LEADER

LG 3219 / LG 3238

RDS SIGNAL GENERATOR /
AM/FM STEREO SIGNAL GENERATOR

INSTRUCTION MANUAL

LEADER
ELECTRONIC MEASURING INSTRUMENTS

SAFETY PRECAUTIONS

(Be sure to keep the following precautions.)

Precautions that must be kept in order to prevent injuries to users or any other people and damages to their properties are explained below.

Use this instrument in a manner specified in this instruction manual. Otherwise, the protection provided by this instrument may be impaired.

■ Levels of injuries or damages that may occur when the instrument is used incorrectly without paying attention to descriptions of warnings or cautions are divided with marks shown below and their meanings are explained.

⚠ **DANGER**	Indicates a potentially hazardous situations which, if not heeded, should result in death or serious injury.
⚠ **WARNING**	Indicates a potentially hazardous situations which, if not heeded, could result in death or serious injury.
⚠ **CAUTION**	Indicates a potentially hazardous situations which, if not heeded, could result in minor or moderate injury or machine damage.

■ Precautions that must be kept are divided with marks shown below and their meanings are described. (Some of the marks are given below.)

	This mark describes matters which users must pay attention to.
	This mark describes matters which users must not perform.
	This mark describes matters which users must perform.

■ SAFETY SYMBOLS.

	**High voltage symbol:** This mark describes dangerous voltage exceeding 600 V.
	**Frame or chassis terminal:** Terminals with this mark are connected to chassis ground.
	**Power ON symbol:** In-position of the bistable power switch. At in-position, power is turned on.
	**Power OFF symbol:** Out-position of the bistable power switch. At out-position, power is turned off.

⚠ WARNING

Be sure to connect the protective earth terminal of the power cable to the ground.

Connect the protective earth terminal of the power cable to the ground to avoid an electric shock.

Do not attempt to damage the power cable and power plug.

Do not damage, modify, forcefully bend, twist, stretch, nor bind the power cable and power plug. Do not put a heat apparatus close to them nor a heavy object on them.

Using a damaged power cable or power plug may cause an electric shock, short-circuit, or fire.

- For repair of the damaged power cable or power plug, contact the dealer or representative from which you purchased the product.

Clean dust off the power plug periodically.

Any dust on the plug may cause insulation failure due to absorbed moisture. It may further result in fire.
Disconnect the power plug to wipe it with a dry cloth.

Surely insert the power plug to the full.

Improper insertion may cause an electric shock or fire due to the heated plug.
Never use a damaged plug or loose socket outlet.

Operate the instrument at the specified supply voltage.

Follow the supply voltage specified in the instruction manual. Otherwise, fire may break out.

Never insert or pull out the power cable with a wet hand.

Such an attempt may cause an electric shock.

Do not use the instrument in an explosive environment.

Never use the instrument in rooms having a flammable or volatile gas or vapor. Otherwise, explosion or fire may break out.

⚠ WARNING

Do not apply voltage exceeding the specified value.

Fire may break out. Do not apply voltage exceeding the value specified in this manual.

Do not disassemble the instrument.

Disassembly may cause an electric shock or malfunction.

- Though critical sections on safety are shielded, disassembly work may expose a hazardous section.

⚠ CAUTION

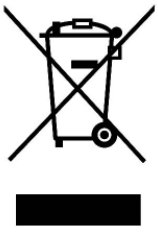
Use the specified fuse.

Use the rated fuse specified in the instruction manual for replacement. Otherwise, fire may break out.

Do not use the instrument which has any trouble nor is broken.

Otherwise, an electric shock or fire may break out. Immediately turn off the instrument and disconnect the power cable. Then contact the dealer or representative from which you purchased the instrument.

Information on Disposal for Users of Waste Electrical & Electronic Equipment (private households)



This symbol on the products and/or accompanying documents means that used electrical and electronic products should not be mixed with general household waste.

For proper treatment, recovery and recycling, please take these products to designated collection points, where they will be accepted on a free of charge basis. Alternatively, in some countries you may be able to return your products to your local retailer upon the purchase of an equivalent new product.

Disposing of this product correctly will help to save valuable resources and prevent any potential negative effects on human health and the environment which could otherwise arise from inappropriate waste handling. Please contact your local authority for further details of your nearest designated collection point.

Penalties may be applicable for incorrect disposal of this waste, in accordance with national legislation.

For business users in the European Union

If you wish to discard electrical and electronic equipment, please contact your dealer or supplier for further information.

Information on Disposal in other Countries outside the European Union

This symbol is only valid in the European Union.

If you wish to discard this product, please contact your local authorities or dealer and ask for the correct method of disposal.

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CHAPTER 1 GENERAL

1-1 INTRODUCTION

This instruction manual consists of the following sections:

CHAPTER 1 GENERAL

Provides a general description and feature of the signal generator.

CHAPTER 2 SPECIFICATIONS

Gives the specifications of this instrument.

CHAPTER 3 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 4 NAMES AND FUNCTIONS OF THE OPERATIONAL PARTS

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

CHAPTER 5 OPERATION

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

CHAPTER 6 GP-IB INTERFACE

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

CHAPTER 7 RS-232-C INTERFACE

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

CHAPTER 8 EXTERNAL CONTROL INTERFACE

Describes the external control interface function unique to the instrument.

CHAPTER 9 MAINTENANCE

Describes the daily maintenance procedure.

1-2 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 generates CW and FM modulation signals in the range of 162 MHz to 163 MHz. The series provides the remote control function.

This series features the FM and AM monophonic modulation function and a built-in FM stereo modulator based on the FM stereo broadcasting system. Additionally the model LG 3219 has built-in RDS and TRI modulators that are widely used in Europe.

A frequency in the range of 70 MHz to 140 MHz and 162 MHz to 163 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 ⊿F 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 dBμV [emf] to 126 dBμV [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 dBμV [emf].

The ⊿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.

This series generates composite stereo modulation signals from the built-in stereo modulator to provide modulation based on the FM stereo broadcasting system.

Besides, the model LG 3219 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 TRI (Traffic Radio 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 TRI 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.

1-3 FEATURES

Given below are main features of the instrument.

1-3-1 Features common to the two instruments

(1) Wide band and high output level

The instrument provides the high output level of 126 dBμV [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) ⊿F and ⊿dB direct reading functions

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

The instrument provides RF outputs ranging from 162.000 0 to 163.000 0 MHz. (available for FM monophonic modulation only)

(9) 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.

(10) DDS oscillator for internal modulation

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.

1-3-2 Features applied to LG 3219 only

RDS and TRI signal sources

The instrument has a built-in RDS or RBDS signal source and TRI (=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.

1-4 FUNCTION

1-4-1 FM stereo modulator

(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 Broadcasti0g 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.

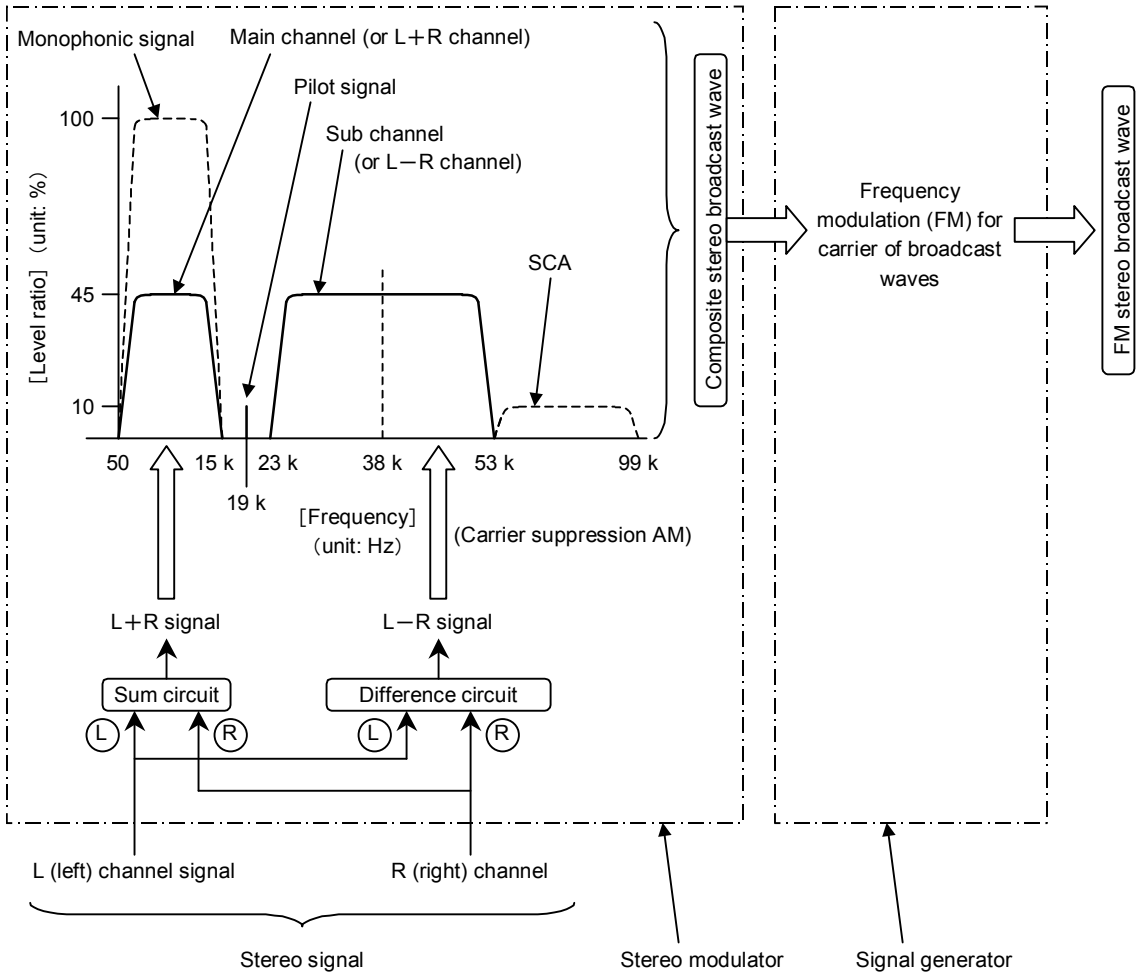


Figure 1-2 Outline of FM stereo broadcasting

(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 μs, 50 μs and 75 μs.

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].

1-4-2 RDS signal (LG 3219 only)

The model LG 3219 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)

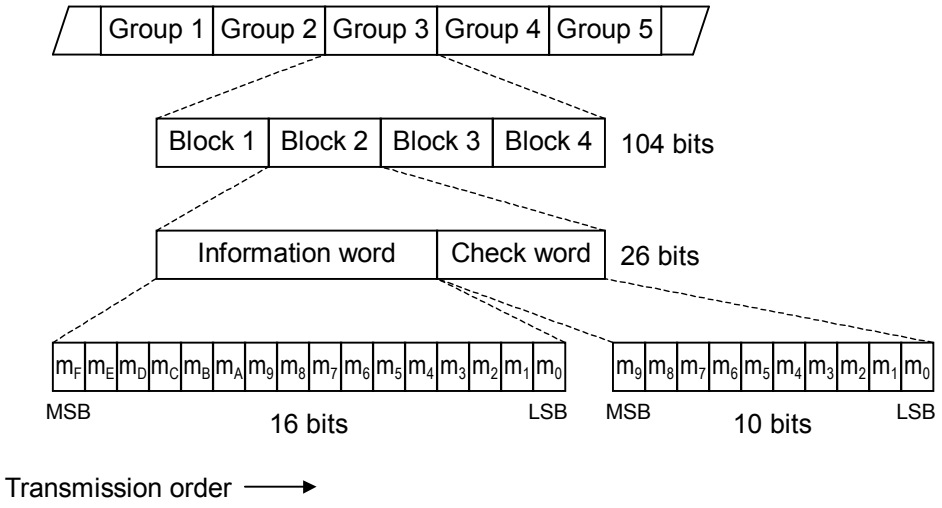


Figure 1-3 RDS data structure

1-4-3 RDS data editor (LG 3219 only)

The model LG 3219 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 LG 3219 and used as its modulation output signals.

1-4-4 TRI (=ARI) signal (LG 3219 only)

The model LG 3219 has the built-in generators of TRI (=ARI) signals that are defined in CENELEC EN 50067 and broadcasted in European countries. The instrument can provide both TRI signals and RDS signals. Listed below are the general specifications of TRI signals.

Table 1-2 Outline of TRI signals

Item	Specification
Sub carrier	SK*1
Frequency	57 kHz
FM deviation	±4 kHz (only TRI) ±3.5 kHz (both RDS/TRI)
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

1-4-5 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.

1-4-6 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

1-4-7 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

1-4-8 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) Relay drive output

CHAPTER 2 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 dBμV [emf] to 126 dBμV [emf]	
Resolution	0.1 dB	
Accuracy	±1.5 dB (Output level ≧0 dBμV [emf]) ±2.0 dB (Output level ＜0 dBμV [emf])	
Output impedance	50 Ω	
VSWR	≦1.3 (Output level≦101 dBμV)	
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 MHz ≦ fs ≦ 35 MHz) ≦−30 dBc (Band 1 : fs≧35.000 1 MHz)	At a point of 10 kHz or more from the carrier fs: 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 μs

■ **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 kΩ	
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	±(Set value × 0.1 + 1) % (Band 1: 0.4 MHz to 1.7 MHz) ±(Set value × 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	±(Set value × 0.1＋0.5) kHz (10.7 MHz±1MHz, 76 MHz to 108 MHz) ±(Set value × 0.1＋1) kHz (Band 1 to 3: 0.3 MHz to 140 MHz)	
Distortion factor	≦0.05 % (10.7 MHz±1 MHz、76 MHzto108 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 μs
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±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	 ≦±1 dB (20 Hz to 100 kHz, reference to 1 kHz) ≦±1 dB (20 Hz to 15 kHz, reference to 1 kHz)	
Pre-emphasis	25 μs / 50 μs / 75 μs / OFF	Increase characteristic at the OFF standard

■ FM stereo

Item	Specification	Condition & Remark
Guaranteed performance range	Frequency≧0.3 MHz	
Main- / Sub-channel signals	(see table below)	
Modulation ratio		
Range	0 % to 127 %	
Resolution	1 %	

Modulation mode	Modulation signal	Description
L＝R	INT / EXT	Stereo modulation with a single signal
L		
R		
L＝－R		
MONO		Monophonic modulation

