MG3633A
Synthesized Signal Generator
Operation Manual

14th Edition

For safety and warning information, please read this manual before attempting to use the equipment.
Keep this manual with the equipment.

ANRITSU CORPORATION

Document No.: M-W0504AE-14.0

Safety Symbols

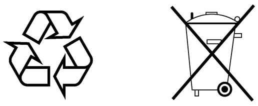
To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

DANGER ⚠	This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
WARNING ⚠	This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
CAUTION ⚠	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

⃠	This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.
○	This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.
△	This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.
□	This indicates a note. The contents are described in the box.
	These indicate that the marked part should be recycled.

MG3633A
Synthesized Signal Generator
Operation Manual

1 November 1989 (First Edition)
7 December 2007 (14th Edition)

Printed in Japan

For Safety

WARNING ⚠

1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the advice in the operation manual is not followed there is a risk of personal injury or reduced equipment performance. The alert mark shown on the left may also be used with other marks and descriptions to indicate other dangers.

2. IEC 61010 Standard
   The IEC 61010 standard specifies four categories to ensure that an instrument is used only at locations where it is safe to make measurements. This instrument is designed for measurement category I (CAT I). DO NOT use this instrument at locations specified as category II, III, or IV as defined below.
   Measurement category I (CAT I):
   Secondary circuits of a device that is not directly connected to a power outlet.
   Measurement category II (CAT II):
   Primary circuits of a device that is directly connected to a power outlet, e.g., portable tools or home appliance.
   Measurement category III (CAT III):
   Primary circuits of a device (fixed equipment) to which power is supplied directly from the distribution panel, and circuits running from the distribution panel to power outlet.
   Measurement category IV (CAT IV):
   Building service-line entrance circuits, and circuits running from the service-line entrance to the meter or primary circuit breaker (distribution panel).

For Safety

WARNING ⚠

Electric Shock

3. To ensure that the instrument is earthed, always use the supplied 3-pin power cord, and insert the plug into an outlet with an earth terminal. If power is supplied without earthing the equipment, there is a risk of receiving a severe or fatal electric shock or causing damage to the internal components.

Repair

WARNING ⚠

4. This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or unit covers or to disassemble internal components. Only qualified service personnel with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

Calibration

5. The performance-guarantee seal verifies the integrity of the equipment. To ensure the continued integrity of the equipment, only Anritsu service personnel, or service personnel of an Anritsu sales representative, should break this seal to repair or calibrate the equipment. If the performance-guarantee seal is broken by you or a third party, the performance of the equipment cannot be guaranteed. Be careful not to break the seal by opening the equipment or unit covers.

Falling Over

6. This equipment should always be positioned in the correct manner. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

   Always set up the equipment in a position where the power switch can be reached without difficulty.

7. DO NOT short the battery terminals and never attempt to disassemble the battery or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak. This fluid is poisonous.

   Battery Fluid

   DO NOT touch the battery fluid, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, rinse them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

For Safety

CAUTION ⚠

Fuse Replacement

CAUTION ⚠

1. Always remove the mains power cable from the power outlet before replacing blown fuses. There is a risk of electric shock if fuses are replaced with the power cable connected. Always use new fuses of the type and rating specified on the rear panel of the instrument. There is a risk of fire if a fuse of a different rating is used.

   T5A250V indicates a time-lag fuse.

Cleaning

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

⚠CAUTION/注意

>18kg

HEAVY WEIGHT/重量物

3. Use two or more people to lift and move this equipment, or use a trolley. There is a risk of back injury, if this equipment is lifted by one person.

Use in a residential environment

4. This instrument is designed for an industrial environment.
   In a residential environment this instrument may cause radio interference in which case the user may be required to take adequate measures.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories, including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within one year after shipment due to a manufacturing fault, under the condition that this warranty is void when:

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

Notes On Export Management

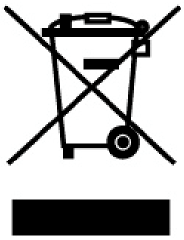
This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.

Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

When you dispose of export-controlled items, the products/manuals need to be broken/shredded so as not to be unlawfully used for military purpose.

Crossed-out Wheeled Bin Symbol

Equipment marked with the Crossed-out Wheeled Bin Symbol complies with council directive 2002/96/EC (the “WEEE Directive”) in European Union.



