30 % to 60 % AM) ≤ 3 % (60 % to 80 % AM) [Band 1 to 3: 0.15 MHz to 140 MHz] ≤ 1.5 % (0 % to 30 % AM) ≤ 3 % (30 % to 60 % AM) ≤ 5 % (60 % to 80 % AM)	Modulation frequency: 1 kHz (RC oscillator) Post detection bandwidth: 50 Hz to 15 kHz Beat components are excluded.
Incidental FM	≤ 150 Hz (Band 1: 0.4 MHz to 1.7 MHz) ≤ 300 Hz (Band 1 to 3: 0.15 MHz to 140 MHz)	At 30 % modulation with the 1 kHz modulation frequency
External modulation frequency response	± 1 dB (with reference to 1 kHz) 20 Hz to 10 kHz	The maximum allowable modulation frequency is 2 % of the carrier frequency for 30 % AM.

■ Frequency modulation (FM)		
Item	Specification	Condition & Remark
Guaranteed performance range	Frequency ≥ 0.3 MHz	
Frequency deviation range	0.0 kHz to 100 kHz	The maximum allowable FM deviation in band 1 is 25 % of the carrier frequency.
Resolution	0.5 kHz	
Accuracy	$\pm(\text{Set value} \times 0.1 + 0.5)$ kHz (10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz) $\pm(\text{Set value} \times 0.1 + 1)$ kHz (Band 1 to 3: 0.3 MHz to 140 MHz)	
Distortion factor	≤ 0.05 % (10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz) ≤ 0.1 % (Band 1 to 3: 0.3 MHz to 140 MHz)	75 kHz deviation with the modulation frequency of 1 kHz Post detection bandwidth: 50 Hz to 15 kHz De-emphasis: 50 μ s
Separation for MPX stereo signals	≥ 55 dB	Frequency: 76 MHz to 108 MHz Modulation frequency: 1 kHz 100 % modulation (67.5 kHz deviation)
Incidental AM	≤ 0.5 % (10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz)	At 75 kHz deviation with the modulation frequency of 1 kHz
External modulation frequency response MONO mode Other modes than MONO mode (for VP-8193A / 8194A only)	$\leq \pm 1$ dB (20 Hz to 100 kHz, reference to 1 kHz) $\leq \pm 1$ dB (20 Hz to 15 kHz, reference to 1 kHz)	
Pre-emphasis (for VP-8193A / 8194A only)	25 μ s / 50 μ s / 75 μ s / OFF	Increase characteristic at the OFF standard

■ FM stereo (for VP-8193A / 8194A only)				
Item	Specification			Condition & Remark
Guaranteed performance range	Frequency≥0.3 MHz			
Main- / Sub-channel signals	Modulation mode	Modulation signal	Description	
	L=R	INT / EXT	Stereo modulation with a single signal	
	L			
	R			
	L=-R			
	MONO	Monophonic modulation		
Modulation ratio				
Range	0 % to 127 %			
Resolution	1 %			

■ FM stereo (for VP-8193A / 8194A only) (Cont'd)		
Item	Specification	Condition & Remark
Accuracy	$\pm(\text{Set value} \times 0.1 + 1) \%$ (10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz) $\pm(\text{Set value} \times 0.1 + 1.5) \%$ (Band 1 to 3: 0.3 MHz to 140 MHz)	
Pilot signal		
Frequency	19 kHz	
Accuracy	± 1 Hz	
Level ratio range	0.0 % to 15.0 %	
Level ratio resolution	0.1 %	
Level ratio accuracy	$\pm(\text{Set value} \times 0.1 + 1) \%$ (10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz)	
Stereo separation	≥ 55 dB (Modulation frequency 400 Hz to 1 kHz)	At 10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz
38 kHz sub-carrier leakage	≤ -50 dB	
Distortion	$\leq 0.05 \%$ (10.7 MHz \pm 1 MHz, 76 MHz to 108 MHz)	At 100 % modulation with the modulation frequency of 1 kHz Post detection bandwidth: 50 Hz to 15 kHz De-emphasis: 50 μ s
Pre-emphasis	25 μ s / 50 μ s / 75 μ s / OFF	Increase characteristic at the OFF standard

■ FM / AM mixed modulation		
Item	Specification	Condition & Remark
FM mono / AM mixed modulation	(1) FM mono (EXT) — AM (INT) (2) FM mono (INT) — AM (EXT) (3) FM mono (EXT) — AM (EXT) (4) FM mono (INT) — AM (INT)	
FM stereo / AM mixed modulation (for VP-8193A / 8194A only)	(1) FM stereo (EXT) — AM (INT) (2) FM stereo (INT) — AM (EXT) (3) FM stereo (EXT) — AM (EXT) (4) FM stereo (INT) — AM (INT)	

■ RDS signal (for VP-8194A only)		
Item	Specification	Condition & Remark
Level range	0.0 % to 10 %	Assuming 75 kHz FM deviation as 100 %
Level resolution	0.1 %	
Accuracy	$\pm(\text{Set value} \times 0.1 + 0.5) \%$	
Spurious	≤ -50 dB (53 kHz, 10 % output) ≤ -40 dB (61 kHz, 10 % output)	
Sub-carrier		
Frequency accuracy	57 kHz \pm 6 Hz	
Phase	0° or 90°	With reference to the pilot signal

■ RDS signal (for VP-8194A only) (Cont'd)

Item	Specification	Condition & Remark
Phase accuracy	$\pm 10^\circ$	
Leakage	≤ -50 dB	
Internal data		
Mode	Sub-carrier / Null data / Internal data	
Number of patterns	Max. 16 patterns	
Pattern length	Max. 2 048 groups	

■ ARI signal (for VP-8194A only)

Item	Specification	Condition & Remark
SK signal		
Level range	0.0 % to 10 %	Assuming 75 kHz FM deviation as 100 %
Level resolution	0.1 %	
Accuracy	$\pm (\text{Set value} \times 0.1 + 0.5) \%$	
Frequency accuracy	57 kHz ± 6 Hz	
Phase	0°	With reference to the pilot signal
Phase accuracy	$\pm 10^\circ$	
DK signal		
Frequency accuracy	125 Hz (57 kHz / 456) $\pm 1 \%$	
AM degree range	0 % to 40 %	
AM resolution	1 %	
AM accuracy	$\pm 5 \%$	
AM distortion factor	$\leq 1 \%$ (SK=5.3 %, AM=30 %)	
BK signal		
Frequency accuracy	Code A: 23.75 Hz (57 kHz / 2 400) $\pm 1 \%$ Code B: 28.27 Hz (57 kHz / 2 016) $\pm 1 \%$ Code C: 34.93 Hz (57 kHz / 1 632) $\pm 1 \%$ Code D: 39.58 Hz (57 kHz / 1 440) $\pm 1 \%$ Code E: 45.67 Hz (57 kHz / 1 248) $\pm 1 \%$ Code F: 53.98 Hz (57 kHz / 1 056) $\pm 1 \%$	
AM degree range	0 % to 80 %	
AM resolution	1 %	
AM accuracy	$\pm 5 \%$	
AM distortion factor	$\leq 2 \%$ (SK=5.3 %, AM=60 %)	

■ Preset function

Item	Specification	Condition & Remark
Parameter description	Parameters for frequency, output level, modulation status (AM/FM, internal/external signal, modulation degree, ON / OFF), and external control output are stored or recalled.	Max. number of parameters stored: 100

■ DDS signal (option, for VP-8193A / 8194A only)		
Item	Specification	Condition & Remark
Oscillation	Direct digital synthesizer, 12 bits	
Frequency range	20 Hz to 20 kHz	
Resolution	1 Hz	
Accuracy	$\pm 0.1 \%$	
Flatness	Same as the external modulation response	

■ Weather band output (option)		
Item	Specification	Condition & Remark
Frequency range	162.000 0 MHz to 163.000 0 MHz	
Resolution	100 Hz	
Accuracy	$\pm 5 \times 10^{-6}$	
Guaranteed performance modulation mode	FM monophonic	

■ External interface																																			
Item	Specification	Condition & Remark																																	
SCA INPUT		For VP-8193A / 94A only																																	
Input level	0.56 V [P-P] (0.2 V [rms])	Equivalent to the level ratio of 10 %																																	
Frequency range	20 kHz to 99 kHz, ± 1 dB	With reference to 57 kHz																																	
Input impedance	Approx. 10 k Ω																																		
COMP OUTPUT	Output terminal for monitoring modulation signals	For VP-8193A / 94A only																																	
Output voltage	Approx. 5 V [P-P]	Terminated at 600 Ω , FM mono 100 kHz																																	
Output impedance	Approx. 600 Ω																																		
PILOT OUTPUT	Output in modulation modes other than the MONO mode.	For VP-8193A / 94A only																																	
Output voltage	Approx. 1 V [rms]																																		
Output impedance	Approx. 1 k Ω																																		
GP-IB	<table border="1"> <thead> <tr> <th>Function</th><th>Code</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Source handshake</td><td>SH1</td><td>Complete capability</td></tr> <tr> <td>Acceptor handshake</td><td>AH1</td><td>Complete capability</td></tr> <tr> <td>Talker</td><td>T7</td><td>Basic talker, talker release MLA, and talk only</td></tr> <tr> <td>Listener</td><td>L3</td><td>Basic listener, listener release MTA, and listen only</td></tr> <tr> <td>Service request</td><td>SR0</td><td>No capability</td></tr> <tr> <td>Remote / Local</td><td>RL1</td><td>Complete capability</td></tr> <tr> <td>Parallel poll</td><td>PP0</td><td>No capability</td></tr> <tr> <td>Device clear</td><td>DC1</td><td>Complete capability</td></tr> <tr> <td>Device trigger</td><td>DT0</td><td>No capability</td></tr> <tr> <td>Controller</td><td>C0</td><td>No capability</td></tr> </tbody> </table>		Function	Code	Description	Source handshake	SH1	Complete capability	Acceptor handshake	AH1	Complete capability	Talker	T7	Basic talker, talker release MLA, and talk only	Listener	L3	Basic listener, listener release MTA, and listen only	Service request	SR0	No capability	Remote / Local	RL1	Complete capability	Parallel poll	PP0	No capability	Device clear	DC1	Complete capability	Device trigger	DT0	No capability	Controller	C0	No capability
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Controller	C0	No capability																																	