■ FM stereo (Cont'd)		
Item	Specification	Condition & Remark
Accuracy	±(Set value × 0.1 + 1) % (10.7 MHz ± 1MHz, 76 MHz to 108 MHz) ±(Set value × 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	±(Set value × 0.1 + 1) % (10.7 MHz ± 1MHz, 76 MHz to 108 MHz)	
Stereo separation	≧55 dB (Modulation frequency 400 Hz to 1 kHz)	At 10.7 MHz ± 1 MHz, 76 MHz to 108 MHz
38 kHz sub-carrier leakage	≦−50 dB	
Distortion	≦0.05 % (10.7 MHz ± 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 µs
Pre-emphasis	25 µs / 50 µs / 75 µs / 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	(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 LG 3219 only)		
Item	Specification	Condition & Remark
Level range	0.0 % to 10 %	Assuming 75 kHz FM deviation as 100 %
Level resolution	0.1 %	
Accuracy	±(Set value × 0.1 + 0.5) %	
Spurious	≦−50 dB (53 kHz, 10 % output) ≦−40 dB (61 kHz, 10 % output)	
Sub-carrier		
Frequency accuracy	57 kHz ± 6 Hz	
Phase	0° or 90°	With reference to the pilot signal

■ RDS signal (for LG 3219 only) (Cont'd)		
Item	Specification	Condition & Remark
Phase accuracy	±10°	
Leakage	≦−50 dB	
Internal data		
Mode	Sub-carrier / Null data / Internal data	
Number of patterns	Max. 16 patterns	
Pattern length	Max. 2 048 groups	

■ TRI (=ARI) signal (for LG 3219 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	±(Set value × 0.1 + 0.5) %	
Frequency accuracy	57 kHz±6 Hz	
Phase	0°	With reference to the pilot signal
Phase accuracy	±10°	
DK signal		
Frequency accuracy	125 Hz (57 kHz / 456)±1 %	
AM degree range	0 % to 40 %	
AM resolution	1 %	
AM accuracy	±5 %	
AM distortion factor	≦1 % (SK=5.3 %, AM=30 %)	
BK signal		
Frequency accuracy	Code A: 23.75 Hz (57 kHz / 2 400)±1 % Code B: 28.27 Hz (57 kHz / 2 016)±1 % Code C: 34.93 Hz (57 kHz / 1 632)±1 % Code D: 39.58 Hz (57 kHz / 1 440)±1 % Code E: 45.67 Hz (57 kHz / 1 248)±1 % Code F: 53.98 Hz (57 kHz / 1 056)±1 %	
AM degree range	0 % to 80 %	
AM resolution	1 %	
AM accuracy	±5 %	
AM distortion factor	≦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.	Maximum number of parameters stored: 100

■ DDS signal

Item	Specification	Condition & Remark
Oscillation	Direct digital synthesizer, 12 bits	
Frequency range	20 Hz to 20 kHz	
Resolution	1 Hz	
Accuracy	±0.1 %	
Flatness	Same as the external modulation response	

■ Weather band output

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		
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 kΩ	
COMP OUTPUT	Output terminal for monitoring modulation signals	
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.	
Output voltage	Approx. 1 V [rms]	
Output impedance	Approx. 1 kΩ	
GP-IB		

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

■ 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 ℃ to 35 ℃ / 20 % to 85 % (RH)	
Limit range of operation	0 ℃ to 40 ℃ / 20 % to 85 % (RH)	
Limit range of storage	−20 ℃ to 55 ℃ / 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 (CD) 1	
	Power cable..... 1	
	RDS Data Editor (CD) 1	For LG 3219 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)

2-6 REGULATORY INFORMATION

[Statement of Compliance]

This instrument has been designed and tested in accordance with;

EN 61010-1:	Safety requirements for electrical equipment for measurement, control, and laboratory use
EN 61326-1:	Electrical equipment for measurement, control, and laboratory use - EMC requirements

and has been supplied in a safe condition.

This instruction manual contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

NOTICE: This signal generator is complied with emission limits for the Class A equipment. However, be carefull that this signal generator may cause radio frequency interference only at frequency of signal output with higher signal output level. In this case, the user is recommended to take corrective actions as required.

CHAPTER 3 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.

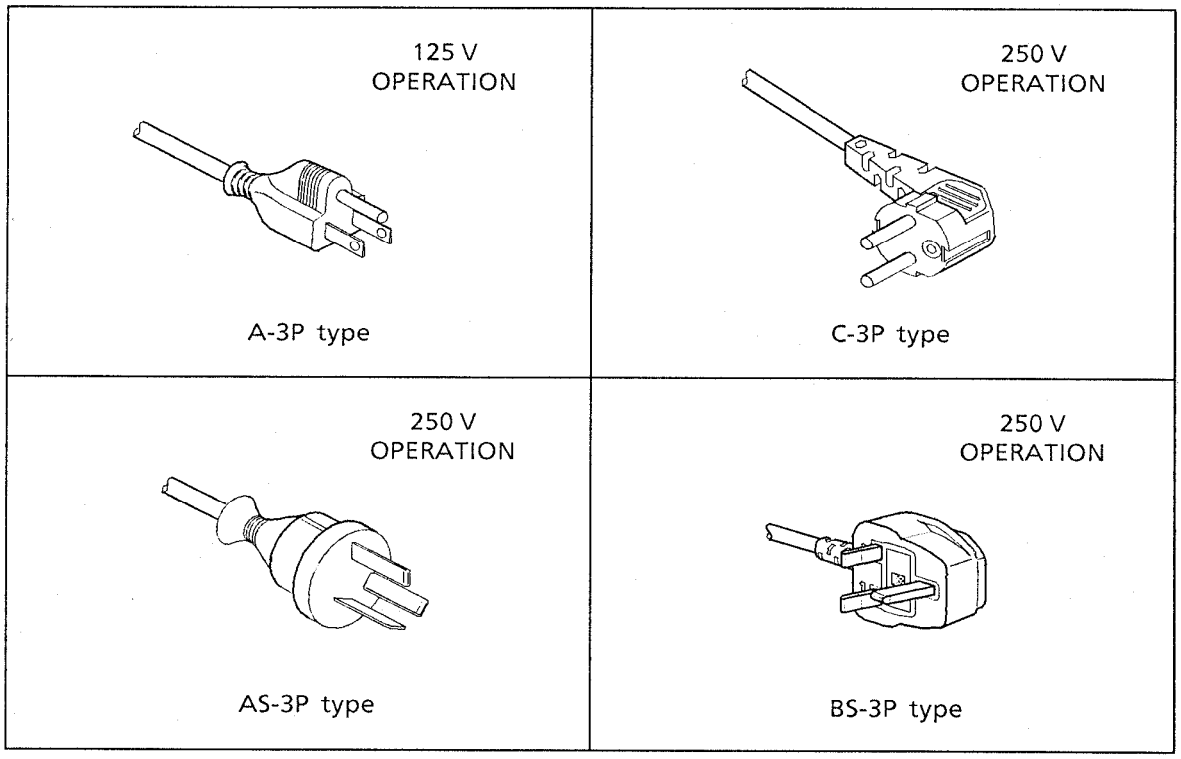


Figure 3-1 Power cables

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 60297-1.

3-7 BATTERY

The memory back-up battery built in this instrument is a lithium cell.

■ATTENTION

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.

The battery should be treated as indicated in the battery's instruction for use. Removal of the instrument's cover is only permitted to a qualified personnel.

Contact the dealer or representative from which you purchased the instrument in such a case.

3-8 INSTALL OF EDITOR (LG 3219 only)

The instrument provides 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 98 / 2000 / XP *
Compatible computer	Applicable to the above compatible OS. 100 % AT Compatibility
CD	CD drive 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 98, Windows 2000, and Windows XP 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 ℃ to 40 ℃. For entirely-guaranteed performance, use the instrument in the range of 10 ℃ to 35 ℃.

(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 4 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.

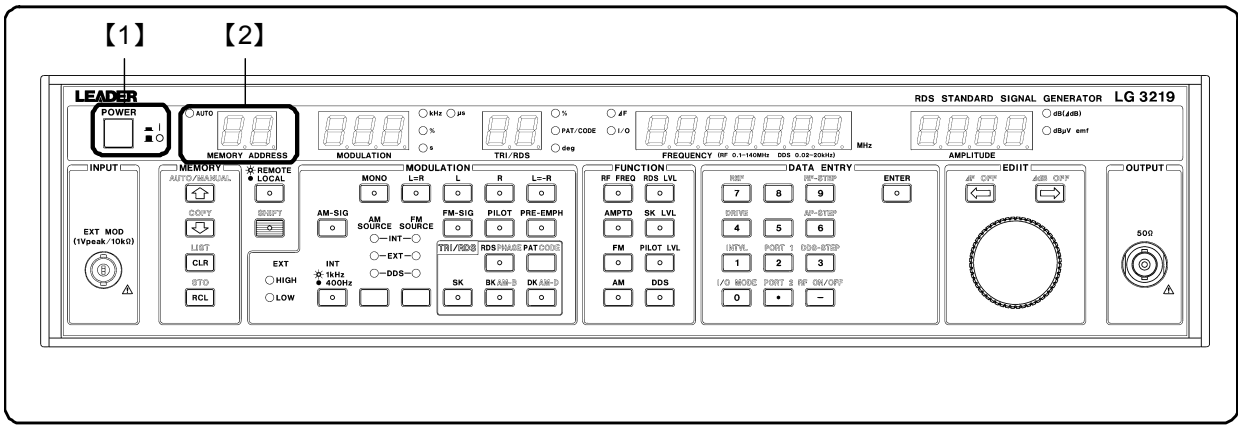
4-2 DESCRIPTION OF THE FRONT PANEL

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 LG 3219 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.

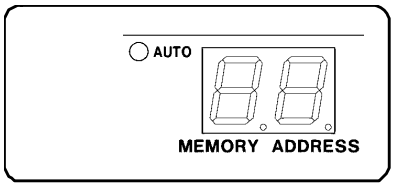


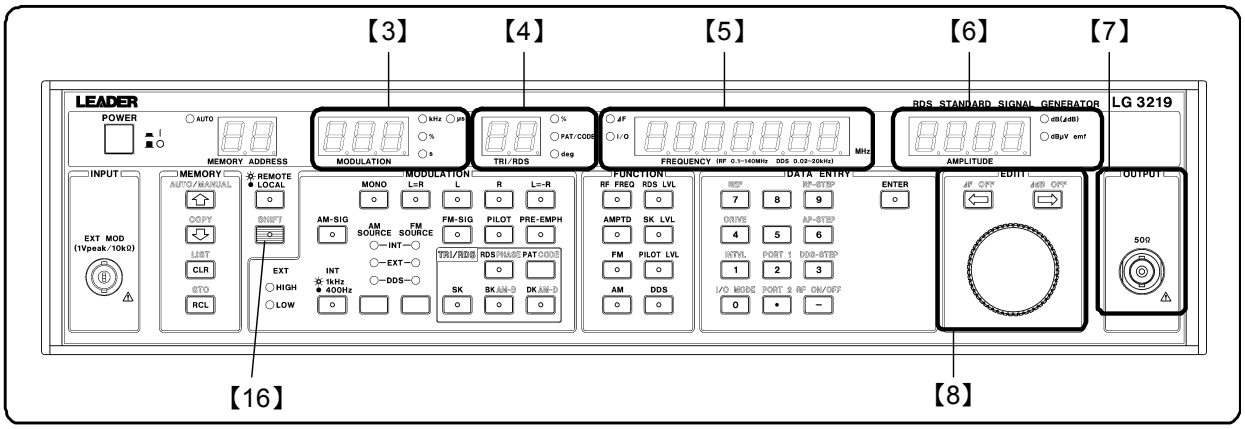
【1】***POWER*** switch

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

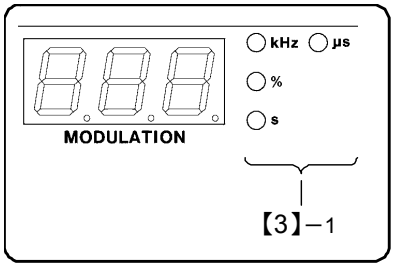
Indicates the address of the current assorted preset memory.





【3】***MODULATION*** readout

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



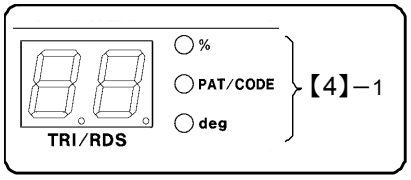
Description	Unit light (【3】−1)
AM degree	%
FM deviation	kHz
FM stereo modulation ratio*	%
Pilot level*	%
Interval time	s
Pre-emphasis	µs

【3】−1 Unit light

The Unit light corresponding to the displayed value is lit.

【4】***TRI / RDS*** readout (for LG 3219 only)

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



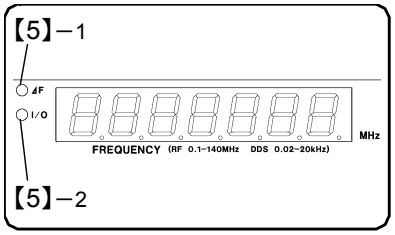
Description	Unit light (【4】−1)
RDS level	%
RDS pattern number	PAT / CODE
RDS sub carrier phase	deg
TRI SK level	%
TRI BK / DK signal modulation degree	%
TRI code number	PAT / CODE

【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.



【5】−1 ***⊿F*** light

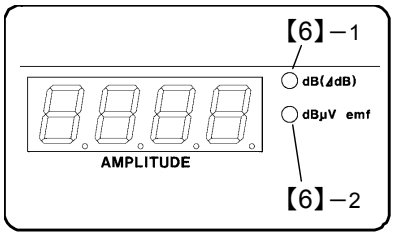
Lit when a relative RF frequency is set.

【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 (⊿dB)*** light

Lit when a relative RF level is set.

【6】−2 ***dBμV emf*** light

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

【7】***OUTPUT*** connector

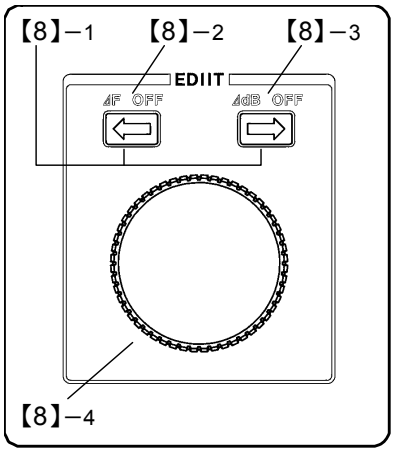
A BNC receptacle for supplying RF output signals.

【8】***EDIIT*** block

Used for the setting operation as described below.

Common.....RF frequency, Output level, AM degree, FM deviation, FM stereo modulation ratio, Pilot level, and DDS frequency (option)

LG 3219 only.....RDS level, SK level of TRI, RDS pattern selection, BK modulation degree, and DK modulation degree



【8】−1 ⇦ ⇨ keys

Press either key to specify a digit subject to setting.