For Products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

CE Conformity Marking

Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Model: MG3633A Synthesized Signal Generator

2. Applied Directive

EMC: Directive 2004/108/EC
LVD: Directive 2006/95/EC

3. Applied Standards

- EMC: Emission: EN 61326-1: 2006 (Class A)
  Immunity: EN 61326-1: 2006 (Table 2)

	Performance Criteria*
IEC 61000-4-2 (ESD)	B
IEC 61000-4-3 (EMF)	A
IEC 61000-4-4 (Burst)	B
IEC 61000-4-5 (Surge)	B
IEC 61000-4-6 (CRF)	A
IEC 61000-4-11 (V dip/short)	B, C

*: Performance Criteria

A: During testing, normal performance within the specification limits.

B: During testing, temporary degradation, or loss of function or performance which is self-recovering.

C: During testing, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.

Harmonic current emissions:
EN 61000-3-2: 2006 (Class A equipment)

- LVD: EN 61010-1: 2001 (Pollution Degree 2)

4. Authorized representative

Name: Loic Metais
European Quality Manager
ANRITSU S.A. France
Address, city: 16/18 Avenue du Québec SILIC 720 Zone de Courtaboeuf
91951 Les Ulis Cedex
Country: France

C-tick Conformity Marking

Anritsu affixes the C-tick mark on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-tick marking

N274

1. Product Model

Model: MG3633A Synthesized Signal Generator

2. Applied Standards

EMC:Emission: EN 61326-1: 2006 (Class A equipment)

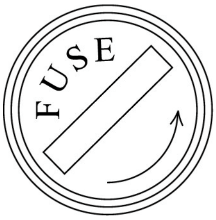
Power Line Fuse Protection

For safety, Anritsu products have either one or two fuses in the AC power lines as requested by the customer when ordering.

Single fuse:	A fuse is inserted in one of the AC power lines.
Double fuse:	A fuse is inserted in each of the AC power lines.

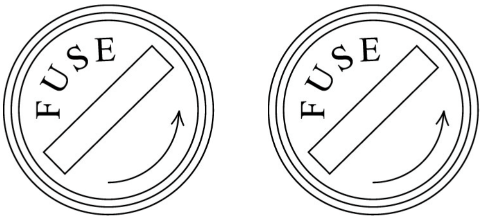
Example 1: An example of the single fuse is shown below:

Fuse Holder



Example 2: An example of the double fuse is shown below:

Fuse Holders



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MG3633A

Synthesized Signal Generator

Operation Manual

ANRITSU CORPORATION

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TABLE OF CONTENTS

SECTION 1
GENERAL

This section provides an outline of this manual and describes the standard composition, optional accessories, peripheral devices for expanding its functions and the specifications of the MG3633A Synthesized Signal Generator.

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SECTION 1
GENERAL

1.1 Product Outline

The MG3633A Synthesized Signal Generator is designed for use in R&D and testing of quasi-microwave band mobile communications, digital mobile communications, mobile satellite communications, satellite broadcasting, radio LANs and for various other analog and digital radio equipment. The MG3633A also has excellent basic performance in regards to frequency resolution, switching speed, signal purity, and output level accuracy as well as various modulation functions. The MG3633A performs amplitude, frequency, and phase modulation functions in the frequency range of 0.01 to 2700 MHz. Since the maximum output level is as large as +17 dBm , it is also used for various local signal sources.

The MG3633A is provided with versatile sweep functions for carrier frequency, output level, and modulation frequency parameters so that it can perform sweeping suitable for both the measured object and measuring equipment.

The MG3633A is also equipped with two memory functions: a FREQ memory to store up to 1000 carrier frequencies and a FUNCTION memory to store up to 100 panel setting conditions.

1.2 Operation Manual

This operation manual contains eight sections and three appendixes. The format and outline of each section is described below.