■ External interface (Cont'd)		
Item	Specification	Condition & Remark
RS-232-C		
Baud rate	38 400 bps	
Character length	8 bits	
Parity	EVEN	
Flow control	Xon / Xoff	
Stop bit	1 bit	
External control interface		
Description	(1) Remote sequential recall (2) Remote modify (3) Remote direct recall (4) Control output (5) Print out of memory contents (list output) (6) Data read (7) Relay drive output Output voltage: Approx. 5 V Output current: Approx. 50 mA	

■ Power requirement		
Item	Specification	Condition & Remark
Mains voltage	90 V to 250 V	
Mains frequency	50 Hz / 60 Hz	
Power consumption	≤60 VA	

2-2 ENVIRONMENTAL CONDITIONS

■ Temperature and relative humidity range		
Item	Specification	Condition & Remark
Limit range of guaranteed performance	10 °C to 35 °C / 20 % to 85 % (RH)	
Limit range of operation	0 °C to 40 °C / 20 % to 85 % (RH)	
Limit range of storage	−20 °C to 55 °C / 20 % to 90 % (RH)	

■ Overvoltage category		
Item	Specification	Condition & Remark
Overvoltage category	CAT. II (IEC 61010-1)	

2-3 MECHANICAL PERFORMANCE

■ External dimensions and mass		
Item	Specification	Condition & Remark
External dimensions	426 (w) × 99 (H) × 300 (D) mm	(The knobs, connectors, handle, and feet are excluded.)
Mass	Approx. 9.0 kg	

2-4 ACCESSORIES

■ Furnished accessories		
Item	Specification	Condition & Remark
	Instruction manual 1	
	Power cable 1	
	Spare fuse..... 1	
	Floppy disk..... 1	For VP-8194A only
	Editor instruction manual 1	For VP-8194A only

2-5 WIRING REQUIREMENTS

■ Wiring requirements		
Location	Item (Cable name)	Product specifications (Requirements)
Front panel	AF EXT INPUT cable	<3 m (BNC type, shielded)
	RF OUTPUT cable	<3 m (BNC type, shielded)
Rear panel	AC Power cable	<3 m (attached)
	RS-232-C interface cable	<3 m (shielded)
	GP-IB interface cable	<5 m (metal shell, shielded)
	EXT CONTROL I/O interface cable	<3 m (shielded)
	DRIVE OUTPUT cable	<3 m (RCA-PIN type, shielded)
	SCA INPUT cable	<3 m (BNC type, shielded)
	COMPOSITE cable	<3 m (BNC type, shielded)
	PILOT cable	<3 m (BNC type, shielded)

CHAPTER III INSTALLATION

This section describes electrical and mechanical precautions for using the Instrument safely and properly. Please read this section before using the instrument.

3-1 POWER REQUIREMENTS



The Instrument can be operated from any power source supplying 90 V to 250 V, 50 or 60 Hz.

Power consumption is 60 VA or less.



WARNING



Operate the instrument at the specified supply voltage.

Before connecting AC power to the instrument, be sure that the supply voltage is within the range from 90 V to 250 V.

3-2 FUSE



Verify the proper fuse is installed in the fuse holder. Ratings of the fuse are noted on the rear panel and listed below.

Nominal voltage	Fuse
100 V	250 V
120 V	0.8 A (T)
220 V	250 V
230 V	0.4 A (T)



CAUTION



Use the specified fuse.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of make-shift fuses and short-circuiting of fuse holders are prohibited.

3-3 POWER CABLE



The Instrument is equipped with a detachable power cable assembly. The type of the plug shipped with each instrument depends on the country of destination. Figure 3-1 illustrates four types of power cables available.

To order a power cable, include the instrument model number, instrument ID number, and the cable type shown in Figure 3-1. Address the order to the dealer or representative from which you purchased the instrument.

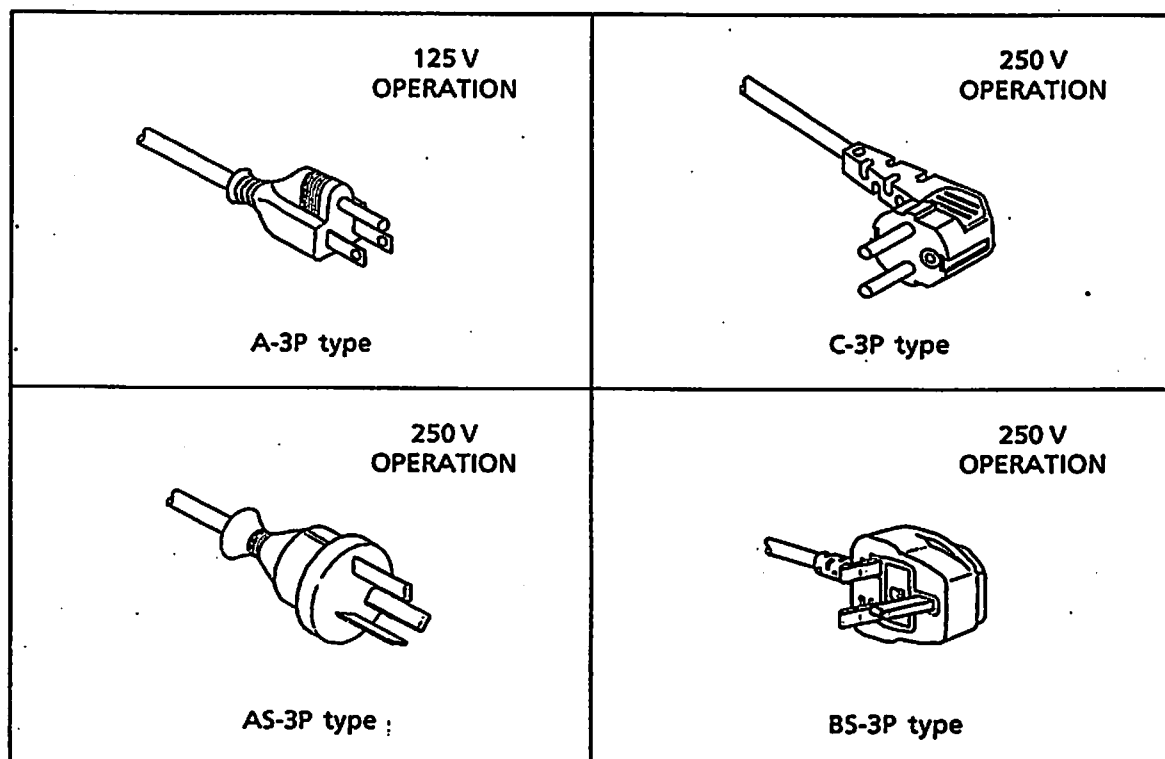


Figure 3-1 Power cables

3-4 CONNECTING TO OTHER EQUIPMENT

Plug the power cable into a properly grounded 3-wire receptacle before connection the instrument to other equipment. The interconnections are made with input / output coaxial connectors on the front panel and RCA-type pin connector *GP-IB* connector, *RS-232-C* connector, *EXT CONTROL I/O* connector and coaxial connectors on the rear panel.

All outer metal shells of coaxial connectors and RCA-type pin connector are directly connected to the chassis and frame of the instrument.

No hazardous voltage will appear on any pin of all types of connectors. The multi-pin rear panel connectors, *GP-IB* connector, *RS-232-C* connector, *EXT CONTROL I/O* connector, should only be connected to the control devices meeting the specifications of the instrument. See chapters 6 to 8 of this manual.

Use the dedicated cable, VQ-023H10 for connecting the *EXT CONTROL I/O* connector of the instrument with a printer for memory list output. Otherwise it may result in failure.



CAUTION

- Never apply reverse power to the coaxial output connectors or a failure may occur.

3-5 INSTALLING ON A DESKTOP

The instrument has plastic feet and a foldaway tilt stand. The tilt stand raises the front of the instrument for easier operation of the front panel controls.

Stacking with other instruments may be allowed only when it does not cause degradation of the performance due to interference such as vibration or electromagnetic induction.

3-6 OPTIONAL RACK MOUNT

The instrument has dedicated rack mounted.

If the instrument is rack mounted, a set of rack mount kit is required. The kit can be assembled easily and suited to 480 mm wide racks conforming to IEC 6010. (Rack mount kit: VQ-069H10)

3-7 BATTERY

The memory back-up battery built in this instrument is a rechargeable lithium cell. The battery should be treated as follows:

- (1) The battery life is three years or longer under normal operating environment. After the life is over, replacement will be needed to avoid insufficient back-up.
- (2) Do not remove or short-circuit the battery and never throw it into a fire.

3-8 INSTALL OF EDITOR (VP-8194A only)

The instrument provides a software "RDS data editor" operated on Microsoft Windows to make a data for RDS pattern. To operate the supplied editor, first it must be install on a computer hardware disk. Described below are the computer environment required to operate the editor, connection of the instrument with a computer, install of the editor, and deletion of the editor.

3-8-1 Operational environment

The supplied editor is software operated on Microsoft Windows. In most cases, the editor can be operated on a computer providing environment where Microsoft Windows is available.

Table 3-2 shows the environmental conditions for operating the editor, which must be provided for a computer.

Table 3-1 Operational environment

Item	Required conditions
Compatible OS	Windows 95/98, Windows NT4.0
Compatible computer	Applicable to the above compatible OS. 100 % AT Compatibility
Necessary memory	16 M bytes or more (Windows 95/98)* 32 M bytes or more (Windows NT4.0)*
FDD	1.44 MB 3.5" drive 1 unit
Hard disk	When install empty capacity over 5 MB is required.
Display	640 × 480 dots (VGA) required , 800 × 600 dots recommended
Key board	Applicable to the above compatible OS.
Serial Port	Possible to use communication port compatible to over one RS-232C

* : Windows 95, Windows 98, and Windows NT4.0 are the registered trademark of Microsoft Corp.