【8】−2 ***⊿F OFF*** key

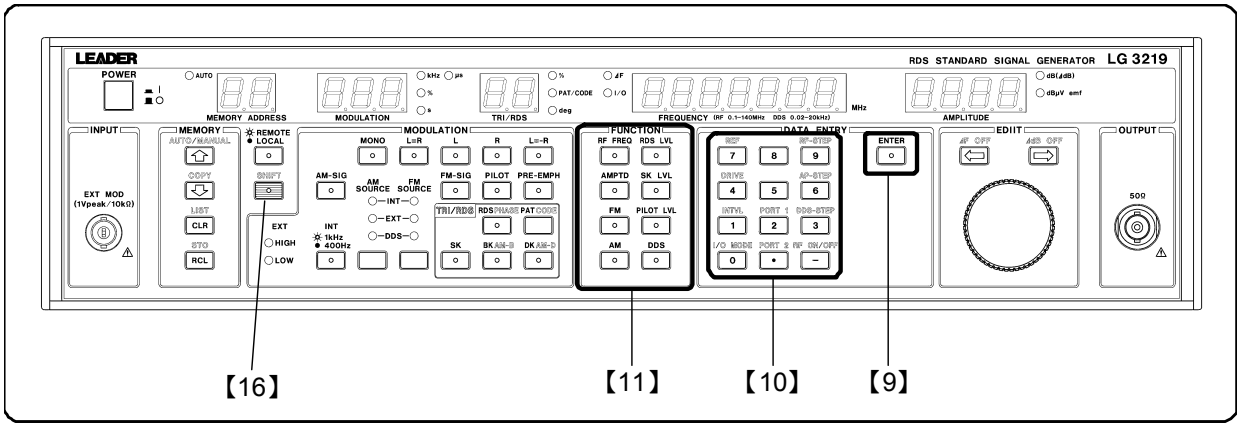
Press this key following the ***SHIFT*** key【16】to cancel the relative value display of a frequency.

【8】−3 ***⊿dB OFF*** key

Press this key following the ***SHIFT*** key【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 ⇦ or ⇨ key.



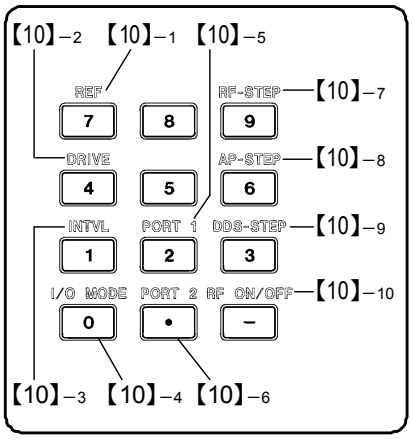
【9】***ENTER*** key

Confirms the value entered with the keys in the ***DATA ENTRY*** block【10】.

【10】***DATA ENTRY*** 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 (option)

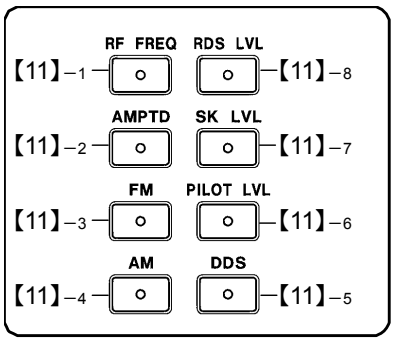
Press this key following the ***SHIFT*** key【16】to specify a variable step amount of a DDS frequency.

【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.



【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 (option)

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

【11】−6 ***PILOT LVL*** key

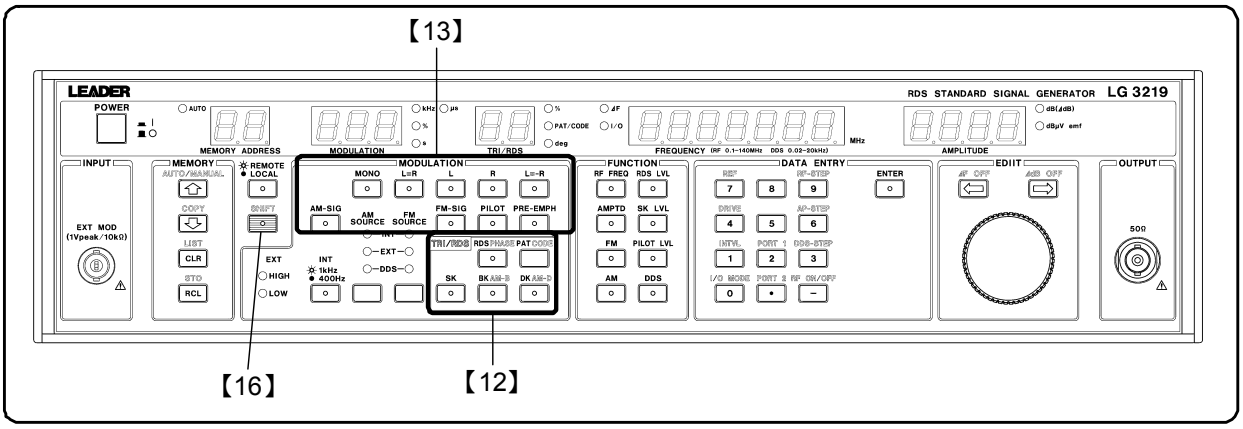
Press this key to enable the setting operation for a pilot signal level.

【11】−7 ***SK LVL*** key (for LG 3219 only)

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

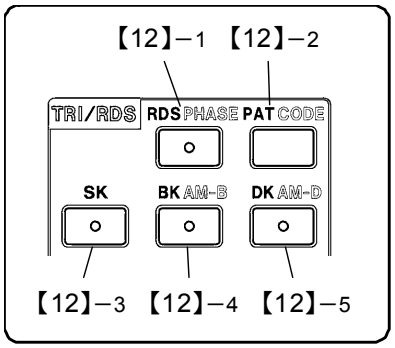
【11】−8 ***RDS LVL*** key (for LG 3219 only)

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



【12】***TRI / RDS*** block (for LG 3219 only)

Used to make settings related to TRI (=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 ***TRI / 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 TRI code number.

In either case, the ***PAT / CODE*** light in the ***TRI / RDS*** readout【4】is lit.

【12】−3 ***SK*** key

Press this key to turn TRI 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 TRI 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 TRI BK signals. In this case, the ***%*** light in the ***TRI / RDS*** readout【4】is lit.

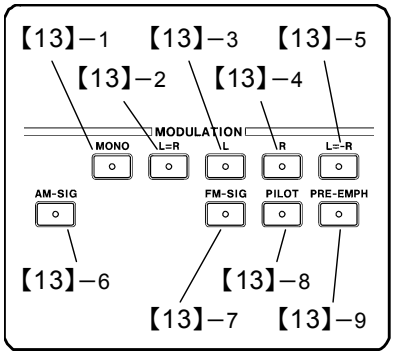
【12】−5 ***DK / AM-D*** key

Press this key to turn TRI 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 TRI DK signals. In this case, the ***%*** light in the ***TRI / RDS*** readout【4】is lit.

【13】***MODULATION*** block 1

Used to make various settings related to modulation.



【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.

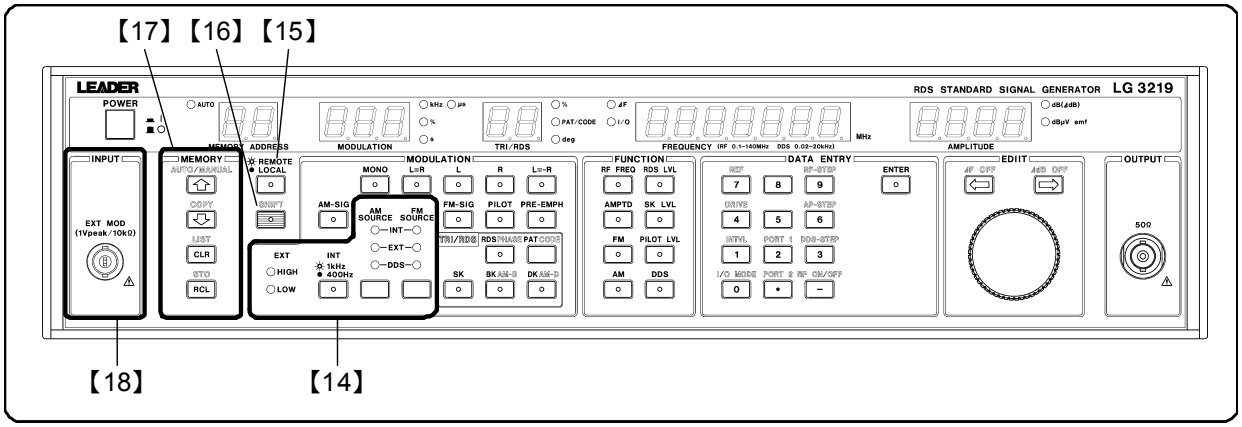
【13】−8 ***PILOT*** key

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

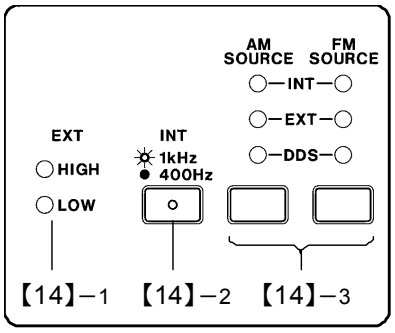
Used to select a pre-emphasis amount among OFF, 25 μs, 50 μs, and 75 μs.

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.



【14】***MODULATION***block 2

Used to make various settings related to modulation signals.



【14】−1 ***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.

【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, you may select DDS, too. In either case, the relevant light is lit.

【15】***REMOTE / LOCAL*** key

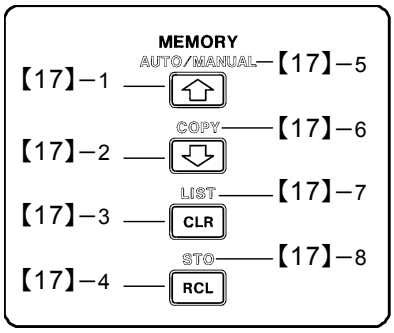
Press this key to toggle between the GP-IB remote state and local state. The light is lit when the remote state is enabled, and it is lit off when the local state is enabled.

【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

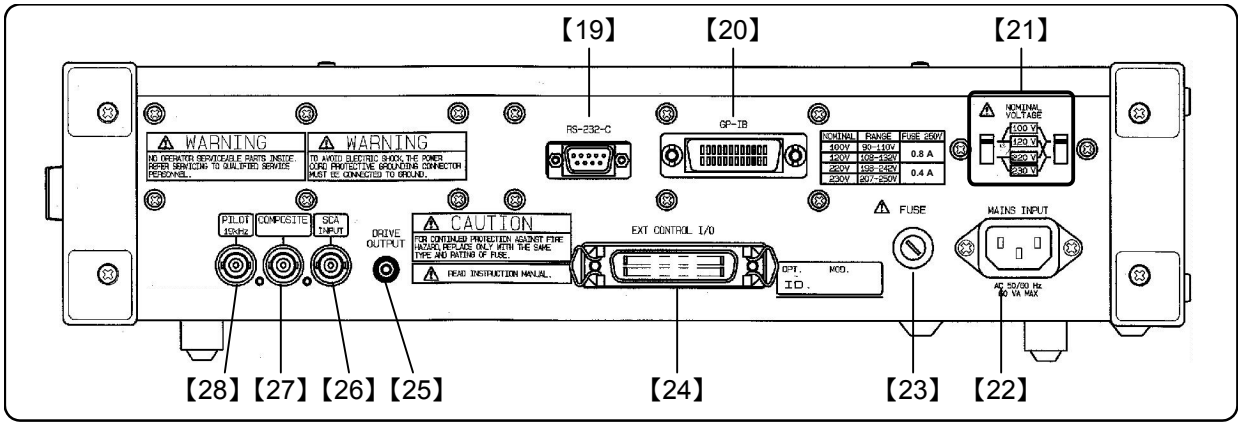
Press this key following the ***SHIFT*** key【16】to store the assorted preset memory contents, or divide into groups in the sequential recall operation.

【18】***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

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

【27】***COMPOSITE*** connector

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

【28】***PILOT*** connector

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

CHAPTER 5 OPERATION

5-1 GENERAL

This chapter describes the basic panel operation of the models LG 3238 / LG 3219 in the following order. It also contains the GP-IB program codes associated with each operation.

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 and 162.000 0 MHz to 163.000 0 MHz in the ***FREQUENCY*** readout. The decimal point represents the position of MHz.

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)
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	

■ NOTE

- The weather band and the bands 1 to 3 can be switched by means of direct setting RF frequency with the data keys. ***MODIFY*** knob cannot used for this switching. (See the paragraph "5-2-2 Direct setting with the data keys.")
- 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 ***⊿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 ***EDIIT*** 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

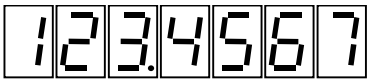
5-2-2 Direct setting with the data keys

Ex. Setting an RF frequency to 123.456 7 MHz

1 Press the RF FREQ key.

2 Enter an RF frequency with the data keys.

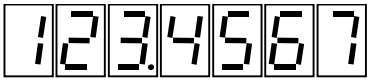
1 2 3 · 4 5 6 7



■ NOTE

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

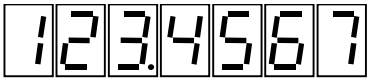
3 Press the ENTER key.



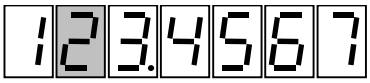
5-2-3 Modification with the *EDIIT* knob

Ex. Modifying the value from 123.456 7 MHz to 123.457 0 MHz

1 Press the RF FREQ key.

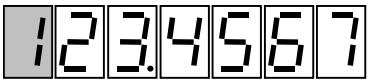


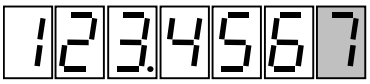
2 Specify a digit to be modified with the ΔF OFF or ΔdB OFF key.



The currently specified digit blinks.

Press the ΔF OFF key three times.

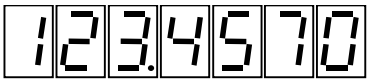




■ NOTE

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

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



Turn the knob clockwise by three steps.

■ NOTE

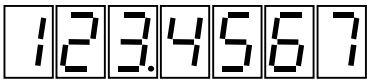
The ***MODIFY*** knob can be turned endlessly. Turning the knob clockwise increases the frequency, while turning it counterclockwise decreases the frequency. Carry and borrow are available.

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 －99.999 9 MHz to 99.999 9 MHz.

Ex. Setting a reference frequency to 100 MHz.

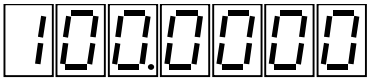


1 Press the SHIFT [○] key.

2 Press the REF [7] key.

3 Press the RF FREQ [○] key.

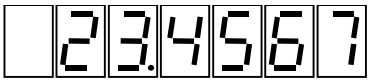
4 Enter a reference frequency with the data keys.



[1] [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.

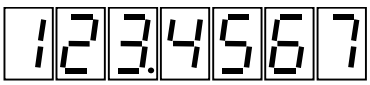
5 Press the ENTER [○] key.



The ⊿*F* 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

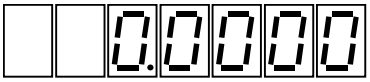


1 Press the SHIFT [○] key.

2 Press the REF [7] key.

3 Press the RF FREQ key.

4 Press the ENTER key.



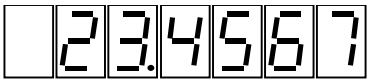
The ⊿*F* light is lit and a relative value is displayed.