Section	Title	Contents
1	GENERAL	Description of the MG3633A (standard configuration, specifications), optional accessories and peripheral equipment, and outline of operation manual.
2	PRECAUTION	Operations to be performed before powering-up the MG3633A
3	PANEL LAYOUT AND PREPARATION	Layout, function and method of preparative operation of components such as keys, connectors, knobs, and indicators on both the front and rear panels.
4	OPERATING INSTRUCTIONS	Details of manual operation (local operation) of the front and rear panels. (Except for remote control by GP-IB)
5	MEASUREMENT	Methods for measuring sensitivity and selectivity of receivers as typical measurement examples using a signal generator
6	PERFORMANCE TEST	Measuring instrument setup, and procedures required for performance testing
7	CALIBRATION	Measuring instrument setup, and procedures required for calibration
8	STORAGE AND TRANSPORTATION	Daily maintenance, long period storage, re-packing and transportation
APPENDIX	A	For easy reference while proceeding through this manual, front and rear-panel illustrations are located in fold-out pages at the back of this manual.
APPENDIX	B	MA1610A Pulse Modulator operation manual
APPENDIX	C	Operation manual for Frequency-Response Compensation Software (option 07) MX5126B/MX5251B

Note: For GP-IB, see separate GP-IB manual.

1.3 Composition

This paragraph describes the standard configuration of the MG3633A and the options for expanding its functions.

1.3.1 Standard composition

The standard configuration of the MG3633A is listed in the table below.

Table 1-1 Standard Composition

Item	No.	Model number/ Order number	Name	Qty.	Remarks
Instru-ment	1	MG3633A	Synthesized Signal Generator	1	
Accessories supplied	2	J0025A	50Ω coaxial cable	1	Approx. 1m (S-5DWP·5D2W·S-5DWP), for RF output cable
	3	J0127A	50Ω coaxial cable	1	Approx. 1m (BNC-P·RG-58A/U·BNC-P), for modulation signal cable
	4		Power cord	1	
	5	F0012 (3.15A) or F0013 (5A)	AC fuse	2	***A (T***A250V)
	6	W0504AE	Operation manual	1	

1.3.2 Options

MG3633A options (sold separately) are listed in the table below.

Table 1-2 Options (Sold separately)

Option No.	Model number/ Order number	Name	Remarks
01	MG3633A-01	Reference crystal oscillator	Frequency: 10 MHz Start-up characteristics: $\leqq 7\times10^{-8}$/day (after 30-minute operation) Start-up characteristics: $\leqq 3\times10^{-8}$/day (after 60-minute operation) Aging rate: $\leqq 5\times10^{-9}$/day (after 24-hour operation) Temperature characteristics: $\leqq \pm5\times10^{-8}$ (at 0° to 50°C)
02	MG3633A-02	Reference crystal oscillator	Frequency: 10 MHz Start-up characteristics: $\leqq 2\times10^{-8}$/day (after 60-minute operation) Aging rate: $\leqq 2\times10^{-9}$/day (after 24-hour operation) Temperature characteristics: $\leqq \pm1.5\times10^{-8}$ (at 0° to 50°C)
03	MG3633A-03	Reference crystal oscillator	Frequency: 10 MHz Aging rate: $\leqq 5\times10^{-10}$/day (after 48-hour operation) Temperature characteristics: $\leqq \pm5\times10^{-9}$ (at 0° to 50°C)
04	MG3633A-04	Rear RF output	SMA connector The rear RF output cannot share the connector with the front RF output.
07	MX5126B	Frequency-response compensation software	Used with PACKET II e, III, III s Computer and ML4803A Power Meter (Appendix C)
	MX5251B	Frequency-response compensation software	Used with PACKET V Computer and ML4803A Power Meter (Appendix C)

1.4 Optional Accessories and Peripheral Equipment

The major optional accessories and peripheral equipment for the MG3633A are listed below. The items listed are sold separately.

Table 1-3 Optional Accessories (Sold separately)

Model number/ Order number	Name	Remarks
MP51A MP52A	Impedance Conversion Pad	For matching the MG3633A impedance to that of the measuring system (0 to 200 MHz). MP51A (from a 75Ω system to a 50Ω system) MP52A (from a 50Ω system to a 75Ω system)
MP614A	50Ω↔75Ω Impedance Transformer	For matching the MG3633A impedance to that of a 75Ω measuring device (10 to 1200 MHz)
Z-164A Z-164B	T-pad	For measuring two-signal characteristics, Z-164A for 50Ω, Z-164B for 75Ω
MP659A	Four-port Junction Pad	For measuring three-signal characteristics
MP721☐	Fixed Attenuator	Nominal attenuations: 3, 6, 10 to 60 dB (10 dB steps), covering the frequency range of DC to 12.4 GHz. For level adjustment and improvement of impedance characteristics.
B0043	Rack mount kit	