3-8-2 Connection

If a measurement program created with the editor is downloaded to the instrument, the instrument must be connected with a computer via the RS-232-C interface.

- D-sub 9-pin female to D-sub 9-pin female, reverse connection cable

3-8-3 Install of editor

- ① Turn on the computer and run Microsoft Windows.
- ② Insert the supplied floppy disk "Editor Setup Disk" into the floppy disk drive.
- ③ Select the [START] - [DESIGNATE A FILE NAME AND EXECUTE...].
- ④ Enter "<drive name>:\setup" in the [COMMAND LINE:] box and select the <OK> button. If the floppy disk is set in the drive A, enter "A: \setup" and select the <OK> button.
- ⑤ The installation screen appears.
- ⑥ According to the screen, install the files.

3-9 OTHERS

(1) Ambient temperature

The instrument can be operated within the temperature range of 0 °C to 40 °C. For entirely-guaranteed performance, use the instrument in the range of 10 °C to 35 °C.

(2) Warm-up

Allow a warm-up period of at least fifteen minutes before using the instrument for measurements.

(3) Caution for installation

To disconnect power source completely from the instrument, pull the mains plug from the fixed mains socket outlet.

Install the instrument so that the mains plug can be pulled out easily.

CHAPTER IV NAMES AND FUNCTIONS OF THE OPERATIONAL PARTS

4-1 GENERAL

This chapter describes the name and function of each section on the front and rear panels of this series of signal generators.

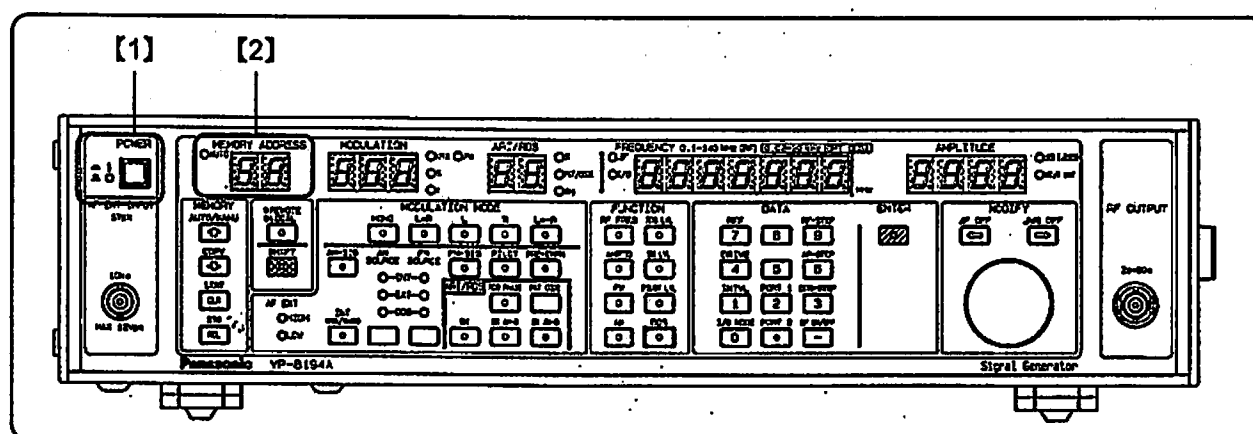
4-2 DESCRIPTION OF THE FRONT PANEL

4-3 DESCRIPTION OF THE REAR PANEL

4-2 DESCRIPTION OF THE FRONT PANEL

Shown below is the front panel of this series of signal generators. This paragraph gives you the name of each section and brief description of its function.

Note that the overall view of the model VP-8194A is used to shown the position of each block on the panel. Also the detailed description of each block is available in the relevant partially magnified figure.

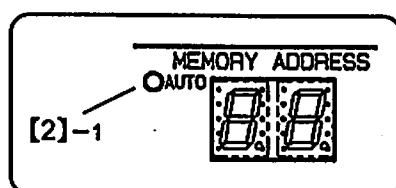


[1] POWER switch

Turns the mains power ON or OFF. Press the switch to turn on the power, and depress the switch to turn it off.

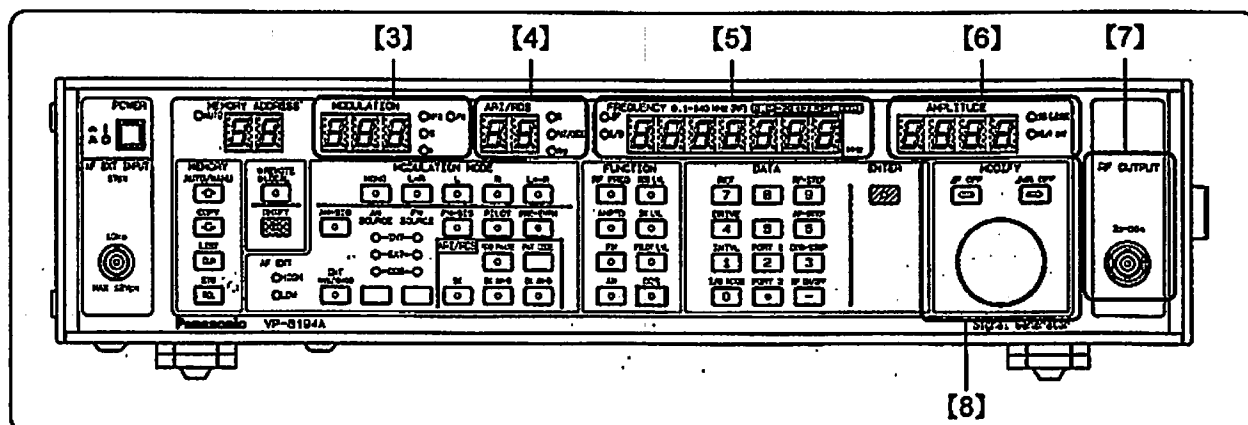
[2] MEMORY ADDRESS readout

Indicates the address of the current assorted preset memory.



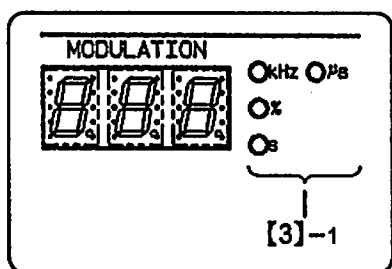
[2]-1 AUTO light

Lit when the assorted preset memory operates in the auto sequence mode.

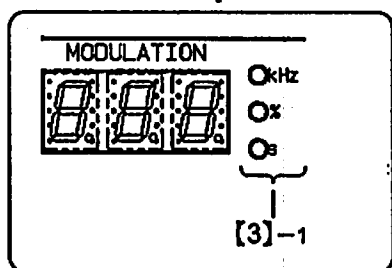


[3] MODULATION readout

Indicates various values related to modulation. The following table lists the details of values.



[VP-8193A / 94A]



[VP-8192A]

Description	Unit light ([3]-1)
AM degree	%
FM deviation	kHz
FM stereo modulation ratio*	%
Pilot level*	%
Interval time	s
Pre-emphasis*	μs

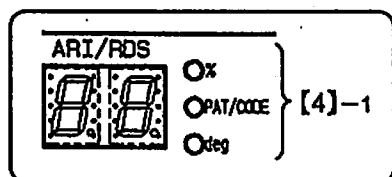
* for VP-8193A / 94A only

[3]-1 Unit light

The Unit light corresponding to the displayed value is lit.

[4] ARI / RDS readout (for VP-8194A only)

Indicates various values related to ARI signals and RDS signals. The following table lists the details of values.



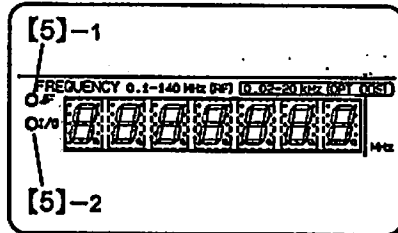
Description	Unit light ([4]-1)
RDS level	%
RDS pattern number	PAT / CODE
RDS sub carrier phase	deg
ARI SK level	%
ARI BK / DK signal modulation degree	%
ARI code number	PAT / CODE

[4]-1 Unit light

The Unit light corresponding to the displayed value is lit.

[5] FREQUENCY readout

Indicates a set value of an RF frequency, I/O mode related to GP-IB or external control interface, or auto sequence mode of the assorted preset memory. Also it indicates a frequency of the DDS option (for VP-8193A / 8194A only).



[5]-1 $\angle F$ light

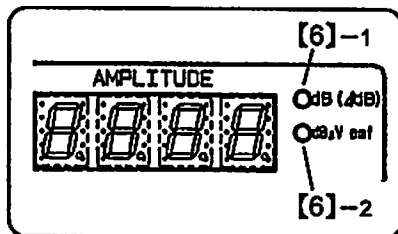
Lit when a relative RF frequency is set.

[5]-2 I/O light

Lit when an I/O mode or auto sequence mode is set.

[6] AMPLITUDE readout

Indicates an RF output level. Nothing is indicated when RM output is turned off.



[6]-1 dB ($\angle dB$) light

Lit when a relative RF level is set.

[6]-2 dB μ V emf light

Lit when an item other than an relative RF level is set.

[7] RF OUTPUT connector

A BNC receptacle for supplying RF output signals.

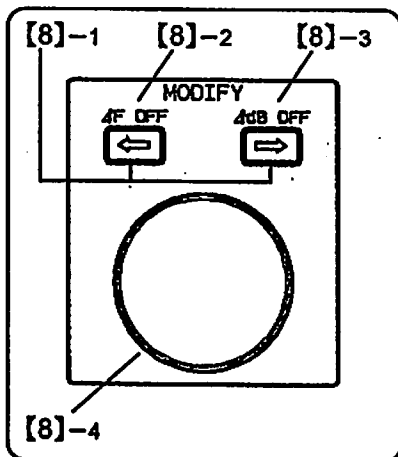
[8] MODIFY block

Used for the setting operation as described below.

CommonRF frequency, Output level, AM degree, FM deviation

VP-8193A / 8194A only.....FM stereo modulation ratio, Pilot level, DDS frequency (option)

VP-8194A onlyRDS level, SK level of ARI, RDS pattern selection, BK modulation degree, DK modulation degree



[8]-1 \leftarrow \rightarrow keys

Press either key to specify a digit subject to setting.