(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 ⊿*F* light is lit).

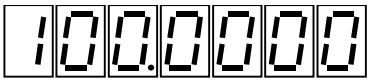
Ex. Verifying the reference frequency



1 Press the SHIFT key.

2 Press the REF 7 key.

3 Press the RF FREQ key.



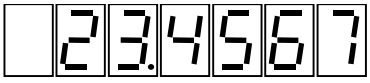
■ NOTE

The reference frequency cannot be verified as long as the relative value display is disabled (the ⊿*F* 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 ⊿*F* light is lit).

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

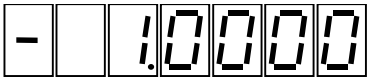


1 Press the RF FREQ key.

2 Enter a relative frequency with the data keys.

– 1

3 Press the ENTER key.



5-2-6 Disabling the relative value display

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

1 Press the SHIFT ○ key

2 Press the Δ F OFF ⇦ key.

Then the relative value display of an RF frequency is disabled, and the ⊿*F* 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 －99.999 9 MHz to 99.999 9 MHz.

Ex. Setting a variable step amount to 10 MHz.

1 Press the SHIFT ○ key.

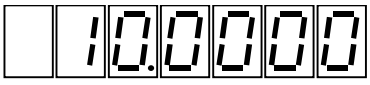
2 Press the RF-STEP 9 key.

3 Enter a variable step amount with the data keys.

1 0

■ 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 ENTER ○ key.

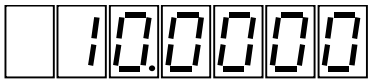


The set value is displayed for about 10 seconds.

Ex. Verifying the variable step amount

1 Press the SHIFT [O] key.

2 Press the RF-STEP [9] key.

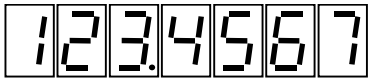


The set value is displayed for about 10 seconds.

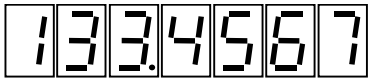
5-2-8 Changing an RF frequency with a variable step amount

Ex. Increasing the RF frequency from 123.456 7 MHz once, and then decrease twice at a 10 MHz step.

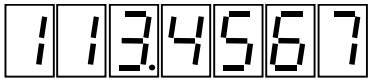
1 Press the RF FREQ [O] key.



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



3 Turn the ***EDIIT*** 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 SHIFT [O] key.

2 Press the RF-STEP [9] key.

3 Press the I/O MODE [0] key.

4 Press the ENTER [O] key.

■ NOTE

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

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 dBμV to 126 dBμV [emf] (0 dBμV = 1 μV [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 ***EDIIT*** 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

5-3-2 Direct setting with the data keys

Ex. Setting an output level to 12.3 dBμV [emf]

1 Press the AMPTD key.

2 Enter an output level with the data keys.

1 2 · 3

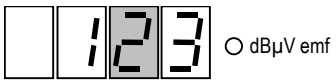
3 Press the ENTER key.

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

Ex. Modifying the value from 12.3 dBµV [emf] to 13 dBµV [emf]

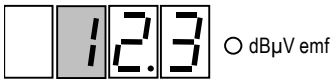
1 Press the AMPTD ○ key.

2 Specify a digit to be modified with the ΔF OFF ⇦ or ΔdB OFF ⇨ key.



The currently specified digit blinks.

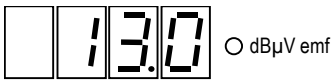
Press the ΔF OFF ⇦ key three times.



■ 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 ***EDIIT*** knob.



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 dBµV [emf].

1 Press the SHIFT ○ key.

2 Press the REF 7 key.

3 Press the AMPTD ○ key.

4 Enter a reference output level with the data keys.

1 2

■ 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 ENTER ○ key.

The ⊿***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 SHIFT ○ key.

2 Press the REF 7 key.

3 Press the AMPTD ○ key.

4 Press the ENTER ○ key.

The ⊿***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 ⊿***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 ⊿***dB*** light is lit).

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

(A relative level is displayed.)

1 Press the AMPTD ○ key.

2 Enter a relative output level with the data keys.

[3] [4]

■ 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 ENTER [○] key.

5-3-6 Disabling the relative value display

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

1 Press the SHIFT [○] key.

2 Press the Δ dB OFF [⇨] key.

Then the relative value display of an output level is disabled, and the ***⊿dB*** 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 ***⊿dB*** light is lit).

1 Press the SHIFT [○] key.

2 Press the RF ON/OFF [—] 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 SHIFT ○ key.

2 Press the AP-STEP 6 key.

3 Enter a variable step amount with the data keys.

5 · 5

■ 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 ENTER ○ key.

The set value is displayed for about 10 seconds.

Ex. Verifying the variable step amount

1 Press the SHIFT ○ key.

2 Press the AP-STEP 6 key.

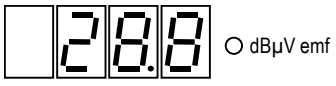
The set value is displayed for about 10 seconds.

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 AMPTD ○ key.

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



3 Turn the ***EDIIT*** knob counterclockwise by two 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.
- 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 SHIFT ○ key.

2 Press the AP-STEP 6 key.

3 Press the I/O MODE 0 key.

4 Press the ENTER ○ key.

■ NOTE

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

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 AM key or FM 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 EDIIT knob

5-4-6 External amplitude modulation

5-4-2 Turning amplitude modulation ON or OFF

1 Press the AM-SIG key.

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)
- 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. 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.

5-4-4 Direct setting with the data keys

Ex. Setting an AM degree to 34.5 %

1 Press the AM key.

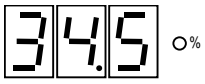
2 Enter an AM degree with the data keys.

3 4 · 5

■ 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 ENTER key.



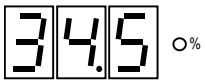
■ NOTE

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

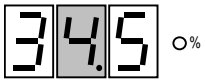
5-4-5 Modification with the *EDIIT* knob

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

1 Press the AM ○ key.

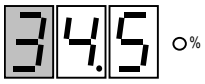


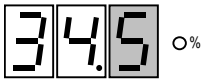
2 Specify a digit to be modified with the ΔF OFF ⇦ or Δ dB OFF ⇨ key.



The currently specified digit blinks.

Press the ΔF OFF ⇦ key three times.

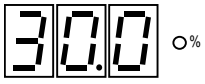




■ NOTE

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

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



Turn the knob counterclockwise by nine steps.

■ NOTE

The ***EDIIT*** 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 kΩ	
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 ***EDIIT*** 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 ***EXT*** block is lit. In this case, adjust an input signal level in such a way that neither lights is lit.

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 AM key or FM 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 ***EDIIT*** knob
5-5-6 External frequency modulation

5-5-2 Turning frequency modulation ON or OFF

1 Press the FM-SIG key.

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)
- 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. 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.

5-5-4 Direct setting with the data keys

Ex. Setting an FM deviation to 34.5 kHz

1 Press the FM key.

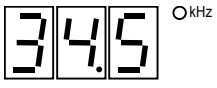
2 Enter an FM deviation with the data keys.

3 4 · 5

■ 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 ENTER key.



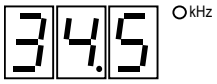
■ NOTE

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

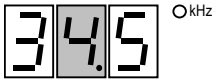
5-5-5 Modification with the *EDIIT* knob

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

1 Press the FM ○ key.

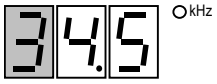


2 Specify a digit to be modified with the ΔF OFF ⇦ or Δ dB OFF ⇨ key.



The currently specified digit blinks.

Press the ΔF OFF ⇦ 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 ***EDIIT*** knob.

Turn the knob counterclockwise by thirty-nine steps.

■ NOTE

The ***EDIIT*** 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 kΩ	
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 ***EDIIT*** 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 ***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 ***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.

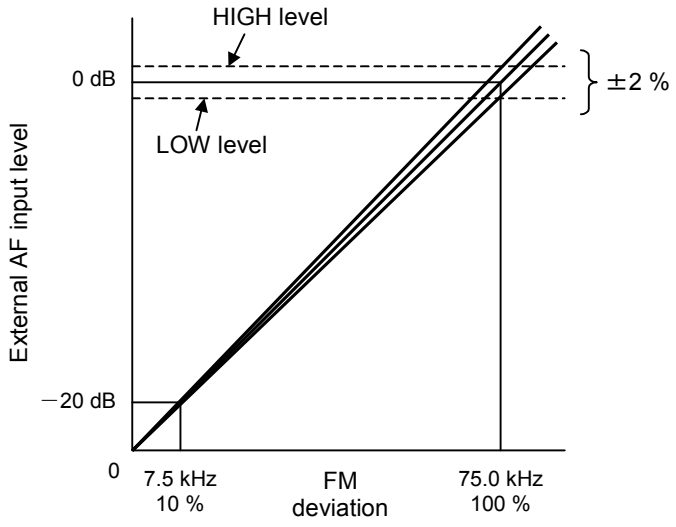


Figure 5-1 External AF input level and FM deviation

5-6 MAIN- AND SUB-CHANNEL SIGNALS OF FM STEREO

5-6-1 General

At the FM stereo modulation time, modulation status is shown in the ***MODULATION*** block and a modulation ratio is shown in the ***MODULATION*** readout with a 75 kHz FM deviation assumed as 100 %.

The setting range and resolution of a modulation ratio are shown in Table 5-10 below.

Table 5-10 Setting range and resolution of an FM stereo modulation ratio

Setting range (%)	Resolution (%)
0.0 to 127	1

■ NOTE

- The maximum allowable modulation ratio is the deviation amount equal to 50 % of an RF frequency. When an RF frequency is 100 kHz, for example, the maximum allowable deviation is 50 kHz, which is equal to a deviation ratio of 66 %.
- The maximum allowable modulation ratio for guaranteed performance is the deviation amount equal to 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 AM key or FM key.
- When pre-emphasis is ON, the ***MODULATION*** readout does not show an actual deviation amount.

For main- and sub-channel signal modulation of FM stereo, the instrument supports the modulation modes as listed in Table 5-11. To specify a mode, press either one of the ***MODULATION*** block keys (L=R, L, R, and L=−R).

Table 5-11 Modulation modes (FM stereo)

Modulation signal source	Modulation mode	Remark
Internal signal or external signal (one signal)	L=R	Main-channel component only
	L	L-channel signal only
	R	R-channel signal only
	L=−R	Sub-channel component only

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

5-6-2 Turning main- / sub-channel signals ON or OFF

5-6-3 Selecting a modulation signal

5-6-4 Direct setting with the data keys

5-6-5 Modification with the ***EDIIT*** knob

5-6-2 Turning main- / sub-channel signals ON or OFF

1 Press the FM-SIG key.

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 main- / sub-channel signals are turned OFF, the ***MODULATION*** readout still shows an FM ratio.

2 Press either one of the ***MODULATION*** block keys (L=R, L, R, and L=−R) to select a desired modulation mode.

The key light corresponding to the selected modulation mode is lit.

5-6-3 Selecting a modulation signal

A modulation 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 15 kHz (EXT)
- 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. 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.

5-6-4 Direct setting with the data keys

Ex. Setting an FM ratio to 85 %

1 Press the FM key.

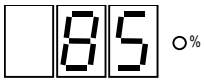
2 Enter an FM ratio with the data keys.

8 5

■ NOTE

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

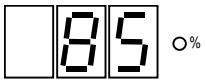
3 Press the ENTER key.



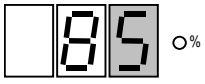
5-6-5 Modification with the *EDIIT* knob

Ex. Modifying the FM ratio from 85 % to 105 %

1 Press the FM key.

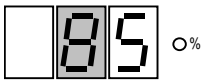


2 Specify a digit to be modified with the ΔF OFF or ΔdB OFF key.



The currently specified digit blinks.

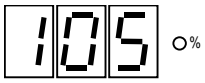
Press the ΔF OFF key two times.



■ 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 ***EDIIT*** knob.



Turn the knob clockwise by two steps.

■ NOTE

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

5-7 PILOT SIGNAL

5-7-1 General

As for pilot signals, the ON / OFF status of a pilot signal is shown in the ***MODULATION*** block and a pilot signal level ratio is shown in the ***MODULATION*** readout.

A pilot signal level ratio represents a level ratio when a 75 kHz deviation is assumed as 100 %.

The setting range and resolution of an FM stereo pilot signal level ratio are shown in Table 5-13 below.

Table 5-13 Setting range and resolution of an FM stereo pilot signal level ratio

Setting range (%)	Resolution (%)
0 to 15.0	0.1

The basic operations related to a pilot signal are described in the following paragraphs.

5-7-2 Turning a pilot signal ON or OFF

5-7-3 Direct setting with the data keys

5-7-4 Modification with the ***EDIIT*** knob

5-7-2 Turning a pilot signal ON or OFF

1 Press the PILOT key.

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

■ NOTE

When the modulation mode is MONO, the ***PILOT*** key may not be turned ON.

5-7-3 Direct setting with the data keys

Ex. Setting a pilot signal level ratio to 9.5 %

1 Press the PILOT LVL key.

2 Enter a pilot signal level ratio with the data keys.

9 · 5

■ 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 ENTER key.

■ NOTE

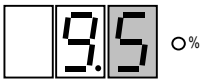
Once a pilot signal level ratio is specified, the display unit is changed into % and the ***PILOT*** key light is lit in the ***MODULATION*** block.

5-7-4 Modification with the *EDIIT* knob

Modifying the pilot signal level ratio from 9.5 % to 13.5 %

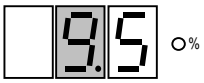
1 Press the PILOT LVL key.

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



The currently specified digit blinks.

Press the ΔF OFF key two 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 ***EDIIT*** knob.

Turn the knob clockwise by four steps.

■ NOTE

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

5-8 PRE-EMPHASIS

5-8-1 General

In the FM stereo modes, signals can be provided with the pre-emphasis feature as follows.