Table 1-4 Peripheral Equipment (Sold separately)

Model number/ Order number	Name	Remarks
MG442A	Synthesized Level Generator	For external modulation signal 10 Hz ~ 20 MHz
MS2602A	Spectrum Analyzer	For automated transmitter/receiver measurements 50 Hz ~ 5.5 GHz
MS616B	Modulation Analyzer	For automated transmitter/receiver measurements 150 kHz ~ 3 GHz
ML422A/B/C	Selective Level Meter	For highly-accurate testing of transmission characteristics 20 Hz ~ 30 MHz
MA1610A	Pulse Modulator	For generating a pulse-modulated RF signal (Appendix B)
PACKET V	Personal Technical Computer	A controller for remote control of the MG3633A via GP-IB
MH055B	GP-IB Extender	For converting the GP-IB interface to serial interface.
MS010A	Multi Function Selector	Controlled by PTA or personal computer via GP-IB. Used as a scanner.
MB24A	Portable Test Rack	Supports 100 kg.

1.5 Specifications

The MG3633A specifications are listed below.

Specifications (1/8)

Carrier frequency	Range	10 kHz to 2700 MHz		
	Resolution	0.01 Hz		
	Accuracy	Same as that for the reference oscillator		
	Internal reference oscillator *1	Frequency	10 MHz	
		Start-up characteristics	After 30-minute operation: $\leqq 1\times10^{-7}$/day After 60-minute operation: $\leqq 5\times10^{-8}$/day	
		Aging rate	After 24-hour operation: $\leqq 2\times10^{-8}$/day	
		Temperature characteristics	$\pm5\times10^{-8}$ (0° to 50°C)	
	External reference signal input	10 MHz, TTL level, BNC connector on rear panel		
	Reference signal output	10 MHz, TTL level, BNC connector on rear panel		
	Switching time	Elapsed time from last command until frequency has stabilized to within ±500 Hz of set frequency during remote operation: ≦10 ms		
Output level	Range	−143 to +23 dBm		
	Unit	dBm, dBμ, V, mV, μV (Terminated and open voltages are selected in units of dBμ, V, mV or μV by special function.)		
	Resolution	0.1 dB		
	Frequency response	≦ ±0.5 dB reffered to 0 dBm (<1280 MHz) ≦ ±1 dB reffered to 0 dBm (≧1280 MHz)		
	Level accuracy	Frequency / Output level	10 kHz to <1280 MHz	≧1280 MHz
		+17.1 to +23 dBm	——	——
		±15.1 to +17 dBm	±1 dB	——
		−122.9 to +15 dBm	±1 dB	±2 dB
		−132.9 to −123 dBm	±3 dB	±4 dB
		−143 to −133 dBm	——	——

*1 Aging rates up to 5×10^{-10}/day are available as option.

Specifications (2/8)