[8]-2 $\angle F$ OFF key

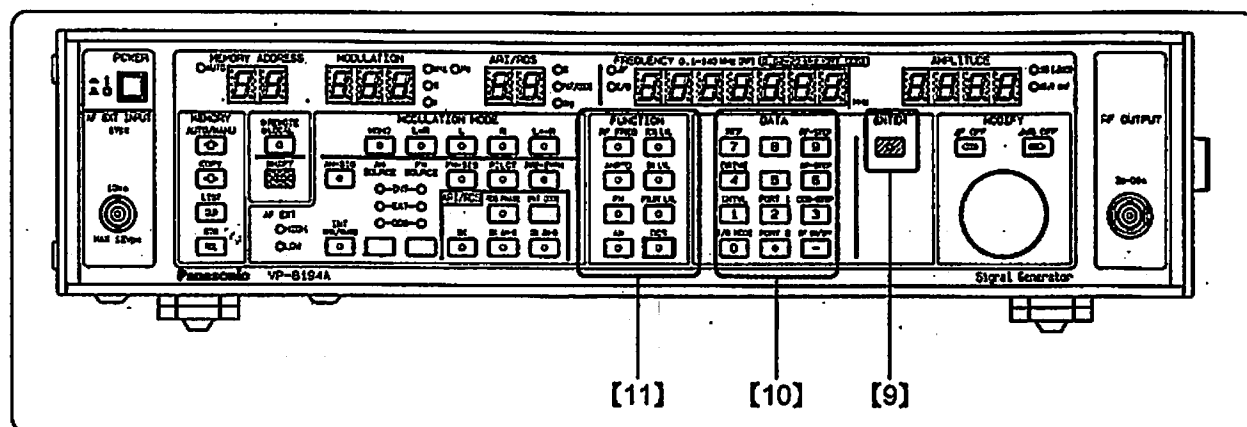
Press this key following the **SHIFT** \leftarrow [16] to cancel the relative value display of a frequency.

[8]-3 $\angle dB$ OFF key

Press this key following the **SHIFT** \leftarrow [16] to cancel the relative value display of an RF output level.

[8]-4 Rotary encoder knob

Changes the numeric value at the digit specified with the \leftarrow or \rightarrow key.



[9] ENTER key

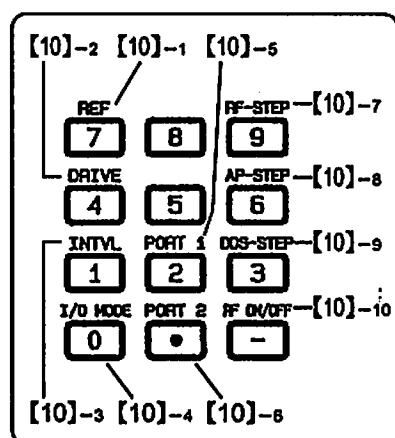
Confirms the value entered with the keys in the **DATA** block [10].

[10] DATA block



Data keys

Twelve keys are provided. Press the data keys to enter a numeric value for each setting.



[10]-1 REF key

Press this key following the **SHIFT** key [16] to specify a reference value for the relative value display of an RF frequency or output level.

[10]-2 DRIVE key

Press this key following the **SHIFT** key [16] to specify a reverse frequency of a relay drive output.

[10]-3 INTVL key

Press this key following the **SHIFT** key [16] to enable the interval time setting mode in the auto sequence operation of the assorted preset memory.

[10]-4 I/O MODE key

Press this key following the **SHIFT** key [16] to specify the I/O mode of GP-IB, external control interface, or auto sequence of the assorted preset memory.

[10]-5 PORT 1 key

Press this key following the **SHIFT** key [16] to specify the mode of PORT 1 of the external control interface.

[10]-6 PORT 2 key

Press this key following the **SHIFT** key [16] to specify the mode of PORT 2 of the external control interface.

[10]-7 RF-STEP key

Press this key following the **SHIFT** key [16] to specify a variable step amount of an RF frequency.

[10]-8 AP-STEP key

Press this key following the **SHIFT** key [16] to specify a variable step amount of an output level.

[10]-9 DDS-STEP key (for VP-8193A / 94A only, option)

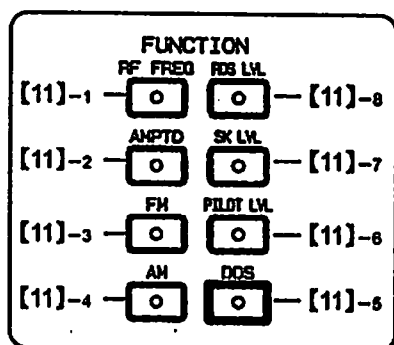
Press this key following the **SHIFT** key [16] to specify a variable step amount of a DDS frequency.

[10]-10 RF-ON / OFF key

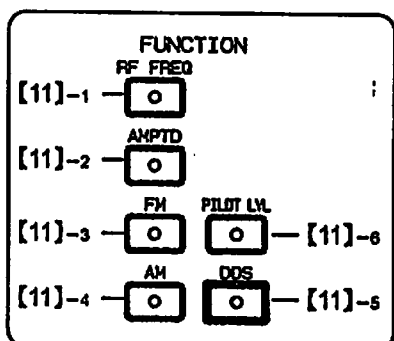
Press this key following the **SHIFT** key [16] to turn RF output ON or OFF. In the OFF case, the 7-segment LED in the **AMPLITUDE** readout [6] is lit off.

[11] FUNCTION block

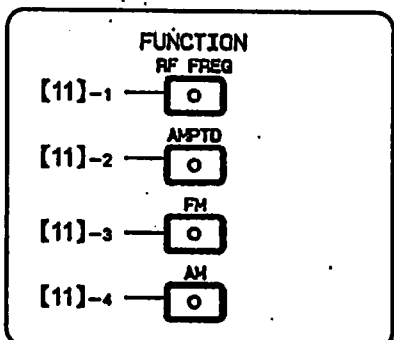
Used to select a setting function for each value. The key light corresponding to the specified function is lit.



[VP-8194A]



[VP-8193A]



[VP-8192A]

[11]-1 RF FREQ key

Press this key to enable the setting operation for an RF frequency.

[11]-2 AMPTD key

Press this key to enable the setting operation for an output level.

[11]-3 FM key

Press this key to enable setting operation for frequency modulation.

[11]-4 AM key

Press this key to enable the setting operation for amplitude modulation.

[11]-5 DDS key (for VP-8193A / VP-8194A only, option)

Press this key to enable the setting operation for a DDS frequency.

[11]-6 PILOT LVL key (for VP-8193A / VP-8194A only)

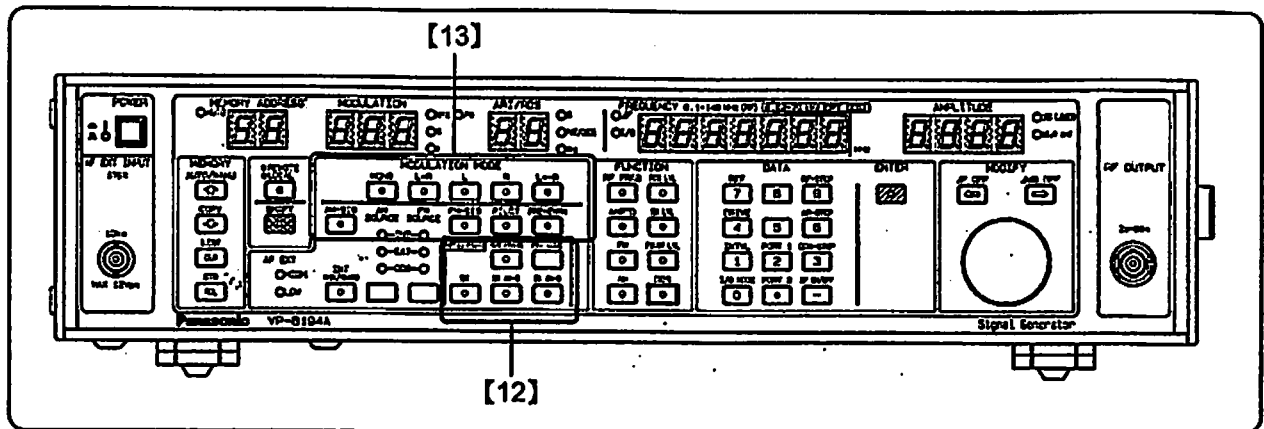
Press this key to enable the setting operation for a pilot signal level.

[11]-7 SK LVL key (for VP-8194A only)

Press this key to enable the setting operation for an SK signal level.

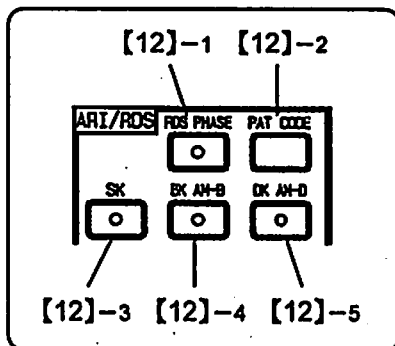
[11]-8 RDS LVL key (for VP-8194A only)

Press this key to enable the setting operation for an RDS signal level.



[12] ARI / RDS block (for VP-8194A only)

Used to make settings related to ARI and RDS signals.



[12]-1 RDS / PHASE key

Press this key to turn RDS signal output ON or OFF. In the ON case, the relevant light is lit.

Press this key following the **SHIFT** key [16] to enable the setting mode for a sub carrier phase of RDS signals. In this case, the *deg* light in the **ARI / RDS** readout [4] is lit.

[12]-2 PAT / CODE key

Press this key to enable the setting mode for an RDS pattern number.

Press this key following the **SHIFT** key [16] to enable the setting mode for an ARI code number.

In either case, the **PAT / CODE** light in the **ARI / RDS** readout [4] is lit.

[12]-3 SK key

Press this key to turn ARI SK signal output ON or OFF. In the ON case, the relevant light is lit.