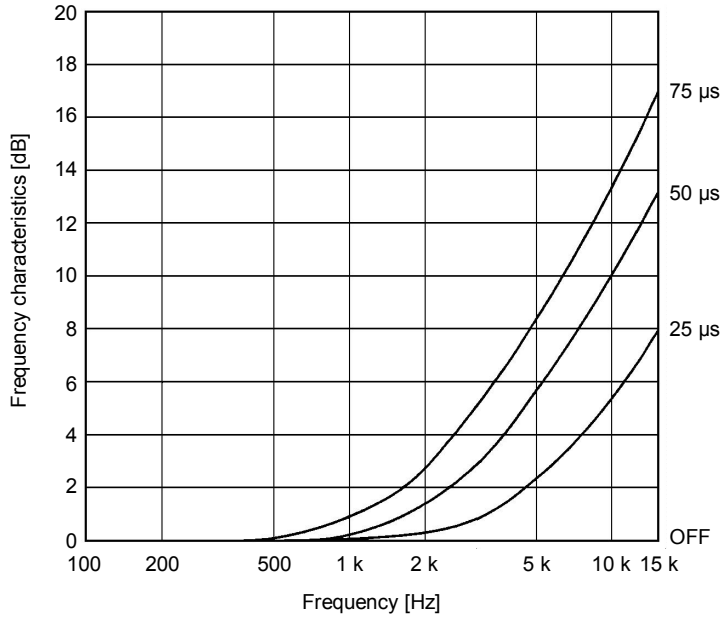


Figure 5-2 Pre-emphasis feature

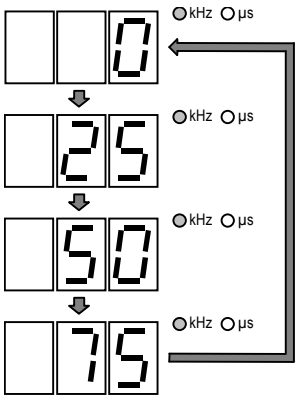
The basic operations related to the pre-emphasis feature are described in the following paragraphs.

5-8-2 Selecting a time constant

5-8-2 Selecting a time constant

A time constant of the pre-emphasis feature can be selected among 0 µs (OFF), 25 µs, 50 µs, and 75 µs.

Press the PRE-EMPH key once to show the current time constant in the ***MODULATION*** readout. Every press of the key causes a time constant to be changed as shown right. The key light is lit off when a time constant is 0 µs (OFF), and it is lit when a time constant other than 0 is selected.



■ NOTE

- If there is no operation during five seconds, the time constant display disappears.
- Pre-emphasis is only effective for frequency modulation.
- When the ***FM-SIG*** key is turned OFF, the pre-emphasis cannot be turned ON.
- When a time constant is already set, turning the ***FM-SIG*** key ON automatically turns the pre-emphasis ON.

5-9 SCA SIGNAL

When an SCA signal is required to generate a composite stereo signal, apply a 0.56-V [P-P] signal to the ***SCA INPUT*** connector on the rear side of the instrument. Then the SCA component equal to the deviation of 7.5 kHz can be obtained.

■ NOTE

When a signal is applied to the ***SCA INPUT*** connector, an RF output signal is modulated regardless of the modulation mode of the instrument. For this reason, apply a signal to the ***SCA INPUT*** connector only when an SCA signal is required.

Note that the instrument is not provided with the indication of SCA signals. Thus the input level should always keep 0.56 V [P-P].

5-10 COMPOSITE SIGNAL OUTPUT LEVEL

The instrument is equipped with the ***COMPOSITE*** connector on the rear panel to obtain a composite stereo signal. When an FM monophonic deviation is 100 kHz, the output level is approx. 5 V [P-P] (at 600 Ω termination).

This connector is helpful when the instrument is used only as a stereo modulator.

5-11 RDS SIGNAL (LG3219 only)

5-11-1 General

The instrument can download desired pattern data from a computer for output. It can download up to 16 pattern data and assign pattern numbers 0 to 15 to them for management.

Besides, the instrument can output the NULL pattern data and Sc pattern data. The NULL pattern data consists of all 0 data, while the Sc pattern data consists of sub carrier signals only. You do not need to download them because they are already installed in the instrument.

The status of an RDS signal is shown in the ***TRI / RDS*** block and ***TRI / RDS*** readout. The ***TRI / RDS*** block contains RDS signal ON / OFF status, while the ***TRI / RDS*** readout contains an RDS signal level, sub-carrier phase of an RDS signal, and an RDS signal pattern.

The range and resolution of an RDS signal level are shown in Table 5-16 below.

Table 5-16 RDS signal level range and resolution

RDS signal level (%)	Resolution (%)
0.0 to 10	0.1

■ NOTE

- The ***TRI / RDS*** readout normally shows either RDS signal level or TRI SK signal level. To switch between RDS level and SK level, press the RDS LVL key or SK LVL key.
- RDS signals are available only in the FM stereo mode. Before turning an RDS signal ON, be sure to set FM to the stereo mode.

The basic operations related to an RDS signal are described in the following paragraphs.

5-11-2 Turning an RDS signal ON or OFF
5-11-3 Direct setting of a signal level with the data keys
5-11-4 Modification of a signal level with the ***EDIIT*** knob
5-11-5 Direct setting of pattern data with the data keys
5-11-6 Modification of pattern data with the ***EDIIT*** knob
5-11-7 Selecting a sub-carrier phase

5-11-2 Turning an RDS signal ON or OFF

1 Press the RDS PHASE key.

Pressing this key switches an RDS signal 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 an RDS signal is turned OFF, the ***TRI / RDS*** readout still shows an RDS signal level.
- RDS signals are available only in the FM stereo mode. Before turning an RDS signal ON, be sure to set FM to the stereo mode.

5-11-3 Direct setting of a signal level with the data keys

Ex. Setting an RDS signal level to 5.3 %

1 Press the RDS LVL key.

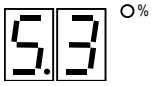
2 Enter an RDS signal level with the data keys.

5 · 3

■ 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 ENTER key.



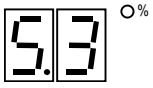
■ NOTE

When an RDS signal level is specified with The data keys or GP-IB code and RS-232-C codes, the RDS signal operation is automatically turned ON.

5-11-4 Modification of a signal level with the *EDIIT* knob

Ex. Modifying the RDS signal level from 5.3 % to 5.0 %

1 Press the RDS LVL key.



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

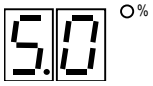
The currently specified digit blinks.

Press the ΔF OFF key one time.

■ 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 ***EDIIT*** knob.



Turn the knob counterclockwise by three steps.

■ NOTE

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

5-11-5 Direct setting of pattern data with the data keys

Ex. Selecting the pattern data 3

1 Press the PAT CODE key.

2 Enter a pattern data number with the data key.

3

■ 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 ENTER key.

Table 5-17 shows the relationship among pattern data numbers, key inputs, and display contents of the ***TRI / RDS*** readout.

Table 5-17 Relationship among pattern data numbers, key inputs, and displays

Number	Key input	Display	Number	Key input	Display
Pattern 0	0	0	Pattern 9	9	9
Pattern 1	1	1	Pattern 10	1 0	A
Pattern 2	2	2	Pattern 11	1 1	b
Pattern 3	3	3	Pattern 12	1 2	C
Pattern 4	4	4	Pattern 13	1 3	d
Pattern 5	5	5	Pattern 14	1 4	E
Pattern 6	6	6	Pattern 15	1 5	F
Pattern 7	7	7	Null	–	-
Pattern 8	8	8	Sc	·	.

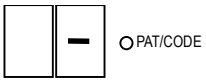
5-11-6 Modification of pattern data with the *EDIIT* knob

Ex. Changing from the pattern data 3 to Null

1 Press the PAT CODE key.

3 Modify the value with the ***EDIIT*** knob.

Turn the knob counterclockwise by five steps.



■ NOTE

The ***EDIIT*** knob can be turned endlessly. Turning the knob clockwise increases the pattern data number, while turning it counterclockwise decreases the pattern data number. Turning the knob clockwise at the Sc position ([·] displayed) causes the pattern data 0 to be selected. Turning the knob counterclockwise at the pattern data 0 causes the pattern data Sc to be selected.

5-11-7 Selecting a sub-carrier phase

For RDS signals, a sub-carrier phase can be set to either 0° or 90°.

Ex. Setting a sub-carrier phase of an RDS signal to 90°

1 Press the SHIFT key.

2 Press the RDS PHASE key.

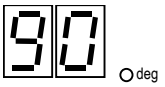
3 Enter a sub-carrier phase with the data keys.

9 0

■ 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 ENTER key.



■ NOTE

- When an TRI signal is turned ON, the sub-carrier phase of an RDS signal is fixed to 90°.
- When a sub-carrier phase may be entered (as described in the above procedure 3), turning the ***EDIIT*** knob toggles a sub-carrier phase between 0° and 90°.

5-12 TRI（=ARI）SIGNAL (LG 3219 only)

5-12-1 General

The status of TRI signals is shown in the ***TRI / RDS*** block and ***TRI / RDS*** readout. The ***TRI / RDS*** block contains SK, BK, and DK signals ON / OFF status, while the TRI/RDS readout contains an SK signal level, BK signal code data, and AM degrees of a BK signal and DK signal.

The range and resolution of each setting value are shown in Table 5-19 below.

Table 5-19 Setting range and resolution

Item	Setting range (%)	Resolution (%)
SK signal level	0.0 to 10	0.1
AM degree of a BK signal	0 to 80	1
AM degree of a DK signal	0 to 40	1

■ NOTE

- The ***TRI / RDS*** readout normally shows either RDS signal level or TRI SK signal level. To switch between RDS level and SK level, press the RDS LVL key or SK LVL key.
- TRI signals are available only in the FM stereo mode. Before turning an TRI signal ON, be sure to set FM to the stereo mode.

The basic operations related to TRI signals are described in the following paragraphs.

5-12-2 Turning an SK signal ON or OFF
5-12-3 Direct setting of an SK signal level with the data keys
5-12-4 Modification of an SK signal level with the ***EDIIT*** knob
5-12-5 Turning a BK signal ON or OFF
5-12-6 Direct setting of the AM degree of a BK signal with the data keys
5-12-7 Modification of the AM degree of a BK signal with the ***EDIIT*** knob
5-12-8 Selecting a BK signal code data
5-12-9 Modification of a BK signal code data with the ***EDIIT*** knob
5-12-10 Turning a DK signal ON or OFF
5-12-11 Direct setting of the AM degree of a DK signal with the data keys
5-12-12 Modification of the AM degree of a DK signal with the ***EDIIT*** knob

5-12-2 Turning an SK signal ON or OFF

1 Press the SK key.

Pressing this key switches an SK signal 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 an SK signal is turned OFF, the ***TRI / RDS*** readout still shows an SK signal level.
- SK signals are available only in the FM stereo mode. Before turning an SK signal ON, be sure to set FM to the stereo mode.

5-12-3 Direct setting of an SK signal level with the data keys

Ex. Setting an SK signal level to 5.3 %

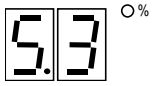
1 Press the SK LVL key.

2 Enter an SK signal level with the data keys.

5 · 3

■ 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 ENTER key.

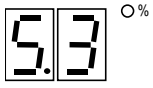


■ NOTE
When an SK signal level is specified with The data keys or GP-IB code and RS-232-C codes, the SK signal operation is automatically turned ON.

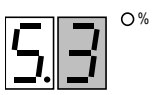
5-12-4 Modification of an SK signal level with the *EDIIT* knob

Ex. Modifying the SK signal level from 5.3 % to 5.0 %

1 Press the SK LVL key.



2 Specify a digit to be modified with the ΔF OFF ⇦ or ΔdB OFF ⇨ key.



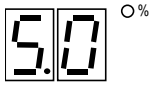
The currently specified digit blinks.

Press the ΔF OFF ⇦ key one time.

■ 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 ***EDIIT*** knob.



Turn the knob counterclockwise by three steps.

■ NOTE

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

5-12-5 Turning a BK signal ON or OFF

1 Press the BK AM-B ○ key.

Pressing this key switches a BK signal 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 a BK signal is turned OFF, the ***TRI / RDS*** readout still shows a BK signal level.
- BK signals are available only in the FM stereo mode. Before turning a BK signal ON, be sure to set FM to the stereo mode.

5-12-6 Direct setting of the AM degree of a BK signal with the data keys

Ex. Setting the AM degree of an BK signal to 60 %

1 Press the SHIFT ○ key.

2 Press the BK AM-B ○ key.

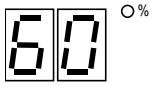
3 Enter an AM degree with the data keys.

6 0

■ 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 ENTER key.



■ NOTE

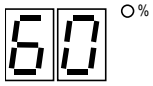
When an AM degree of a BK signal is set with The data keys or GP-IB code and RS-232-C codes, the BK signal operation is automatically turned ON.

5-12-7 Modification of the AM degree of a BK signal with the *EDIIT* knob

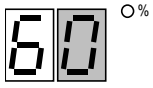
Ex. Modifying the AM degree from 60 % to 55 %

1 Press the SHIFT key.

2 Press the BK AM-B key.



3 Specify a digit to be modified with the Δ F OFF or Δ dB OFF key.



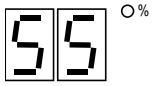
The currently specified digit blinks.

Press the Δ F OFF key one time.

■ NOTE

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

4 Modify the value with the ***EDIIT*** knob.



Turn the knob counterclockwise by five steps.

■ NOTE

The EDIIT 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.

5-12-8 Selecting a BK signal code data

例 Ex. Selecting the code data E

1 Press the SHIFT key.

2 Press the PAT CODE key.

3 Enter a code data number with the data key.

1 4

■ 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 ENTER key.

Table 5-20 shows the relationship among code data, key inputs, and display contents of the ***TRI / RDS*** readout.

Table 5-20 Relationship among code data, key inputs, and displays

Number	Key input	Display	Number	Key input	Display
Code A	1 0	A	Code D	1 3	d
Code B	1 1	b	Code E	1 4	E
Code C	1 2	C	Code F	1 5	F

5-12-9 Modification of a BK signal code data with the *EDIIT* knob

Ex. Changing from the code data E to A

1 Press the SHIFT key.

2 Press the PAT CODE key.

3 Modify the value with the ***EDIIT*** knob.

Turn the knob clockwise by two steps.

■ NOTE

The ***EDIIT*** knob can be turned endlessly. Turning the knob clockwise moves code data upward in Table 5-20, while turning it counterclockwise moves code data downward. Thus turning the knob clockwise at the code F position causes the Code A to be selected, and turning it counterclockwise at the code A position causes the code F to be selected.

5-12-10 Turning a DK signal ON or OFF

1 Press the DK AM-D key.

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 a DK signal is turned OFF, the ***TRI / RDS*** readout still shows a DK signal level.
- DK signals are available only in the FM stereo mode. Before turning a DK signal ON, be sure to set FM to the stereo mode.

5-12-11 Direct setting of the AM degree of a DK signal with the data keys

Ex. Setting the AM degree of a DK signal to 30 %

1 Press the SHIFT key.

2 Press the DK AM-D key.

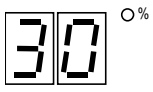
3 Enter an AM degree with the data keys.

3 0

■ 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 ENTER key.



■ NOTE

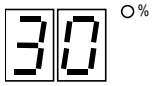
When an AM degree of a DK signal is set with The data keys or GP-IB code and RS-232-C codes, the DK signal operation is automatically turned ON.

5-12-12 Modification of the AM degree of a DK signal with the *EDIIT* knob

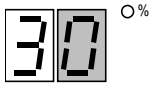
Ex. Modifying the AM degree from 30 % to 25 %

1 Press the SHIFT key.

2 Press the DK AM-D key.



3 Specify a digit to be modified with the ΔF OFF or ΔdB OFF key.



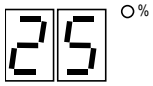
The currently specified digit blinks.