<table>
<tr><td rowspan="3">Output level (Cont.)</td><td>Impedance</td><td colspan="2">50Ω, N-type connector
VSWR: ≦1.5 (<1280 MHz, ≦ −3 dBm)
≦1.8 (≧1280 MHz, ≦ −3 dBm)</td></tr>
<tr><td>Switching time</td><td colspan="2">Elapsed time from last command until output level is stabilized during remote operation:
≦25 ms (at LEVEL NORMAL mode)
≦80 ms (when setting level is crossing over −59 dBm, at LEVEL NORMAL mode)
≦5 ms/0.1 dB (at LEVEL CONTINUOUS mode)</td></tr>
<tr><td>Interference radiation</td><td colspan="2">≦1 μV (Terminated with 50Ω load, measured 25 mm from front panel with a two-turn 25 mm diameter loop antenna. Interference is greater during sweep.)</td></tr>
<tr><td rowspan="7">Signal purity</td><td rowspan="4">Spurious</td><td colspan="2">At +7 dBm, CW mode: f_c: carrier frequency</td></tr>
<tr><td>Harmonics (2nd, 3rd)</td><td>≦ −30 dBc (at ≧100 kHz)</td></tr>
<tr><td>Sub-harmonics ($f_c/2$, $3f_c/2$, $5f_c/2$, 7fc/2)</td><td>None (at <1280 MHz)
≦ −30 dBc (at ≧1280 MHz)</td></tr>
<tr><td>Non-harmonics</td><td>≦ −80 dBc (f_c<640 MHz, ≧10 kHz offset)
≦ −74 dBc (640 MHz≦f_c<1280 MHz, ≧10 kHz offset)
≦ −68 dBc (f_c≧1280 MHz, ≧10 kHz offset)</td></tr>
<tr><td>SSB phase noise</td><td colspan="2">At +7 dBm, CW mode and 0° to 35°C:
<table>
<tr><th>Offset frequency
Frequency</th><th>1 kHz</th><th>20 kHz≦f≦300 kHz</th></tr>
<tr><td>10 kHz ≦f_c <40 MHz</td><td>−116 dBc/Hz</td><td>−140 dBc/Hz</td></tr>
<tr><td>40 MHz ≦f_c <300 MHz</td><td>−119 dBc/Hz</td><td>−145 dBc/Hz</td></tr>
<tr><td>300 MHz ≦f_c <600 MHz</td><td>−113 dBc/Hz</td><td>−143 dBc/Hz</td></tr>
<tr><td>600 MHz ≦f_c <1100 MHz</td><td>−107 dBc/Hz</td><td>−140 dBc/Hz</td></tr>
<tr><td>1100 MHz ≦f_c <2400 MHz</td><td>−101 dBc/Hz</td><td>−132 dBc/Hz</td></tr>
<tr><td>2400 MHz ≦f_c</td><td>−97 dBc/Hz</td><td>−120 dBc/Hz</td></tr>
</table>
Floor noise: ≦ −145 dBc/Hz (at 40 MHz ≦f_c<1100 MHz, +7 dBm, CW mode)</td></tr>
<tr><td>Residual AM</td><td colspan="2">≦0.02% rms at ≧150 kHz (demodulation band: 300 Hz to 3 kHz)</td></tr>
<tr><td>Residual FM</td><td colspan="2">≦0.8 Hzrms at <1280 MHz (demodulation band: 300 Hz to 3 kHz)
≦4 Hzrms at <1280 MHz (demodulation band: 50 Hz to 20 kHz)</td></tr>
</table>

Specifications (3/8)

Amplitude modulation	Range	0 to 100%			
	Resolution	0.1%			
	Internal modulation frequency	Fixed frequency	400 Hz, 1 kHz		
		Variable frequency	0.1 Hz to 100 kHz, 0.1 Hz resolution		
		Frequency accuracy	100 ppm		
	Accuracy	± (5% of indicated value +2%) [at ≧250 kHz, ≦ +7 dBm, 0 to 90% and internal 1 kHz]			
	Frequency response	At ≦ +7 dBm, ±1 dB			
		Lower modulation frequency limit	20 Hz (EXT AC mode) DC (EXT DC mode)		
		Upper modulation frequency limit	Modulation factor Carrier frequency	0 to 30%	30.1 to 80%
			0.25 MHz≦f_c<0.5 MHz	5 kHz	5 kHz
			0.5 MHz≦f_c<80 MHz	20 kHz	10 kHz
			80 MHz≦f_c	50 kHz	20 kHz
	External modulation	Input level	Approx. $2V_{p\text{-}p}/600\Omega$		
		Input impedance	Nominal 600Ω		
	Distortion	≦1% (at ≧1 MHz, ≦ +7 dBm, internal 1 kHz, 30%) ≦3% (at ≧1 MHz, ≦ +7 dBm, internal 1 kHz, 80%) ≦3% (at 250 kHz≦f_c<1 MHz, < +7 dBm, internal 1 kHz, 30%) ≦10% (at 250 kHz≦f_c<1 MHz, < +7 dBm, internal 1 kHz, 80%)			
	Incidental FM	<200 Hz peak (at ≧250 kHz, < +7 dBm, internal 1 kHz, 30%, demodulation band 0.3 to 3 kHz)			

Specifications (4/8)