[12]-4 BK / AM-B key

Press this key to turn ARI BK signal output ON or OFF. In the ON case, the relevant light is lit.

Press this key following the **SHIFT** key [16] to enable the setting mode for a modulation degree of ARI BK signals. In this case, the % light in the **ARI / RDS** readout [4] is lit.

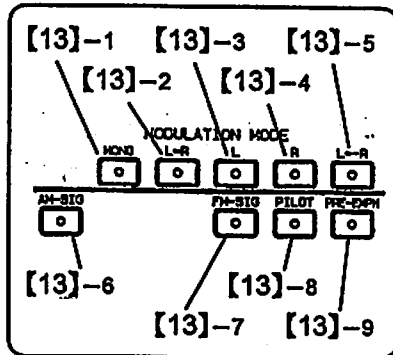
[12]-5 DK / AM-D key

Press this key to turn ARI DK signal output ON or OFF. In the ON case, the relevant light is lit.

Press this key following the **SHIFT** key [16] to enable the setting mode for a modulation degree of ARI DK signals. In this case, the % light in the **ARI / RDS** readout [4] is lit.

[13] MODULATION MODE block 1 (MODULATION block for VP-8192A)

Used to make various settings related to modulation.



[VP-8193A/94A]

[13]-1 MONO key

Sets the frequency modulation (FM) to the MONO mode.

[13]-2 L=R key

Sets the frequency modulation (FM) to the L=R mode.

[13]-3 L key

Sets the frequency modulation (FM) to the L mode.

[13]-4 R key

Sets the frequency modulation (FM) to the R mode.

[13]-5 L=R key

Sets the frequency modulation (FM) to the L=R mode.

[13]-6 AM-SIG key

Press this key to turn amplitude modulation (AM) ON or OFF. In the ON case, the relevant light is lit.

[13]-7 FM-SIG key

Press this key to turn frequency modulation (FM) ON or OFF. In the ON case, the relevant light is lit.

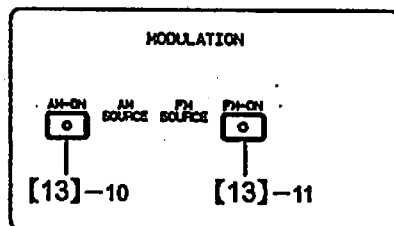
[13]-8 PILOT key

Press this key to turn pilot signal output ON or OFF. In the ON case, the relevant light is lit. Note that pilot signal output cannot be turned OFF when the modulation mode is set to MONO.

[13]-9 PRE-EMPH key

Used to select a pre-emphasis amount among OFF, 25 μ s, 50 μ s, and 75 μ s.

Press this key once to display the current pre-emphasis amount in the MODULATION readout [3]. Press it again to change the pre-emphasis amount. In the OFF case, the relevant light is off. In the other cases, the light is lit.



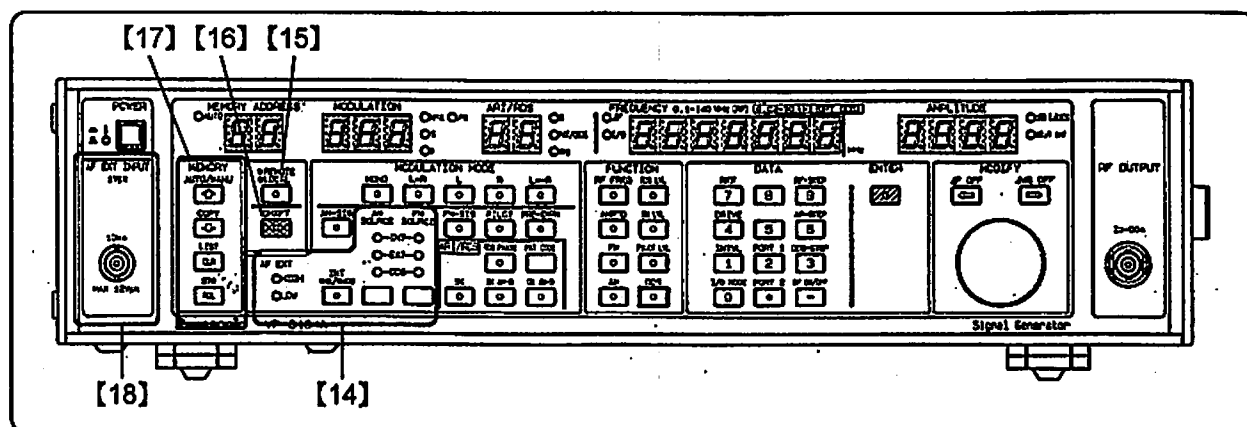
[VP-8192A]

[13]-10 AM-ON key

Press this key to turn amplitude modulation (AM) ON or OFF. In the ON case, the relevant light is lit.

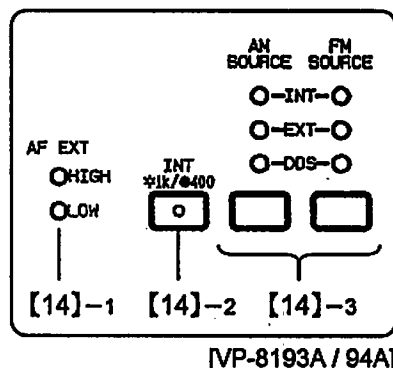
[13]-11 FM-ON key

Press this key to turn frequency modulation (FM) ON or OFF. In the ON case, the relevant light is lit.



[14] MODULATION MODE block 2 (MODULATION block for VP-8192A)

Used to make various settings related to modulation signals.



[VP-8193A / 94A]

[14]-1 AF EXT HIGH / LOW lights

Indicates the judgment result of the external modulation input signal level when AM or FM external modulation operation is enabled.

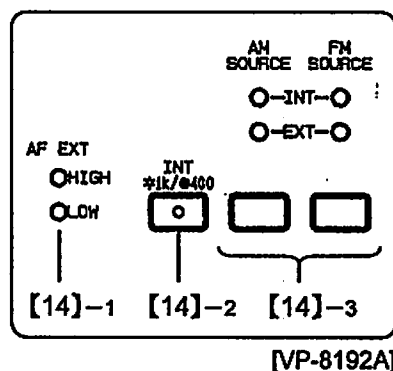
The **HIGH** light is lit when the input level is above the upper limit value. The **LOW** light is lit when the input level is below the lower limit value.

The both lights are off when the input level falls between the upper limit and lower limit values.

[14]-2 INT 1k / 400 key

Selects a frequency of the internal modulation signal.

The light is lit when 1kHz is selected, and lit off when 400 Hz is selected.



[VP-8192A]

[14]-3 AM SOURCE / FM SOURCE key

Used to select a modulation signal source for each AM and FM. Press keys to select either INT (internal signal source) or EXT (external signal source).

If the optional DDS signal source is provided in VP-8193A / 8194A, you may select DDS, too. In either case, the relevant light is lit.

[15] REMOTE / LOCAL key

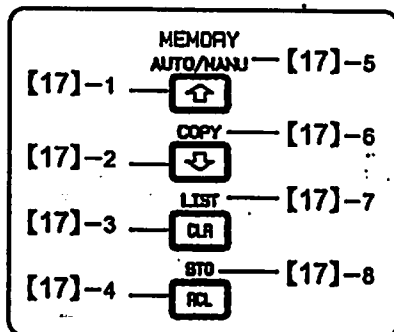
Press this key to toggle between the GP-IB remote state and local state. The light is lit when the remote state is enabled, and it is lit off when the local state is enabled.

[16] SHIFT key

Used together with a key that provides two functions to enable its second function (indicated in blue on the panel). The light is lit when the key is pressed, and lit off when the key providing the second function is pressed.

[17] MEMORY block

Used to make various settings related to the assorted preset memory.



[17]-1 key

Press this key to recall the address next to the currently displayed memory address in the sequential recall operation of the assorted preset memory.

[17]-2 key

Press this key to recall the address before the currently displayed memory address in the sequential recall operation of the assorted preset memory.

[17]-3 **CLR** key

Press this key to recall the start address in the sequential recall operation of the assorted preset memory.

[17]-4 **RCL** key

Press this key to specify a group in the direct or sequential recall operation of the assorted preset memory.

[17]-5 **AUTO/MANU** key

Press this key following the **SHIFT** key [16] to start or stop the auto sequence operation of the assorted preset memory.

[17]-6 **COPY** key

Press this key following the **SHIFT** key [16] to transfer the contents of the assorted preset memory to another signal generator via GP-IB interface.

[17]-7 **LIST** key

Press this key following the **SHIFT** key [16] to output the contents of the assorted preset memory to a printer via external control interface.

[17]-8 **STO** key

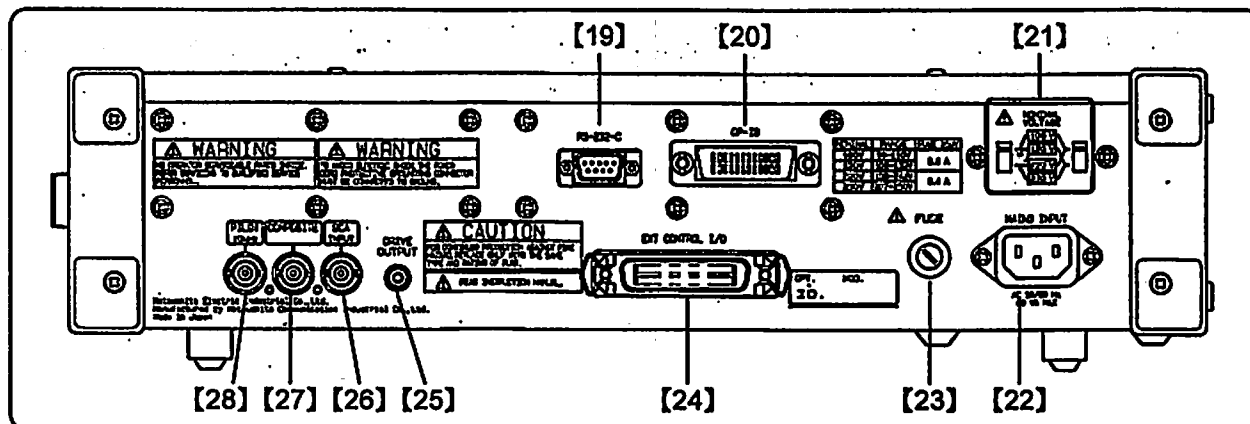
Press this key following the **SHIFT** key [16] to store the assorted preset memory contents, or divide into groups in the sequential recall operation.