Press the ΔF OFF key one time.

■ NOTE

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

4 Modify the value with the ***EDIIT*** knob.



Turn the knob counterclockwise by five steps.

■ NOTE

The ***EDIIT*** 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.

5-13 DDS FREQUENCY

5-13-1 General

The DDS frequency is indicated in the ***FREQUENCY*** readout in the range of 0.020 kHz to 20.000 kHz. The decimal point represents the position of the kHz unit. The resolution is 1 Hz.

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

5-13-2 Direct setting with the data keys

5-13-3 Modification with the ***EDIIT*** knob

5-13-4 Specifying a variable step amount of the DDS frequency

5-13-5 Changing the DDS frequency at a variable step amount

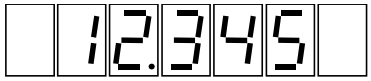
5-13-6 Canceling the step DDS frequency

5-13-2 Direct setting with the data keys

Ex. Setting the DDS frequency to 12.345 kHz

1 Press the DDS key.

2 Enter a DDS frequency with the data keys.

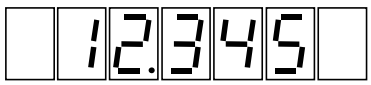


1 2 . 3 4 5

■ NOTE

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

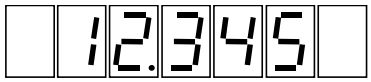
3 Press the ENTER key.



5-13-3 Modification with the *EDIIT* knob

Ex. Modifying the frequency from 12.345 kHz to 12.400 kHz

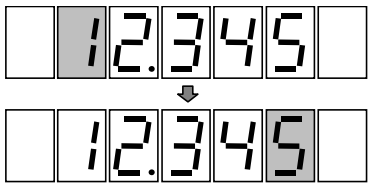
1 Press the DDS ○ key.



2 Specify a digit to be modified with the Δ F OFF ⇦ or Δ dB OFF ⇨ key.

The currently specified digit blinks.

Press the Δ F OFF ⇦ key two times.

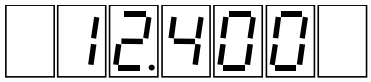


■ NOTE

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

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

Turn the knob clockwise by fifty-five 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.

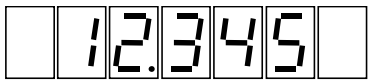
5-13-4 Specifying a variable step amount of the DDS frequency

The DDS frequency can be varied at a certain step amount.

■ NOTE

The step DDS frequency can be set in the range of －10 kHz to 10 kHz.

Ex. Setting a variable step amount to 1.1 kHz



1 Press the SHIFT ○ key.

2 Press the DDS-STEP 3 key.

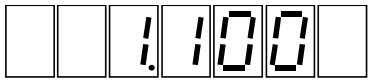
3 Enter a variable step amount with the data keys.

1 . 1

■ 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 ENTER key.

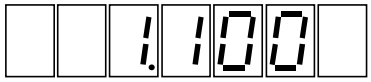


The set value is displayed for about 10 seconds.

Ex. Verifying the variable step amount

1 Press the SHIFT key.

2 Press the DDS-STEP 3 key.

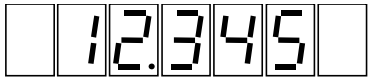


The set value is displayed for about 10 seconds.

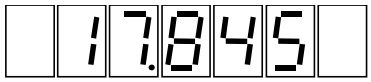
5-13-5 Changing the DDS frequency at a variable step amount

Ex. Increasing the frequency from 12.345 kHz five times, then decrease it twice at a 1.1 kHz step amount

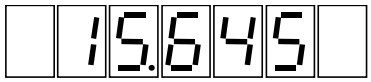
1 Press the DDS key.



2 Turn the ***EDIIT*** knob clockwise by five steps.



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



■ NOTE

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

5-13-6 Canceling the step DDS frequency

1 Press the SHIFT key.

2 Press the DDS-STEP 3 key.

3 Press the I/O MODE 0 key.

4 Press the ENTER key.

■ NOTE

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

5-14 ASSORTED PRESET MEMORY

5-14-1 General

The assorted preset memory function can be used to store up to 100 sets of parameters as described before, and to recall a desired set of parameters as necessary.

The 100 sets of preset memories are managed with the memory address of 00 to 99. A memory address is indicated in the ***MEMORY ADDRESS*** readout.

Table 5-23 lists the setting items that may be stored in one set.

Table 5-23 Setting items that may be stored in the preset memory

Item	Setting
RF frequency	
Frequency	0.100 0 MHz to 140.000 0 MHz 162.000 0 MHz to 163.000 0 MHz
Relative frequency	－99.999 9 MHz to 99.999 9 MHz
Variable step	－99.999 9 MHz to 99.999 9 MHz
Output level	
Level	－20.0 dBμV [emf] to 126.0 dBμV [emf]
Relative level	0 dB to ±146 dB
Output	ON / OFF
Variable step	0 dB to ±146 dB
Amplitude modulation (AM)	
Modulation	ON / OFF
Modulation signal	INT 400 Hz / INT 1 kHz / INT DDS / EXT
Modulation degree	0 % to 100 %
Frequency modulation (FM)	
Modulation	ON / OFF
Modulation signal	INT 400 Hz / INT 1 kHz / INT DDS / EXT
Frequency deviation	0.0 kHz to 100 kHz
Main- / Sub-channel signal	
Modulation	ON / OFF
Modulation mode	MONO / L＝R / L / R / L＝－R
Modulation ratio	0 % to 127 %
Pre-emphasis	25 μs / 50 μs / 75 μs / OFF
DDS frequency	
Frequency	0.020 kHz to 20.000 kHz
Variable step	－10 kHz to 10 kHz
Pilot signal	
Signal	ON / OFF
Level ratio	0.0 % to 15 % (FM stereo)
Selection state of setting item	AMPTD / FREQ / FM / AM PILOT LVL / DDS RDS LVL / SK LVL (for LG 3219only)
External control output	
Port 1	0 to 255
Port 2	0 to 255

(Continued to the next page)

Table 5-23 Setting items that may be stored in the preset memory (Cont'd)

Item	Setting
Reverse frequency of relay drive output	−140 to 140
RDS signal (LG 3219 only)	
Signal	ON / OFF
Level	0.0 % to 10 %
Pattern data	0 to 15 (0_H to F_H) / Null / Sc
Sub carrier phase	0° / 90°
TRI signal (LG 3219 only)	
SK signal	ON / OFF
SK signal level	0.0 % to 10 %
BK signal	ON / OFF
BK signal AM degree	0 % to 80 %
BK signal code data	A to F
DK signal	ON / OFF
DK signal AM degree	0 % to 40 %

The basic operations related to the assorted preset memories are described in the following paragraphs.

5-14-2 Storing operation

5-14-3 Direct recalling operation

5-14-4 Sequential recalling operation

5-14-5 Grouped sequential recalling operation

5-14-2 Storing operation

Ex. Storing the current settings in the preset memory with the memory address 12

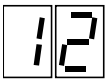
1 Press the SHIFT [○] key.

2 Press the STO [RCL] key.

3 Enter a memory address with the data keys.

[1] [2]

4 Press the ENTER [○] key.

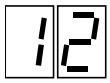


5-14-3 Direct recalling operation

Ex. Recalling the memory with the memory address 12

1 Press the STO / RCL key.

2 Enter a memory address with the data keys.



1 2

■ NOTE

Alternatively, the preset memories with the memory addresses 00 to 09 can be recalled with the procedure as described in the paragraph "Ex. Recalling the memory with the memory address 1."

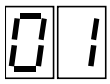
Ex. Recalling the memory with the memory address 1

1 Press the STO / RCL key.

2 Enter a memory address with the data keys.

1

3 Press the ENTER / ○ key.



5-14-4 Sequential recalling operation

The memories between a desired start address and end address can be sequentially recalled with a single key operation.

Setting a start address to 12, and end address to 34

1 Press the SHIFT / ○ key.

2 Press the STO / RCL key.

3 Press the PORT 2 / . key.

4 Enter a two-digit start address with the data keys.

1 2

5 Press the PORT 2 / . key.

6 Enter a two-digit end address with the data keys.

3 4

7 Press the ENTER ○ key. 

■ NOTE

- It is assumed that the smaller one of the two entered addresses is a start address and the bigger one is an end address. Thus setting two addresses as follows causes the preset memories to be sequentially recalled from the address 12 to the address 34.

SHIFT ○ STO RCL · 3 4 · 1 2 ENTER ○

- When a start or end address is specified, it is shown with the dot [·] mark added to its end. 
- If a start and end addresses are set to the same numeric value, both addresses are cancelled.

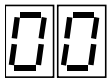
Ex. Canceling a start or end address

1 Press the SHIFT ○ key.

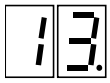
2 Press the STO RCL key.

3 Press the PORT 2 · key.

4 Press the PORT 2 · key.

5 Press the ENTER ○ key. 

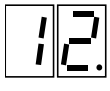
Ex. Recalling addresses sequentially (start address 12, end address 34)

1 Press the AUTO/MANU ⇧ key. 

The address after the current address is recalled.

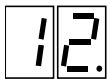
■ NOTE

If the currently displayed address is the end address, the start address is recalled.

2 Press the COPY ⇩ key. 

The address before the current address is recalled.

■ NOTE
If the currently displayed address is the start address, the end address is recalled.

3 Press the LIST CLR key. 

The start address is recalled.

■ NOTE
If the LIST CLR key is pressed when the start and end addresses are cancelled, the address 00 is recalled.

5-14-5 Grouped sequential recalling operation

Preset memories can be divided into up to ten groups. Then you may specify a desired one group to perform sequential recalling.

Ex. Defining Group 5 with a start address set to 12 and an end address set to 34

1 Press the SHIFT ○ key.

2 Press the STO RCL key.。

3 Press the PORT 2 . key.

4 Enter a two-digit start address with the data keys.

1 2

5 Press the PORT 2 . key.

6 Enter a two-digit end address with the data keys.

3 4

7 Press the PORT 2 . key.

8 Enter a group number with the data keys.

5

9 Press the ENTER ○ key. 

■ NOTE
More than one group can share same addresses.

Ex. Defining three groups sharing same addresses

1 Press the SHIFT [O] key.

2 Press the STO [RCL] key.

3 Press the PORT 2 [.] key.

4 Enter a two-digit start address with the data keys.

[0] [0]

5 Press the PORT 2 [.] key.

6 Enter a two-digit end address with the data keys.

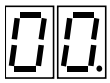
[2] [0]

7 Press the PORT 2 [.] key.

8 Enter a group number with the data keys.

[1]

9 Press the ENTER [O] key.



10 Press the SHIFT [O] key.

11 Press the STO [RCL] key.

12 Press the PORT 2 [.] key.

13 Enter a two-digit start address with the data keys.

[1] [0]

14 Press the PORT 2 [.] key.

15 Enter a two-digit end address with the data keys.

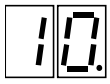
[3] [0]

16 Press the PORT 2 [.] key.

17 Enter a group number with the data keys.

[2]

18 Press the ENTER [O] key.



19 Press the SHIFT ○ key.

20 Press the STO RCL key.

21 Press the PORT 2 · key.

22 Enter a two-digit start address with the data keys.

2 0

23 Press the PORT 2 · key.

24 Enter a two-digit end address with the data keys.

4 0

25 Press the PORT 2 · key.

26 Enter a group number with the data keys.

3

27 Press the ENTER ○ key.

Ex. Specifying Group 1

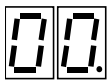
1 Press the STO RCL key.

2 Press the PORT 2 · key.

3 Enter a group number with the data keys.

1

4 Press the ENTER ○ key.



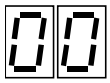
Ex. Canceling sequentially recalling within a group

1 Press the SHIFT ○ key.

2 Press the STO RCL key.

3 Press the PORT 2 · key.

4 Press the PORT 2 · key.

5 Press the ENTER key. 

■ NOTE

When a start and end addresses are set to the same numeric value, both addresses are cancelled.

CHAPTER 6 GP-IB INTERFACE

6-1 GENERAL

The GP-IB interface allows this series of signal generators to execute the following functions:

(1) Remote control of the instrument's settings by program codes that are sent from the controller (listener)
(2) Function for sending the instrument's settings to the controller (talker).
(3) Memory sync and memory copy functions (talk only / listen only).

6-2 GP-IB INTERFACE FUNCTION

Table 6-1 shows the instrument's interface functions.

Table 6-1 Code assignment of command information

Function	Code	Description
Source handshake	SH1	Complete capability
Acceptor handshake	AH1	Complete capability
Talker	T7	Basic talker, talker release by MLA, and talk only
Listener	L3	Basic listener, listener release by 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

6-3 GP-IB CONNECTOR

Figure 6-1 shows the pin assignment of the ***GP-IB*** connector of the instrument.

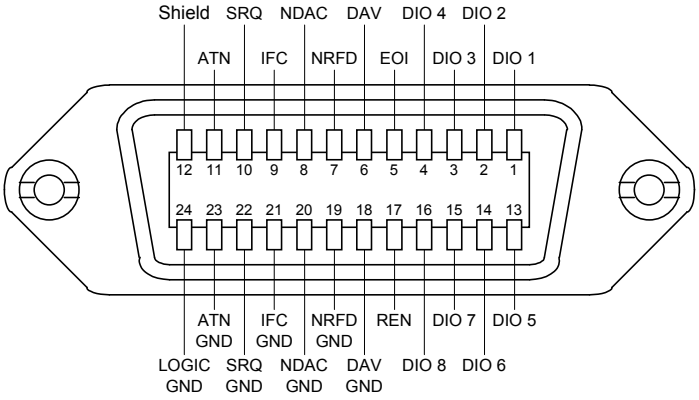


Figure 6-1 GP-IB pin assignment

6-4 GP-IB ADDRESS SETTING

A GP-IB device address is set with panel keys. The GP-IB address appears in the ***FREQUENCY*** readout with the parameters for other I/O modes only during setting and verifying operation.

Ex. Verifying the GP-IB address setting

1 Press the SHIFT [0] key.

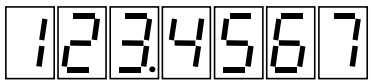
2 Press the I/O MODE [0] key.

The Digits A1 and A2 in the ***FREQUENCY*** readout display the GP-IB device address as a decimal number of 0 to 30.

■ NOTE

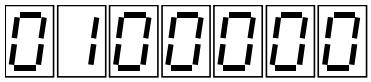
After pressing the I/O MODE [0] key, operating any key and knob other than mentioned under turns the I/O mode light of the ***FREQUENCY*** readout off; i.e. the generator returns to the normal setting state.