Frequency modulation	Range	0 to 400 kHz (1 MHz$\leqq f_c<$40 MHz) 0 to 100 kHz (40 MHz$\leqq f_c<$80 MHz) 0 to 200 kHz (80 MHz$\leqq f_c<$160 MHz) 0 to 400 kHz (160 MHz$\leqq f_c<$320 MHz) 0 to 800 kHz (320 MHz$\leqq f_c<$640 MHz) 0 to 1.6 MHz (640 MHz$\leqq f_c<$1280 MHz) 0 to 3.2 MHz (1280 MHz$\leqq f_c$)	
	Resolution	10 Hz (0 to 9.99 kHz deviation) 100 Hz (10 to 99.9 kHz deviation) 1 kHz (100 to 999 kHz deviation) 10 kHz (1 to 3.2 MHz deviation)	
	Internal modulation frequency	Fixed frequency	400 Hz, 1 kHz
		Variable frequency	0.1 to 100 kHz, 0.1 Hz resolution
		Frequency accuracy	100 ppm
	Accuracy	± (5% of indicated value +20 Hz), (Internal 1 kHz)	
	Frequency response	±1 dB	
		Frequency range	EXT AC mode: 20 Hz to 100 kHz EXT DC mode: DC to 100 kHz
	External modulation	Input level	Approx. $2V_{p\text{-}p}/600\Omega$, polarity may be changed using special function
		Input impedance	Nominal 600Ω
	Distortion	≦1% (Internal 1 kHz, 3.5 kHz deviation)	
	Incidental AM	≦0.4% (Internal 1 kHz, 22.5 kHz deviation, 0.3 to 3 kHz demodulation band)	
	Carrier frequency accuracy in DC-FM mode	±500 Hz during 30 minutes at 2 hours after calibration [at <1280 MHz, <10 kHz deviation]	

Specifications (5/8)

Phase modulation	Range		0 to 80 rad (1 MHz$\leqq f_c$ < 40 MHz) 0 to 20 rad (40 MHz$\leqq f_c$ < 80 MHz) 0 to 40 rad (80 MHz$\leqq f_c$ < 160 MHz) 0 to 80 rad (160 MHz$\leqq f_c$ < 320 MHz) 0 to 160 rad (320 MHz$\leqq f_c$ < 640 MHz) 0 to 320 rad (640 MHz$\leqq f_c$ < 1280 MHz) 0 to 640 rad (1280 MHz$\leqq f_c$) Besides radian, deg unit is also possible for phase deviation display. However, max. 999 deg.
	Resolution		0.01 rad (0 to 9.99 rad deviation) 0.1 rad (10 to 99.9 rad deviation) 1 rad (100 to 640 rad deviation)
	Internal modulation frequency	Fixed frequency	400 Hz, 1 kHz
		Variable frequency	0.1 Hz to 100 kHz, 0.1 Hz resolution
		Frequency accuracy	100 ppm
	Accuracy		± (10% of indicated value +0.05 rad) [at Internal 1 kHz]
	Frequency response		±1 dB
		Frequency range	EXT AC mode: 20 Hz to 5 kHz EXT DC mode: DC to 5 kHz
	External modulation	Input level	Approx. $2V_{p\text{-}p}/600\Omega$, polarity may be changed using special function
		Input impedance	Nominal 600Ω
	Distortion		≦1% (Internal 1 kHz, 5 rad deviation)
Internal modulation signal	Frequency range		400 Hz, 1 kHz (fixed) 0.1 Hz to 100 kHz (variable) DC voltage signals equivalent peak values of internal modulating sine-wave can be applied as a modulating signal using the special function.
	Resolution		0.1 Hz
	Frequency accuracy		100 ppm
	Distortion		≦0.03% (fixed 400 Hz and 1 kHz) ≦0.3% (variable 20 Hz to 50 kHz)
Memory function	Frequency memory		1000 carrier frequencies (store/recall)
	Function memory		100 panel settings (store/recall)

Specifications (6/8)