[18] AF EXT INPUT connector

A BNC input receptacle for applying an external modulation signal.

4-3 DESCRIPTION OF THE REAR PANEL

The rear panel of this series of signal generators is illustrated below. This paragraph gives the name of each section and brief explanation of its function.



[19] RS-232-C connector

A 9-pin connector for connecting the RS-232-C interface.

[20] GP-IB connector

A 25-pin connector for connecting the GP-IB interface.

[21] NOMINAL VOLTAGE switch

Selects a mains voltage appropriate for the local AC supply.

[22] MAINS INPUT connector

Accepts a power cable.

[23] Fuse holder

Holds the mains input fuse.

[24] EXT CONTROL I/O connector

A 36-pin connector for connecting the external control interface.

[25] DRIVE OUTPUT connector

An RCA-type pin connector for obtaining a signal for an external relay drive.

[26] SCA connector (for VP-8193A / 8194A only)

A BNC-type receptacle for obtaining the SCA signal externally.

[27] COMPOSITE connector (for VP-8193A / 8194A only)

A BNC-type receptacle for obtaining an FM stereo modulation signal.

[28] PILOT connector (for VP-8193A / 8194A only)

A BNC-type receptacle for obtaining the PILOT output signal.

CHAPTER V OPERATION

5-1 GENERAL

This chapter describes the basic panel operation of the models VP-8192A / 8193A / 8194A in the following order. It also contains the GP-IB program codes associated with each operation.

5-2 RF FREQUENCY

5-3 OUTPUT LEVEL

5-4 AMPLITUDE MODULATION (AM)

5-5 FREQUENCY MODULATION (FM)

5-6 MAIN- AND SUB-CHANNEL SIGNALS OF FM STEREO (VP-8193A / 8194A only)

5-7 PILOT SIGNAL (VP-8193A / 8194A only)

5-8 PRE-EMPHASIS (VP-8193A / 8194A only)

5-9 SCA SIGNAL (VP-8193A / 8194A only)

5-10 COMPOSITE SIGNAL OUTPUT LEVEL (VP-8193A / 8194A only)

5-11 RDS SIGNAL (VP-8194A only)

5-12 ARI SIGNAL (VP-8194A only)

5-13 DDS FREQUENCY (option, VP-8193A / 8194A only)

5-14 ASSORTED PRESET MEMORY

5-15 AUTO SEQUENCE OF THE ASSORTED PRESET MEMORIES

5-2 RF FREQUENCY

5-2-1 General

An RF frequency appears as a value ranging from 0.100 0 MHz to 140.000 0 MHz in the *FREQUENCY* readout. The decimal point represents the position of MHz. (162 000 to 163 000 MHz can be added optionally.)

Table 5-1 shows the band structure inside the instrument and setting resolutions.

Table 5-1 Frequency band structure

Band	RF frequency range (MHz)	Resolution (Hz)	Note
3	70.000 1 to 140.000 0	100	
2	35.000 1 to 70.000 0		
1	0.100 0 to 35.000 0		
Weather band	162.000 0 to 163.000 0		Option

■ NOTE

In the case of the relative value display, an actual frequency always falls within the allowable setting range. The relative value display is enabled when the $\angle F$ light is lit in the *FREQUENCY* readout. (See the paragraph "5-2-4 Relative value display.")

The basic operations related to RF frequency are explained in the following paragraphs.

5-2-2 Direct setting with the data keys

5-2-3 Modification with the *MODIFY* knob

5-2-4 Relative value display

5-2-5 Specifying a relative RF frequency value

5-2-6 Disabling the relative value display

5-2-7 Specifying a variable step amount of an RF frequency

5-2-8 Changing an RF frequency with a variable step amount

5-2-9 Disabling the variable step operation of an RF frequency

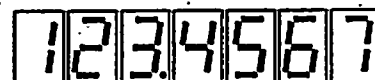
5-2-10 GP-IB program code

5-2-2 Direct setting with the data keys

Ex. Setting an RF frequency to 123.4567 MHz

- 1 Press the  key.

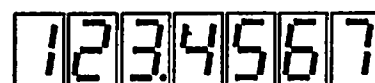
- 2 Enter an RF frequency with the data keys.



■ NOTE

If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

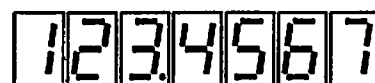
- 3 Press the  key.



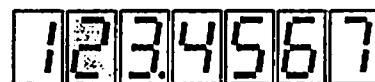
5-2-3 Modification with the *MODIFY* knob

Ex. Modifying the value from 123.4567 MHz to 123.457.0 MHz

- 1 Press the  key.

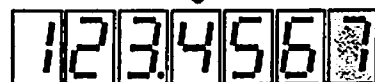
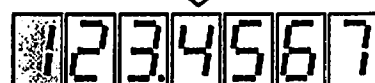


- 2 Specify a digit to be modified with the  or  key.



The currently specified digit blinks.

Press the  key three times.



■ NOTE

If there is no operation for five seconds, the digit will stop blinking.

- 3 When the digit stops blinking, modify the value with the *MODIFY* knob.



Turn the knob clockwise by three steps.

■ NOTE

The *MODIFY* knob can be turned endlessly. Turning the knob clockwise increases the frequency, while turning it counterclockwise decreases the frequency. Carry and borrow are available.

5-2-4 Relative value display

An RF frequency can be represented as a relative value in terms with an increase or decrease from a given reference value.

■ NOTE

The setting range of a relative RF frequency is -99.9999 MHz to 99.9999 MHz.

Ex. Setting a reference frequency to 100 MHz.

1 2 3 4 5 6 7

1 Press the  key.

2 Press the  key.

3 Press the  key.

4 Enter a reference frequency with the data keys.

1 0 0 . 0 0 0 0

■ NOTE

- Be sure to start numeral input while The data keys are blinking. Once they are lit off, you may not enter any value.
- If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

5 Press the  key.

2 3 4 5 6 7

The ΔF light is lit and a relative value is displayed.

■ NOTE

The setting range and resolution are as shown in Table 5-1.

Ex. Setting the current frequency as a reference frequency

1 2 3 4 5 6 7

1 Press the  key.

2 Press the  key.

- 3 Press the  key.

- 4 Press the  key.



The ΔF light is lit and a relative value is displayed.

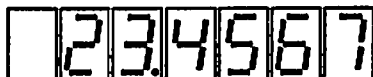
(The relative value display indicates 0 because the current frequency is the reference frequency.)

■ NOTE

The reference frequency cannot be set as long as the relative value display is enabled (the ΔF light is lit).

Ex. Verifying the reference frequency

- 1 Press the  key.



- 2 Press the  key.

- 3 Press the  key.



■ NOTE

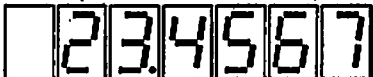
The reference frequency cannot be verified as long as the relative value display is disabled (the ΔF light is lit off).

5-2-5 Specifying a relative RF frequency value

To perform this operation, the relative value display should be enabled (the ΔF light is lit).

Ex. Setting a relative frequency value to -1 MHz when the reference frequency is 100 MHz

- 1 Press the  key.



- 2 Enter a relative frequency with the data keys.

- 3 Press the  key.



5-2-6 Disabling the relative value display

To perform this operation, the relative value display should be enabled (the ΔF light is lit).

1 Press the  key

2 Press the  key.

Then the relative value display of an RF frequency is disabled, and the ΔF light is lit off. The *FREQUENCY* readout returns to the normal frequency display.

5-2-7 Specifying a variable step amount of an RF frequency

An RF frequency can be varied at a certain step amount.

■ NOTE

The setting range of a step RF frequency is -99.9999 MHz to 99.9999 MHz.

Ex. Setting a variable step amount to 10 MHz.

1234567

1 Press the  key.

2 Press the  key.

3 Enter a variable step amount with the data keys.

■ NOTE

If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

4 Press the  key.

10.0000

The set value is displayed for about 10 seconds.

Ex. Verifying the variable step amount.

1 Press the  key.

2 Press the  key.

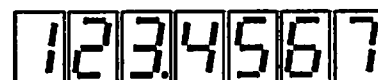


The set value is displayed for about 10 seconds.

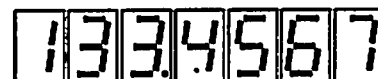
5-2-8 Changing an RF frequency with a variable step amount

Ex. Increasing the RF frequency from 123.4567 MHz once, and then decrease twice at a 10 MHz step.

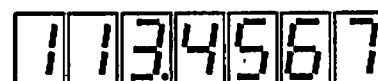
1 Press the  key.



2 Turn the *MODIFY* knob clockwise by one step.



3 Turn the *MODIFY* knob counterclockwise by two steps.



■ **NOTE**

- The *MODIFY* knob can be turned endlessly. Turning the knob clockwise increases the frequency, while turning it counterclockwise decreases the frequency. Carry and borrow are available.
- The variable range is as shown in Table 5-1.
- When the variable step operation is enabled, the *MODIFY* knob works as a variable step knob. Thus it cannot be used for normal frequency modification operation.

5-2-9 Disabling the variable step operation of an RF frequency

1 Press the  key.

2 Press the  key.

3 Press the  key.

4 Press the  key.

■ **NOTE**

Once the variable step operation is disabled, the *MODIFY* knob can be used for normal frequency modification operation.

5-2-10 GP-IB program code

As for an RF frequency, GP-IB control is available for the direct setting with numeric values. Table 5-2 contains the program codes used for this purpose.