Ex. Setting the GB-IB address to 15

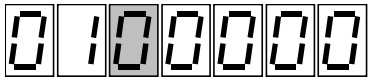


1 Press the SHIFT [0] key.

2 Press the I/O MODE [0] key.



3 Specify the A1 digit with the ΔF OFF [⇦] ΔdB OFF [⇨] keys.

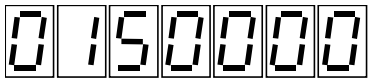


The currently specified digit is displayed blinking,

4 Enter an address with ***DATA*** keys.

[1] [5]

5 Press the ENTER [0] key.

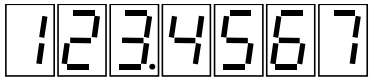


6 Press the ***POWER*** switch.

Turn the power off.

7 Press the ***POWER*** switch.

Again turn the power on.



■ NOTE

Turning the ***POWER*** switch off and then on completes the setting procedure. Note that if this step is omitted, the generator will maintain the previous setting.

6-5 DEVICE CLEAR

The DCL or SDC command clears the signal generator to the initial conditions shown in Table 6-2.

Table 6-2 Initial conditions

Item	Setting
Output level	−20.0 dBμV [emf]
Effective digit of the ***AMPLITUDE*** readout	The first digit (The lowest digit)
RF frequency	140.000 0 MHz
Effective digit of the ***FREQUENCY*** readout	The first digit (The lowest digit)
Status of the ***FUNCTION*** block	***RF FREQ*** key light is lit
Contents of the ***MODULATION*** readout	AM degree
Frequency modulation	OFF
Modulation signal	INT
Deviation	0.0 kHz
Amplitude modulation	OFF
Modulation signal	INT
Modulation degree	0 %
Internal modulation frequency	1 kHz
Main- and sub-channel modulation signal	
Modulation level ratio	0 %
Modulation mode	MONO
PILOT signal	OFF
Pilot level	0 %
Pre-emphasis	OFF
RDS signal (LG 3219 only)	OFF
Level ratio	0 %
Selection of the pattern	Null
Sub carrier phase	0°
TRI SK signal (LG 3219 only)	OFF
Level ratio	0 %
TRI DK signal (LG 3219 only)	OFF
AM degree	0 %
TRI BK signal (LG 3219 only)	OFF
AM degree	0 %
Code selection	A
DDS frequency	
Frequency	20 kHz
I/O mode	
Operation mode for auto sequence	0 (Repeat up)
External control output signal Port 1	0
Port 2	0
Memory address	00
Reverse frequency of a relay drive output	30 MHz

6-6 FUNCTIONS REMOTELY UNCONTROLLABLE

Most of the instrument functions executed through panel operation can be remotely controlled via the GP-IB. The following functions, however, cannot be remotely controlled.

- The ***EDIIT*** knob operation
- The relative value display of RF frequency and output level
- Sequential memory recall (AUTO/MANU  , COPY  , and LIST  keys operation)
- Memory grouping
- Group specification for sequential memory recall
- Starting and ending of memory auto sequence
- Setup of the I/O mode

6-7 REMOTE / LOCAL FUNCTION

The remote / local function is controlled with the system controller and the ○ REMOTE ● LOCAL  key of the signal generator.

The instrument is always in either of the three modes; local, remote, and remote with lockout. Each mode is described in the following paragraph.

6-7-1 Local mode

The instrument enters the local monde when:

- the ***POWER*** switch is turned on,
- the ○ REMOTE ● LOCAL  key is pressed to turn the key light off,
- the GTL command is received, or
- the REN line becomes false in the remote mode.

■ NOTE

When the mode is switched from remote to local, the setup condition in the remote mode remains effective in the local mode.

6-7-2 Remote mode

The generator enters the remote mode if it receives the MLA command with the REN line true.

■ NOTE

- In the remote mode, the ***POWER*** switch and 

key are only effective.
- When the mode is switched from local to remote, the setup condition in the local mode remains effective in the remote mode.

6-7-3 Remote mode with lockout

In this mode, the 

key cannot be used to switch to the local mode.

To set the generator in the local mode, 1) issue the GTL address command, 2) make the REN line false, or 3) turn the power off and then on again.

6-8 RESPONSE TO COMMANDS

Table 6-3 shows the types of commands and the generator's response to each command.

Table 6-3 Response to commands

Type	Name	Description	Response
Universal command	DCL	Clears all devices.	○
	SPE	Enables serial polling.	×
	SPD	Clears serial polling.	×
	PPU	Clears parallel polling.	×
	LLO	Sets all devices in the local lockout mode to disable manual operation.	○
Address command	UNL	Releases the specified listener.	○
	UNT	Releases the specified talker,	○
	SDC	Clears the specified device.	○
	GTL	Sets the specified device in the local mode.	○
	PPC	Enables parallel polling line assignment to the specified listener during parallel polling.	×
	GET	Issues a trigger to the specified device.	×
	TCT	Transfers bus control to the talker-specified controller when the system has two or more controllers.	×

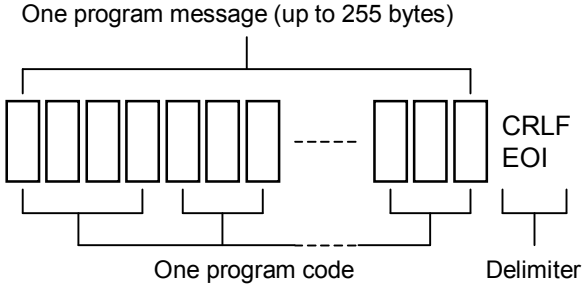
6-9 PROGRAM CODE INPUT FORMAT

This paragraph describes the input format for GP-IB program codes.

6-9-1 Input program message format

To set the generator in a desired state through the GP-IB interface, several program codes must be sent from the controller to the generator.

The instrument can receive a program message of up to 255 bytes of program codes in 7-bit ASCII code. The program message format is as follows.



6-9-2 Delimiter for a program message

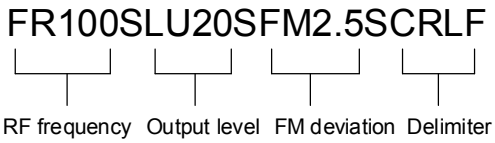
Either one of the following delimiters must be used for a program message.

- CRLF (0D＋0A in hexadecimal notation)
- LF (0A in hexadecimal notation)
- EOI (GP-IB uniline message)

6-9-3 The end code

The end code “S” is required for frequency, output level, modulation, recall, and store functions.

Given below are examples.



Setup value: RF frequency.... 100 MHz
Output level..... －20 dBμV
FM deviation .... 2.5 kHz

6-9-4 Program code input format

A GP-IB program code consists of a header code, data code, and unit code. Most header codes consist of two English upper cases. A data code is generally a numeric value. A unit code consists of one or two English upper cases, but many of the program codes require no unit code.

For detailed description of the program codes for setting parameters. The GP-IB program codes are given in a list at the end of this manual.

CHAPTER 7 RS-232-C INTERFACE

7-1 GENERAL

The instrument provides an RS-232-C interface on the rear panel. The RS-232-C interface makes the following functions effective.

(1) Remote control for RF frequency, output level, and modulation settings by program codes that are sent from the host.

(2) Sending and receiving of RDS data by the attached pattern software. (Only for LG 3219)

■ NOTE

Even if RS-232-C remotely controls the instrument, 

key does not go on.

7-2 INTERFACE SPECIFICATIONS

Table 7-1 shows the fixed RS-232-C interface conditions of the instrument.

Table 7-1 RS-232-C interface specifications

Item	Description
Communication system	Asynchronous system
Transmission rate	38 400 bps
Stop bit	1 bit
Character length	8 bits
Parity	EVEN
Control line specification	DTE specification *1
Flow control	Software flow control (Xon: 11_H / Xoff: 13_H)

*1: Use a cross cable to connect with a computer having DTE specifications.

7-3 RS-232-C CONNECTOR

The RS-232-C interface connector of the instrument is 9-pin D-sub plug.

Figure 7-1 shows the pin assignment of the ***RS-232-C*** connector of the instrument.

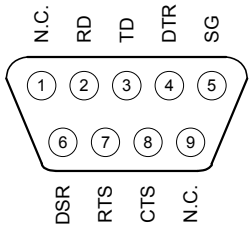


Figure 7-1 RS-232-C pin assignment

Table 7-2 lists signal functions.

Table 7-2 RS-232-C pin connection

Pin No.	Signal	Description
1	N.C.	Not connected
2	RD	Received data
3	TD	Transmitted data
4	DTR	Internal connection with No. 6 terminal
5	SG	Ground for signal
6	DSR	Internal connection with No. 4 terminal
7	RTS	Internal connection with No. 8 terminal
8	CTS	Internal connection with No. 7 terminal
9	N.C.	Not connected

CHAPTER 8 EXTERNAL CONTROL INTERFACE

8-1 GENERAL

Besides the GP-IB and RS-232-C interfaces, the instrument has an external control interface and relay drive output. The dedicated connector is provided on the rear panel. Given below is a general introduction of the basic function.

8-1-1 External control interface function

The following functions are available by using the ***EXT CONTROL I/O*** connector.

(a) Remote sequential recall

Memory sequential recall can be remotely controlled from the outside.

(b) Remote modify

Modification of an RF frequency or output level can be remotely controlled with an external rotary encoder.

(c) Remote direct recall

Memory direct recall can be remotely controlled from the outside.

(d) Control output

The TTL output signal of 8 bits × 2 ports for external device control is available.

(e) Print out of memory contents (list output)

The preset memory contents can be printed out to a printer.

(f) Data read

The 8-bit TTL signal externally applied can be read with the GP-IB controller.

8-1-2 Relay drive output function

A drive signal is obtained from the ***DRIVE OUTPUT*** connector, which reverses between HIGH and LOW according to whether the frequency is higher or lower than the preset reverse frequency.

If the drive output is HIGH, a signal of +5 V, 50 mA is obtained. The signal can be used to drive a small reed relay and control a signal switch or dummy antenna switch.

8-2 EXT CONTROL I/O CONNECTOR

Figure 8-1 shows the pin connection of the ***EXT CONTROL I/O*** connector and Table 8-1 shows the pin function.

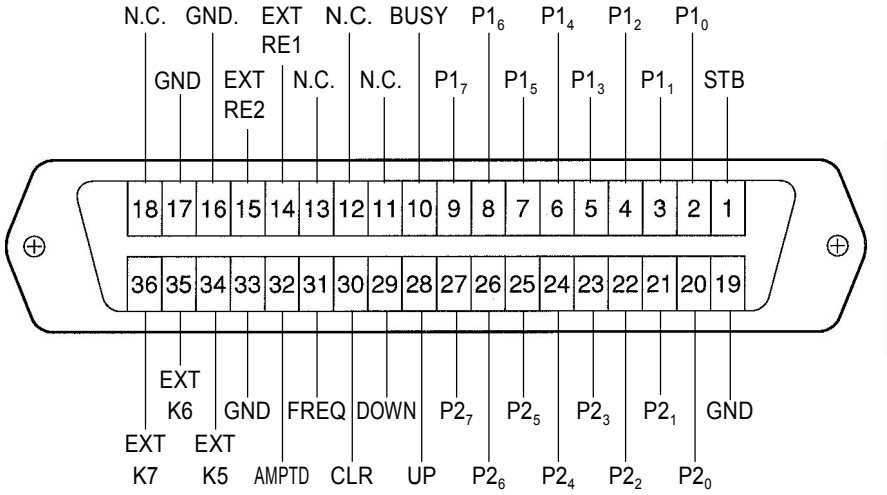


Figure 8-1 ***EXT CONTROL I/O*** connector pin assignment

■ NOTE

Use a shield-type 36-pin plug and cable for connection. An unshielded plug or cable may cause an error due to electrostatic interference.

Table 8-1 Pin function

Number	Name	Function
1	STB	Input terminal for a timing pulse to read address data in memory direct recall, or for a printer acknowledge signal in memory list output.
2 to 9	$P1_0$ to $P1_7$	Input / output terminal for 8-bit data used in control output, memory direct recall, and, memory list output functions. (port 1)
10	BUSY	Output terminal for a signal informing that the generator cannot receive data during memory direct recall, or for a strobe signal from the generator to the printer in memory list output.
11 to 13	N.C.	Not connected to the internal circuit.
14	EXT RE1	External rotary encoder terminal 1. (Corresponding to the ***EDIIT*** knob)
15	EXT RE2	External rotary encoder terminal 2. (Corresponding to the ***EDIIT*** knob)
16	GND	Frame ground
17	GND	Frame ground
18	N.C.	Not connected to the internal circuit.
19	GND	Frame ground
20 to 27	$P2_0$ to $P2_7$	Input / output terminal for 8-bit data used in control output and data read functions. (port 2)

Table 8-1 Pin function (cont'd)

Number	Name	Function
28	UP	AUTO/MANU ⇧ key input terminal for sequential recall.
29	DOWN	COPY ⇩ key input terminal for sequential recall.
30	CLR	***CLR*** key input terminal for sequential recall.
31	FREQ	***FREQ*** key of the ***FUNCTION*** block input terminal.
32	AMPTD	***AMPTD*** key of the ***FUNCTION*** block input terminal.
33	GND	Frame ground
34 to 36	EXT K5 to K7	Spare pins. Do not connect to any external devices.

8-3 MODE SETTING

Use panel keys to set the mode for the EXT CONTROL I/O interface.

The selected mode for the EXT CONTROL I/O interface is displayed with other I/O mode parameters only during the setup and verification operations.

Given below are the relationship between the numeric values of P1 and P2 and modes.

P1	Mode
0	Control output
1	Memory direct recall
2	Memory list output

P2	Mode
0	Control output
1	Data read

Ex. Verifying the EXT CONTROL I/O Interface mode

1 Press the SHIFT ○ key.

2 Press the I/O MODE 0 key.

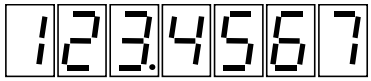
SP A2 A1 TL P1 P2 AS

The digits P1 and P2 in the ***FREQUENCY*** readout display the modes of port 1 and 2 of the EXT CONTROL I/O interface, respectively.

■ NOTE

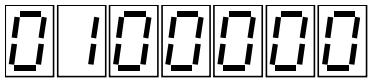
After pressing the I/O MODE 0 key, operating any key and knob other than the mentioned under turns the ***I/O*** light off; i.e. the generator returns to the normal setting state.

Ex. Setting the mode of P1 to memory direct recall "1"

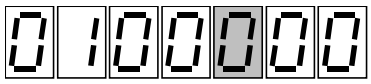


1 Press the SHIFT [0] key.

2 Press the I/O MODE [0] key.



3 Specify either P1 or P2 digit with the ◿F OFF [⇦] ◿dB OFF [⇨] keys.

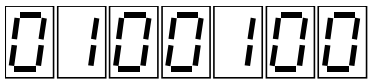


The currently specified digit is displayed blinking.

4 Enter a mode number with ***DATA*** keys.

[1]

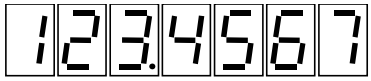
5 Press the ENTER [0] key.



6 Press the ***POWER*** switch.

Turn the power off.

7 Press the ***POWER*** switch.



Again turn the power on.