<table>
<tr><td rowspan="15">Sweep function</td><td>Sweep mode</td><td colspan="5">Carrier frequency, output level, AF frequency</td></tr>
<tr><td rowspan="13">Sweep pattern</td><td colspan="2"></td><td>Carrier frequency</td><td>Output level</td><td>AF frequency</td></tr>
<tr><td rowspan="2">Pattern</td><td>Start/stop</td><td>✓</td><td>✓ *2</td><td>✓</td></tr>
<tr><td>Center/span</td><td>✓</td><td>✓ *2</td><td>✓</td></tr>
<tr><td rowspan="3">Step</td><td>Entering number of steps</td><td>✓</td><td>—</td><td>✓</td></tr>
<tr><td>Entering step size</td><td>✓</td><td>✓ *3</td><td>✓</td></tr>
<tr><td>LOG 1%</td><td>✓</td><td>—</td><td>✓</td></tr>
<tr><td colspan="5">*2 Span: Max. 20 dB
*3 0.1 dB step size only</td></tr>
<tr><td colspan="2"></td><td>Frequency memory</td><td>Function memory</td><td rowspan="5"></td></tr>
<tr><td rowspan="3">Pattern</td><td>Continuous address</td><td>✓</td><td>✓</td></tr>
<tr><td>Random address</td><td>✓</td><td>✓</td></tr>
<tr><td>Continuous, random mixed</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Maximum number of steps</td><td>*4
20</td><td>*4
20</td></tr>
<tr><td colspan="5">*4 One continuous address setting is counted as 3 steps.</td></tr>
<tr><td>Sweep time</td><td colspan="5">Carrier frequency sweep (at CW): 2 ms/step to 600 s/step
Carrier frequency sweep (at FM/ΦM): 3 ms/step to 600 s/step
Output level sweep: 1 ms/step to 600 s/step
AF frequency sweep: 1 ms/step to 600 s/step
Settable range: 0.1 ms/step to 600 s/step, resolution 0.01 ms</td></tr>
<tr><td rowspan="3">Other function</td><td>Marker</td><td colspan="5">One movable marker, output from MARKER on rear panel</td></tr>
<tr><td>Sweep signal output</td><td colspan="5">Staircase (≒ saw-tooth waveform), output from SWEEP OUTPUT on front panel
Start point: 0V, Stop point: 10 V</td></tr>
<tr><td>Modulation signal output</td><td colspan="5">Modulation signal is output when modulating
Output level: Approx. 2 V pp/600Ω</td></tr>
</table>

Specifications (7/8)

<table>
<tr><td rowspan="6">Other function</td><td>Simultaneous modulation</td><td>Simultaneous modulation is possible in combinations shown below.
<table>
<tr><th></th><th>INT AM</th><th>EXT AM</th><th>INT FM</th><th>EXT FM</th><th>INT ΦM</th></tr>
<tr><td>EXT ΦM</td><td>✓</td><td>✓</td><td>—</td><td>—</td><td>✓ *6</td></tr>
<tr><td>INT ΦM</td><td>✓ *5</td><td>✓</td><td>—</td><td>—</td><td></td></tr>
<tr><td>EXT FM</td><td>✓</td><td>✓</td><td>✓ *6</td><td></td><td></td></tr>
<tr><td>INT FM</td><td>✓ *5</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>EXT AM</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
</table>
*5 Uses same internal modulation frequency
*6 Different deviation settings are possible for INT and EXT modulations (using special function).</td></tr>
<tr><td>Relative value display</td><td>Carrier frequency
Output level</td></tr>
<tr><td>Continuously variable output level</td><td>Continuously variable within a ±10 dB range of the set level
Step size: 0.1 dB</td></tr>
<tr><td>Trigger function</td><td>Previously programmed operation procedure can be started by a trigger input through its input terminal (on rear panel, BNC connector, TTL level) or GP-IB.
Maximum program steps for triggered operation: 99 steps</td></tr>
<tr><td>Memory backup</td><td>Last settings are stored when power is turned off.
The following contents are not backed-up: data during key input and GP-IB transfer, remote status, and trigger program execution status.</td></tr>
<tr><td>GP-IB</td><td>All functions except POWER switch, PANEL LOCK key and LOCAL key can be controlled. Talk-only and listen-only modes are provided.
Interface: SH1, AH1, T5, L3, TE0, LE0, SR1, RL1, PP0, DC1, DT1, C0</td></tr>
<tr><td>Reverse power</td><td>Maximum reverse input power</td><td>50W (<1000 MHz), 25W (≧1000 MHz), ±50 Vdc</td></tr>
</table>

Specifications (8/8)