Table 5-2 GP-IB program codes related to an RF frequency

Header code	Data code	Unit code	Description
FR	0.1000 to 140.0000		Specifies an RF frequency.
	162.0000 to 163.0000		Specifies a weather band frequency.(option)

5-3 OUTPUT LEVEL

5-3-1 General

An output level is displayed in the **AMPLITUDE** readout. The display range is as follows.

–20.0 dB μ V to 126 dB μ V [emf] (0 dB μ V = 1 μ V [emf], open end)

The resolution is 0.1 dB.

The relative value display ranges from 0.0 dB to ± 146 dB with the plus (+) symbol omitted. An actual output level, however, does not exceed the allowable setting range. A relative value is displayed in the dB unit.

The basic operations related to an output level are explained in the following paragraphs.

5-3-2 Direct setting with the data keys

5-3-3 Modification with the **MODIFY** knob

5-3-4 Relative value display

5-3-5 Specifying a relative output level value

5-3-6 Disabling the relative value display

5-3-7 Turning an RF output signal ON or OFF

5-3-8 Specifying a variable step amount of an output level

5-3-9 Changing an output level with a variable step amount

5-3-10 Disabling the variable step operation of an output level

5-3-11 GP-IB program code

5-3-2 Direct setting with the data keys

Ex. Setting an output level to 12.3 dB μ V [emf]

1 Press the  key.

2 Enter an output level with the data keys.



3 Press the  key.


 0 dB μ V emf

 0 dB μ V emf

5-3-3 Modification with the *MODIFY* knob

Ex. Modifying the value from 12.3 dB μ V [emf] to 13 dB μ V [emf]

- 1 Press the  key.

 ○ dB μ V emf

- 2 Specify a digit to be modified with the  or  key.

 ○ dB μ V emf

The currently specified digit blinks.

Press the  key three times.

 ○ dB μ V emf

 ○ dB μ V emf

■ NOTE

If there is no operation for five seconds, the digit will stop blinking.

- 3 When the digit stops blinking, modify the value with the *MODIFY* knob.

 ○ dB μ V emf

Turn the knob clockwise by seven steps.

■ NOTE


The *MODIFY* knob can be turned endlessly. Turning the knob clockwise increases the output level, while turning it counterclockwise decreases the level. Carry and borrow are available.

5-3-4 Relative value display

An output level can be represented as a relative value in terms with an increase or decrease from a given reference value.

Ex. Setting a reference level to 12 dB μ V [emf]

- 1 Press the  key.

 ○ dB μ V emf

- 2 Press the  key.

- 3 Press the  key.

- 4 Enter a reference output level with the data keys.

 ○ dB μ V emf

■ NOTE

- Be sure to start numeral input while The data keys are blinking. Once they are lit off, you may not enter any value.
- If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

- 5 Press the  key.

 Δ dB (Δ dB)

The Δ dB light is lit and a relative value is displayed.

■ NOTE

The setting range and resolution are as shown in the paragraph 5-3-1.

Ex. Setting the current output level as a reference level.

- 1 Press the  key.

- 2 Press the  key.

- 3 Press the  key.

- 4 Press the  key.

 Δ dB μ V emf

 Δ dB (Δ dB)

The Δ dB light is lit and a relative value is displayed.

(The relative value display indicates 0 because the current output levels the reference level.)

■ NOTE

The reference level cannot be set as long as the relative value display is enabled (the Δ dB light is lit).

5-3-5 Specifying a relative output level value

To perform this operation, the relative value display should be enabled (the Δ dB light is lit).

Ex. Setting a relative output level value to 34 dB when the reference level is 12 dB μ V [emf].

- 1 Press the  key.

 Δ dB (Δ dB)
(A relative level is displayed.)

- 2 Enter a relative output level with the data keys.



■ NOTE

- Be sure to start numeral input while The data keys are blinking. Once they are lit off, you may not enter any value.
- If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

- 3 Press the  key.



5-3-6 Disabling the relative value display

To perform this operation, the relative value display should be enabled (the ΔdB light is lit).

- 1 Press the  key.

- 2 Press the  key.

Then the relative value display of an output level is disabled, and the ΔdB light is lit off. The *AMPLITUDE* readout returns to the normal output level display.

5-3-7 Turning an RF output signal ON or OFF

To perform this operation, the relative value display should be enabled (the ΔdB light is lit).

- 1 Press the  key.

- 2 Press the  key.

Pressing this key toggles between ON and OFF. The 7-segment LED of the *AMPLITUDE* readout is lit at the ON time, and it is lit off at the OFF time.

5-3-8 Specifying a variable step amount of an output level


An output level can be varied at a certain step amount.

■ NOTE

The setting range of a step output level is 0 dB to ± 146 dB.

Ex. Setting a variable step amount to 5.5 dB.

1 Press the  key.

 0 dB μ V emf

2 Press the  key.


3 Enter a variable step amount with the data keys.

■ NOTE

If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

4 Press the  key.


 0 dB (Δ dB)

The set value is displayed for about 10 seconds.

Ex. Verifying the variable step amount.

1 Press the  key.

2 Press the  key.

 0 dB (Δ dB)

The set value is displayed for about 10 seconds.

5-3-9 Changing an output level with a variable step amount

Ex. Increasing the output level from 12.3 three times, and then decrease twice at a 5.5 dB step.

1 Press the  key.

 0 dB μ V emf

2 Turn the *MODIFY* knob clockwise by three steps.

 0 dB μ V emf





3 Turn the *MODIFY* knob counterclockwise by two steps.

 0 dB μ V emf

■ NOTE

- The *MODIFY* knob can be turned endlessly. Turning the knob clockwise increases the output level, while turning it counterclockwise decreases the level. Carry and borrow are available.
- The variable range is as shown in the paragraph 5-3-1.
- When the variable step operation is enabled, the *MODIFY* knob works as a variable step knob. Thus it cannot be used for normal output level modification operation.

5-3-10 Disabling the variable step operation of an output level

- 1 Press the  key.
- 2 Press the  key.
- 3 Press the  key.
- 4 Press the  key.

■ NOTE

Once the variable step operation is disabled, the *MODIFY* knob can be used for normal output level modification operation.

5-3-11 GP-IB program code

As for output levels, GP-IB control is available for turning ON / OFF of an output signal and its direct setting with numeric values. Table 5-3 contains the program codes used for this purpose.

Table 5-3 GP-IB program codes related to an output level

Header code	Data code	Unit code	Description
AP or LE	—20.0 to 126.0		Specifies an output level
	ON		Turns the output signal ON
	OF		Turns the output signal OFF

5-4 AMPLITUDE MODULATION (AM)

5-4-1 General

The status of amplitude modulation is shown in the **MODULATION** block and **MODULATION** readout. The **MODULATION** block contains modulation ON / OFF status, selection of a modulation signal, and the judgment result of an external modulation input signal level, while the **MODULATION** readout contains an AM degree.



The setting range and resolution of an AM degree are shown in Table 5-4 below.

Table 5-4 AM degree setting range and resolution

AM degree range (%)	Resolution (%)
0 to 100	0.5

■ NOTE

The **MODULATION** readout normally shows either AM degree or FM deviation.

To switch between AM degree and FM deviation, press the  key or  key.

The basic operations related to amplitude modulation are described in the following paragraphs.

5-4-2 Turning amplitude modulation ON or OFF

5-4-3 Selecting an AM signal

5-4-4 Direct setting with the data keys

5-4-5 Modification with the MODIFY knob

5-4-6 External amplitude modulation

5-4-7 GP-IB program code

5-4-2 Turning amplitude modulation ON or OFF

- 1 Press the  key. (or  key in the VP-8192A case.)

Pressing this key switches AM between ON and OFF. The key light is lit in the ON case, and it is lit off in the OFF case.

■ NOTE

Even after amplitude modulation is turned OFF, the **MODULATION** readout still shows AM degree.

5-4-3 Selecting an AM signal

An AM signal can be selected among the following three:

- The internal sine wave of 400 Hz or 1 kHz (INT)
- An externally supplied signal of 20 Hz to 10 kHz (EXT)
- The optional DDS sine wave (DDS)

Select a desired signal using the **AM SOURCE** key in the **MODULATION** block.

Every press toggles a signal among INT, EXT, and DDS. When your model is VP-8192A or the DDS option is not installed in the model VP-8193A / 8194A, an AM signal is toggled between INT and EXT. The selected signal can be identified from the **INT**, **EXT**, and **DDS** lights.

Once INT is selected, press the **INT** key to switch a frequency between 400 Hz and 1 kHz. The key light is lit when 1 kHz is selected. It is lit off when 400 Hz is selected.


■ **NOTE**

The instrument automatically recognizes the DDS option. When the DDS option is not installed, the instrument does not perform any DDS-related control.

The model VP-8192A, which does not support the DDS option, is not equipped with the DDS-related panel keys.

5-4-4 Direct setting with the data keys

Ex. Setting an AM degree to 34.5 %

- 1 Press the  key.
- 2 Enter an AM degree with the data keys.

■ **NOTE**

If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

- 3 Press the  key.

 0%

■ **NOTE**

When an AM degree is set with the data keys or GP-IB code, AM operation is automatically turned ON.

5-4-5 Modification with the *MODIFY* knob

Ex. Modifying the AM degree from 34.5 % to 30 %

- 1 Press the  key.

34.5 0%

- 2 Specify a digit to be modified with the  or  key.

34.5 0%

The currently specified digit blinks.

Press the  key three times.

34.5 0%

34.5 0%

■ NOTE

If there is no operation for five seconds, the digit will stop blinking.

- 3 When the digit stops blinking, modify the value with the *MODIFY* knob.

30.0 0%

Turn the knob counterclockwise by nine steps.

■ NOTE

The *MODIFY* knob can be turned endlessly. Turning the knob clockwise increases the AM degree, while turning it counterclockwise decreases the AM degree. Carry and borrow are available.

5-4-6 External amplitude modulation

An AM signal may be supplied externally. An external modulation signal is applied to the *AF EXT INPUT* connector.

Characteristics of external amplitude modulation

The characteristics of external amplitude modulation are listed in Table 5-5 below.