■ NOTE

The setting procedure is completed by turning the ***POWER*** switch off and then on. Note that if this step is omitted, the generator will maintain the previous setting.

8-4 COMMON ITEMS ON EVERY OPERATION

The external control interface is a TTL-logic control I/O. Described in this paragraph are signals common to every EXTERNAL CONTROL interface operation.

Input signal

An input signal is a TTL-level logic signal. Since each input connector pin is internally pulled up to +5 V, the applied signal is switched between HIGH and LOW by making the input connector pin and GND terminal open or short-circuited.

Output signal

An output signal is also a TTL-level logic signal. The output fan-out of each connector is 1 (LS-TTL).

8-5 REMOTE SEQUENTIAL RECALL

This function remotely controls UP (AUTO/MANU ⇧), DOWN (COPY ⇩), and CLR (LIST CLR) of assorted preset memory.

8-5-1 Connector pins used

Number	Name	Function
28	UP	Connects the UP (AUTO/MANU ⇧) signal.
29	DOWN	Connects the DOWN (COPY ⇩) signal.
30	CLR	Connects the CLR (LIST CLR) signal.
33	GND	Frame ground

8-5-2 Specifications for electrical operation

The UP, DOWN, or CLR operation of the memory is activated at the rising edge where the signal applied to the UP, DOWN, or CLR connector changes from LOW to HIGH. The timing condition is shown in Figure 8-2.

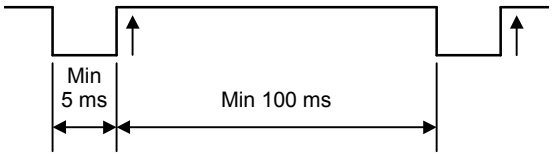


Figure 8-2 Timing diagram for the control signal of the preset memory

8-6 REMOTE MODIFY

This function remotely controls the modifying operation with the rotary encoder (***EDIIT***).

8-6-1 Connector pins used

Number	Name	Function
14	EXT RE1	External rotary encoder terminal 1 (Corresponding to the ***EDIIT*** knob).
15	EXT RE2	External rotary encoder terminal 2 (Corresponding to the ***EDIIT*** knob).
31	FREQ	***FREQ*** key input terminal.
32	AMPTD	***AMPTD*** key input terminal.
33	GND	Frame ground

8-6-2 Specifications for electrical operation

The external rotary encoder terminals 1 and 2 can be used for frequency (FREQ) control or output level (AMPTD) control.

The FREQ control or AMPTD control is selected at the rising edge where the pulse applied to the each pin changes from LOW to HIGH. The timing condition is same as that shown in Figure 8-2.

Use a rotary encoder of contact type dual-phase output to connect to EXT RE1 and EXT RE2. Figure 8-3 shows the timing conditions for a modify signal.

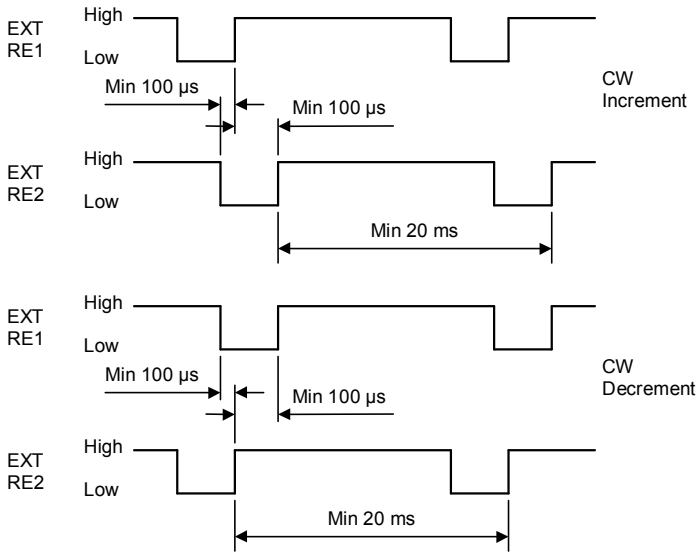


Figure 8-3 Timing diagram for a modify signal

8-7 REMOTE DIRECT RECALL

This function remotely controls the memory direct recall.

8-7-1 Connector pins used

Number	Name	Function
1	STB	Connects a timing pulse for reading data.
2 to 9	$P1_0$ to $P1_7$	Connects address data. (port 1)
10	BUSY	Outputs a signal informing the generator cannot receive data.
19	GND	Frame ground

8-7-2 Specifications for electrical operation

For the pins $P1_0$ to $P1_7$, set the address data of 00 to 99 in BCD code. Given below are the relationship between a signal to be applied to each connector pin and its address data.

Input signal								Address data
$P1_7$	$P1_6$	$P1_5$	$P1_4$	$P1_3$	$P1_2$	$P1_1$	$P1_0$	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0	0	0	0	1	0	0	1	9
0	0	0	1	0	0	0	0	10
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	0	0	1	1	0	0	1	99

0: Low (= 0 V) 1: High (= 5 V)

After the address data is set, applying a timing pulse to the STB pin causes the memory at the set address to be recalled. Figure 8-4 shows the timing condition for each connector.

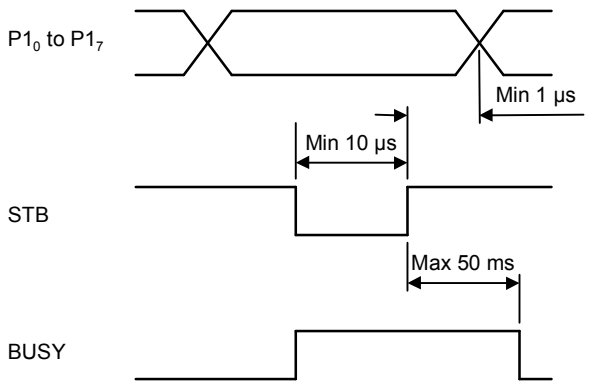


Figure 8-4 Timing diagram for address data

8-8 CONTROL OUTPUT

This function provides TLL signals of up to 8 bits × 2 ports for external device control.

8-8-1 Connector pins used

Number	Name	Function
2 to 9	$P1_0$ to $P1_7$	Outputs 8-bit data (port 1)
20 to 27	$P2_0$ to $P2_7$	Outputs 8-bit data (port 2)
19	GND	Frame ground

8-8-2 Readout

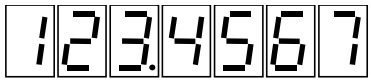
The set value for the control output signal is displayed in the ***FREQUENCY*** readout only during the setting and verifying operations. The readout value denotes the 8-bit data of port 1 or port2, which is expressed as decimal data of 0 to 255 with $P1_0$ or $P2_0$ considered as LSB and $P1_7$ or $P2_7$ as MSB. Given below are the set values and the signals obtained from the ***EXT CONTROL I/O*** connector.

Set value	Output signal							
	$P1_7$ / $P2_7$	$P1_6$ / $P2_6$	$P1_5$ / $P2_5$	$P1_4$ / $P2_4$	$P1_3$ / $P2_3$	$P1_2$ / $P2_2$	$P1_1$ / $P2_1$	$P1_0$ / $P2_0$
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
254	1	1	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

0: Low (= 0 V) 1: High (= 5 V)

8-8-3 Operating procedure

Ex. Setting control for port 1 and 2



1 Press the SHIFT ○ key.

2 Press the PORT 1 2 key.

3 Enter a numeric value with ***DATA*** keys.

1 2

■ NOTE

You cannot enter numerical values when the ***I/O*** light goes out.

4 Press the ENTER key.

5 Press the SHIFT key.

6 Press the PORT 2 key.

7 Enter a numeric value with ***DATA*** keys.

3 4

■ NOTE

You cannot enter numerical values when the ***I/O*** light goes out.

8 Press the ENTER key.

■ NOTE

Operating any key and knob other than the ΔF OFF ⇦ ΔdB OFF ⇨ key turns the ***I/O*** light off; i.e. the generator returns to the normal setting mode.

8-9 RELAY DRIVE OUTPUT

A drive output signal can be obtained from the ***DRIVE OUTPUT*** connector on the rear panel. The signal reverses between HIGH and LOW according to whether the frequency (F) is higher or lower than the preset reverse frequency (FR).

When the drive output is HIGH, a ＋5 V / 50 mA signal can be obtained to drive a small reed relay.

The signal is used for controlling a signal switch or dummy antenna switch. The setting range / resolution of the reverse frequency are:

0 MHz to 140 MHz / 1 MHz

The reverse frequency can be set with a minus (-) sign for an action reverse to that obtained when the reverse frequency is set without a minus sign.

Table 8-3 show the relationship among a reverse frequency set value, RF frequency condition, and drive output signal obtained.

Table 8-3 Frequency and drive signal

Reverse frequency	Condition set value	Drive output
set value Fr without a minus sign	F＜Fr	Low
	F≧Fr	High
Set value Fr with a minus sign	F＜Fr	High
	F≧Fr	Low

8-9-1 Output connector

A drive output signal is obtained from the ***DRIVE OUTPUT*** connector on the rear panel. The connector is an RCA-type pin connector whose center conductor provides an output signal and outer conductor is connected to the frame ground. Connect the center conductor of the ***DRIVE OUTPUT*** connector with the ＋ terminal of the coil of the relay to be controlled. Also connect the outer conductor with the － terminal of the coil. If the coil of the relay to be controlled has no polarity, connect the center conductor of the ***DRIVE OUTPUT*** connector with one terminal of the coil, and the outer conductor with the other terminal.

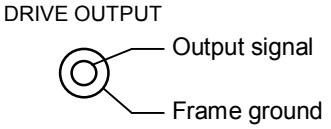


Figure 8-5 Drive output connector

8-9-2 Operating procedure

Ex. Setting a reverse frequency

1 Press the SHIFT ○ key.

2 Press the DRIVE 4 key.

3 Enter an RF frequency value with ***DATA*** keys.

– 1 2 3

■ NOTE

You cannot enter numerical values when the ***I/O*** light goes out.

4 Press the ENTER ○ key.

APPENDIX 1 GP-IB PROGRAM CODE LIST

Parameter	Header	Data code	End code	Description
RF frequency	FR	0.100 0 to 140.000 0 162.000 0 to 163.000 0	S	Specifies an RF frequency. (MHz)
Output level	LU	-20.0 to 126.0	S	Specifies an output level. (dBuV emf)
	LM	-133.0 to 13.0	S	Specifies an output level. (dBm)
AM	AO	0		Turns amplitude modulation OFF.
		1		Turns amplitude modulation ON.
	AM	T1		Sets an amplitude modulation signal to INT 1kHz.
		T4		Sets an amplitude modulation signal to INT 400Hz.
		XD		Sets an amplitude modulation signal to EXT.
		TD		Sets an amplitude modulation signal to DDS.
		0.0 to 100	S	Specifies an amplitude modulation degree.
FM	FO	0		Turns frequency modulation OFF.
		1		Turns frequency modulation ON.
	FM	T1		Sets a frequency modulation signal to INT 1kHz.
		T4		Sets a frequency modulation signal to INT 400Hz.
		XD		Sets a frequency modulation signal to EXT.
		TD		Sets a frequency modulation signal to DDS.
		0.0 to 100	S	Specifies an FM deviation. (kHz)
Internal audio frequency	IN	10		Set the frequency of the internal oscillator to 1kHz.
		04		Set the frequency of the internal oscillator to 400Hz.
Stereo mode	SM	0		Sets a FM stereo mode to L=R (MAIN).
		1		Sets a FM stereo mode to L.
		2		Sets a FM stereo mode to R.
		3		Sets a FM stereo mode to L=-R (SUB).
Modulation mode	MS	00		Turns frequency modulation OFF.
		01		Sets a modulation mode to FM MONO, INT.
		02		Sets a modulation mode to FM L=R (MAIN) , INT.
		03		Sets a modulation mode to FM L, INT.
		04		Sets a modulation mode to FM R, INT.
		05		Sets a modulation mode to FM L=-R (SUB) , INT.
		11		Sets a modulation mode to FM MONO, EXT.
		12		Sets a modulation mode to FM L=R (MAIN) , EXT.
		13		Sets a modulation mode to FM L, EXT.
		14		Sets a modulation mode to FM R, EXT.
		15		Sets a modulation mode to FM L=-R (SUB) , EXT.
Pilot signal	PT	0		Turns a pilot signal OFF.
		1		Turns a pilot signal ON.
	PM	0.0 to 10.0	S	Sets a pilot signal level. (kHz)

Pre-emphasis	PR	0		Turns pre-emphasis OFF.
		1		Turns pre-emphasis OFF.
		2		Turns a time constant to 50 µs
		3		Turns a time constant to 75 µs
DDS	DS	0.020 ～ 20.000	S	Sets DDS frequency. (kHz)
AF modulation	MD	0		Turns AF modulation OFF.
		1		Turns AF modulation ON.
EXT modulation	EX	1		Sets a modulation signal to EXT.
Preset	RC	0 to 99	S	Recall a preset memory.
	ST	0 to 99	S	Stores settings in the preset memory.
Control output	P1 P2	B00000000 to B11111111		Sets control output for port 1 or 2 in binary data.
		H00 to HFF		Sets control output for port 1 or 2 in hexa-decimal data.
		D0 to D255		Sets control output for port 1 or 2 in decimal data.
		S0 to S7		Sets (to 1) the specified bit of port 1 or 2.
		R0 to R7		Resets (to 0) the specified bit of port 1 or 2.

Program codes for RDS (LG3219 only)

Header	Data code	Unit code	Description
RD	ON		Turns an RDS signal ON.
	OF		Turns an RDS signal OFF.
	0.0 to 10	PC	Specifies an RDS signal level
	NULL		Selects the pattern data Null.
	SC		Selects the pattern data Sc.
	0 to F		Selects a registered pattern data. (among the pattern 0 to 15)
	P0		Sets a sub-carrier phase to 0°.
	P9		Sets a sub-carrier phase to 90°.
SK	ON		Turns ARI SK signal ON.
	OF		Turns ARI SK signal OFF.
	0.0 to 10	(PC)	Specifies an ARI SK signal level.
DK	ON		Turns ARI DK signal ON.
	OF		Turns ARI DK signal OFF.
	0 to 40	(PC)	Specifies the AM degree of an ARI DK signal
BK	ON		Turns ARI BK signal ON.
	OF		Turns ARI BK signal OFF.
	0 to 80	(PC)	Specifies the AM degree of an ARI BK signal
	A to F		Specifies the code data of an ARI BK signal.

The unit codes in parentheses can be omitted.

Following information is for Chinese RoHS only

所含有毒有害物质信息

部件号码：LG 3219/3238

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产品中有毒有害物质或元素的名称及含量

部件名称 Parts	有毒有害物质或元素 Hazardous Substances in each Part					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
机箱	×	○	×	×	○	○
机架	×	○	×	×	○	○
电路板組件	×	○	×	×	○	○
連接电線	×	○	×	×	○	○
附属品	○	○	○	○	○	○

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Ver.2

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