Table 5-5 Characteristics of external AM

Item	Specification	Condition & Remark
Input impedance	Approx. 10 k Ω	
Reference input level	Approx. 1 V [peak]	
Frequency bandwidth	20 Hz to 10 kHz*	± 1 dB, 1 kHz reference

* The maximum allowable frequency is 2 % of the RF frequency at 30 % modulation.

Making amplitude modulation external

Press the *AM SOURCE* key in the *MODULATION* block. Then the *EXT* light is lit and amplitude modulation is made externally. (See the paragraph "5-4-3 Selecting an AM signal.")

External AM degree and input signal level

Just like the internal modulation case, an AM degree appears in the **MODULATION** readout as long as an external AM input signal keeps the reference value (approx. 1 V [peak]) so that you can set or modify an AM degree with The data keys or **MODIFY** knob.

■ NOTE

Once external amplitude modulation is enabled, the instrument detects an external AM input level. If it is above or below the reference value, the **HIGH** or **LOW** light in the **AF EXT** block is lit. In this case, adjust an input signal level in such a way that neither lights is lit.

5-4-7 GP-IB program code

In amplitude modulation, GP-IB control is available for modulation ON/OFF, selection of a modulation signal, and direct setting of AM degree with numeric values. Table 5-6 contains the program codes used for this purpose.

Table 5-6 GP-IB program codes related to amplitude modulation

Header code	Data code	Unit code	Description
AM			Selects amplitude modulation
	ON		Turns amplitude modulation ON
	OF		Turns amplitude modulation OFF
	TO		Sets an amplitude modulation signal to INT
	XD		Sets an amplitude modulation signal to EXT
	TD		Sets an amplitude modulation signal to DDS*
	0.0 to 100		Specifies an amplitude modulation degree
TO	1		Sets the frequency of the internal RC oscillator to 1 kHz
	4		Sets the frequency of the internal RC oscillator to 400 Hz

* Option, for VP-8193A / 8194A only

5-5 FREQUENCY MODULATION (FM)

5-5-1 General

The status of frequency modulation is shown in the **MODULATION** block and **MODULATION** readout. The **MODULATION** block contains modulation ON / OFF status, selection of a modulation signal, and the judgment result of an external modulation input signal level, while the **MODULATION** readout contains an FM deviation.

The setting range and resolution of an FM deviation are shown in Table 5-7 below.

Table 5-7 FM deviation setting range and resolution

Setting range (kHz)	Resolution (kHz)
0.0 to 100	0.5

NOTE

- The maximum allowable FM deviation is 50 % of an RF frequency. Setting a value falling outside the specified range turns frequency modulation off.
- The maximum allowable FM deviation for guaranteed performance is 25 % of an RF frequency.
- The **MODULATION** readout normally shows either AM degree or FM deviation.

To switch between AM degree and FM deviation, press the  key or  key.

- When pre-emphasis is ON, the **MODULATION** readout does not show an actual deviation amount.

The basic operations related to frequency modulation are described in the following paragraphs.

5-5-2 Turning frequency modulation ON or OFF

5-5-3 Selecting an FM signal

5-5-4 Direct setting with the data keys

5-5-5 Modification with the **MODIFY** knob

5-5-6 External frequency modulation

5-5-7 GP-IB program code

5-5-2 Turning frequency modulation ON or OFF

- 1 Press the  key. (or  key in the VP-8192A case.)

Pressing this key switches FM between ON and OFF. The key light is lit in the ON case, and it is lit off in the OFF case.

NOTE

Even after frequency modulation is OFF, the **MODULATION** readout still shows an FM deviation.

5-5-3 Selecting an FM signal

An FM signal can be selected among the following three:

- The internal sine wave of 400 Hz or 1 kHz (INT)
- An externally supplied signal of 20 Hz to 100 kHz (EXT)
- The optional DDS sine wave (DDS)

Select a desired signal using the *FM SOURCE* key in the *MODULATION* block.

Every press toggles a signal among INT, EXT, and DDS. When your model is VP-8192A or the DDS option is not installed in the model VP-8193A / 8194A, an FM signal is toggled between INT and EXT. The selected signal can be identified from the *INT*, *EXT*, and *DDS* lights.

Once INT is selected, press the *INT* key to switch a frequency between 400 Hz and 1 kHz. The key light is lit when 1 kHz is selected. It is lit off when 400 Hz is selected.

■ NOTE

The Instrument automatically recognizes the DDS option. When the DDS option is not installed, the instrument does not perform any DDS-related control.

The model VP-8192A, which does not support the DDS option, is not equipped with the DDS-related panel keys.

5-5-4 Direct setting with the data keys

Ex. Setting an FM deviation to 34.5 kHz

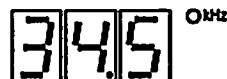
- 1 Press the  key.
- 2 Enter an FM deviation with the data keys.



■ NOTE

If a wrong value is entered, confirm the entered value once, and then repeat the setting operation from the procedure 1.

- 3 Press the  key.



■ NOTE


When an FM deviation is set with The data keys or GP-IB code, FM operation is automatically turned ON.

5-5-5 Modification with the *MODIFY* knob

Ex. Modifying the FM deviation from 34.5 kHz to 15 kHz

1 Press the  key.

34.5 kHz

2 Specify a digit to be modified with the  or  key.

34.5 kHz

The currently specified digit blinks.

Press the  key three times.

34.5 kHz

34.5 kHz

■ NOTE

If there is no operation for five seconds, the digit will stop blinking.

3 When the digit stops blinking, modify the value with the *MODIFY* knob.

15.0 kHz

Turn the knob counterclockwise by thirty-nine steps.

■ NOTE

The *MODIFY* knob can be turned endlessly. Turning the knob clockwise increases the FM deviation, while turning it counterclockwise decreases the FM deviation. Carry and borrow are available.

5-5-6 External frequency modulation

An FM signal may be supplied externally. An external modulation signal is applied to the *AF EXT INPUT* connector.

Characteristics of external frequency modulation

The characteristics of external frequency modulation are listed in Table 5-8 below.

Table 5-8 Characteristics of external FM

Item	Specification	Condition & Remark
Input impedance	Approx. 10 k Ω	
Reference input level	Approx. 1 V [peak]	
Frequency bandwidth	20 Hz to 100 kHz	± 1 dB, 1 kHz reference

Making frequency modulation external

Press the *FM SOURCE* key in the *MODULATION* block. Then the *EXT* light is lit and frequency modulation is made externally. (See the paragraph "5-5-3 Selecting an FM signal.")

Setting an external FM deviation

Just like the internal modulation case, an FM deviation appears in the **MODULATION** readout as long as an external FM input signal keeps the reference value (approx. 1 V [peak]) so that you can set or modify an FM deviation with the data keys or **MODIFY** knob.

■ NOTE

Once external frequency modulation is enabled, the instrument detects an external FM input level. If it is above or below the reference value, the **HIGH** or **LOW** light in the **AF EXT** block is lit. In this case, adjust an input signal level in such a way that neither lights is lit.

Input signal level and FM deviation

As shown in Figure 5-1, FM deviation varies linearly with an input level. If an external FM deviation is set to 75 kHz (the **MODULATION** readout shows 75 kHz, and neither **HIGH** nor **LOW** light of **AF EXT** is lit off) before the external signal is attenuated to 1/10 (20 dB), the **LOW** light is lit. At that time, the 7.5 kHz deviation (equal to 10 % assuming 75 kHz is 100 %) is exactly obtained. However, the deviation display is still 75 kHz.

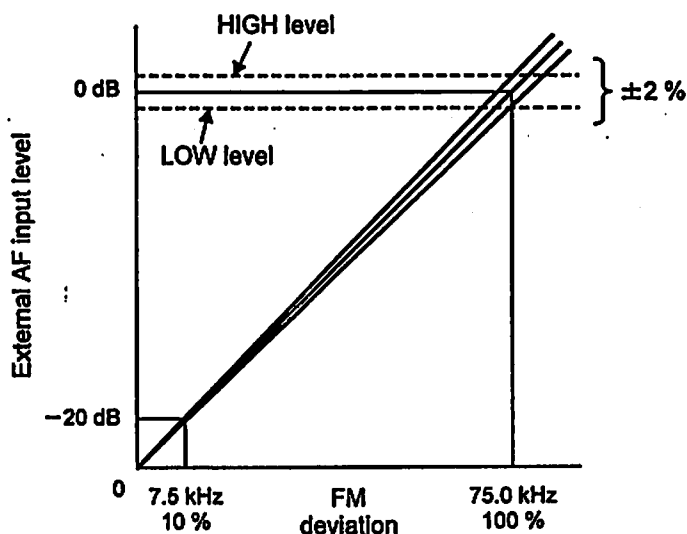


Figure 5-1 External AF input level and FM deviation

5-5-7 GP-IB program code

In frequency modulation, GP-IB control is available for modulation ON / OFF, selection of a modulation signal, and direct setting of FM deviation with numeric values. Table 5-9 contains the program codes used for this purpose.

Table 5-9 GP-IB program codes related to frequency modulation

Header code	Data code	Unit code	Description
FM			Selects frequency modulation
	ON		FM-related settings are reset. ^(Note)
	OF		FM-related settings are all turned OFF. ^(Note)
	TO		Sets an frequency modulation signal to INT
	XD		Sets an frequency modulation signal to EXT
	TD		Sets an frequency modulation signal to DDS (Option, for VP-8193A / 8194A only)
	0.0 to 100	(KZ)	Specifies an FM deviation
	0.0 to 127	(PC)	Specifies a frequency modulation ratio
TO	1		Sets the frequency of the internal RC oscillator to 1 kHz
	4		Sets the frequency of the internal RC oscillator to 400 Hz
MS	ON		Turns FM modulation ON. (Same feature as <i>FM-SIG</i> key)
	OF		Turns FM modulation OFF. (Same feature as <i>FM-SIG</i> key)

Note: Using the FM OF command turns OFF all FM-related settings given below.

- Frequency modulation (Setting condition of the *FM-SIG* key)
- Pilot signal
- Pre-emphasis
- RDS signal
- SK signal
- BK signal
- DK signal

Using the FM ON command returns the FM-related settings to the state immediately before using the FM OF command.

Note that there is no panel key corresponding to the FM ON/OFF commands.