General	Ambient temperature, rated range of use	0° to 50°C
	Power	**Vac +10%/–15% (max. 250 Vac), 47.5 to 63 Hz, ≦270 VA
	Conducted disturbance	EN 61326-1: 2006 (Class A)
	Radiated disturbance	EN 61326-1: 2006 (Class A)
	Harmonic Current Emission	EN 61000-3-2: 2006 (Class A)
	Electrostatic Discharge	EN 61326-1: 2006 (Table 2)
	Electromagnetic Field Immunity	EN 61326-1: 2006 (Table 2)
	Fast Transient / Burst	EN 61326-1: 2006 (Table 2)
	Surge	EN 61326-1: 2006 (Table 2)
	Conducted RF	EN 61326-1: 2006 (Table 2)
	Voltage Dips / Short Interruptions	EN 61326-1: 2006 (Table 2)
	Dimensions & mass	177H × 426W × 451D mm, ≦32 kg

SECTION 2
PRECAUTION

This section describes the preparatory work which must be performed before using the MG3633A Synthesized Signal Generator and the precautions relating to (1) installation and (2) power supply. For GP-IB cable connection, address setting, etc, see Separate GP-IB manual.

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SECTION 2
PRECAUTION

2.1 Installation Precautions

This paragraph describes the MG3633A Synthesized Signal Generator installation precautions and mechanical assembly procedure for mounting the MG3633A in a rack.

2.1.1 Installation site environmental conditions

(1) Location to avoid

The MG3633A operates normally at ambient temperatures of 0° to 50°C.

However, for best performance, do not use or store it in locations where:

- It may be subjected to strong vibrations
- It may be exposed to extreme humidity or dust
- It may be exposed to direct sunlight
- It may be exposed to explosive gases

To maintain stable measurement for a long time, in addition to meeting the conditions listed above, the MG3633A should be used at stable room temperatures and where the AC line voltage fluctuations are small.

CAUTION: ***If the MG3633A is used at room temperature after being used or stored at a low temperature for a long time, condensation may occur inside the instrument which could cause short circuiting. Always ensure that the MG3633A is thoroughly dry before turning on the power.***

(2) Fan clearance

To prevent excessive temperature increase inside the MG3633A, a cooling fan is mounted on the rear panel. Leave a space of at least 10 cm between the rear panel and walls, peripheral devices, obstructions, etc. so that air flow is not obstructed. Do not use the MG3633A on its side.

2.1.2 Rack mounting

To mount the MG3633A in a rack, the optional rack mounting kit (sold separately) is necessary. Order the rack mounting kit by using the order number B0043. Mounting instructions are supplied with the kit.

2.2 Power Supply Safety Measures

The MG3633A operates normally on a **Vac +10%/−15%, 47.5 to 63 Hz power supply. Turn on the AC power only after taking precautions against the following hazards.

- **Electric shock**
- **Damage due to the abnormal power supply voltage**
- **Earth current**

Therefore, observe the following safety measures before supplying AC power.

2.2.1 Connectiing the Power Cord

Check that the POWER switch on the rear panel is turned off.
Insert the power plug into an outlet, and connect the other end to the power inlet on the rear panel.
To ensure that the instrument is grounded, always use the supplied 3-pin power cord, and insert the plug into an outlet with a ground terminal.

WARNING: *If the power cord is connected without the instrument grounded, there is a risk of receiving a fatal electric shock. In addition, the peripheral devices connected to the instrument may be damaged.*
When connecting to the power supply, DO NOT connect to an outlet without a ground terminal. Also, avoid using electrical equipment such as an extension cord or a transformer.

CAUTION: *If an emergency arises causing the instrument to fail or malfunction, disconnect the instrument from the power supply by either turning off the POWER switch on the rear panel, or by pulling out the power cord or the power inlet.*
When installing the instrument, place the instrument so that an operator may easily operate the POWER switch.
If the instrument is mounted in a rack, a power switch for the rack or a circuit breaker may be used for power disconnection.
It should be noted that, the power switch on the front ~LINE of the instrument is a standby switch, and cannot be used to cut the main power.

2.2.2 Fuse replacement

The MG3633A is supplied with two fuses rated as described below.

The relationship between power supply voltage and current rating is shown below.

**Vac	***A (Time lag type)
100 V/110 to 115 V/120 to 127 V	5 A
200 V/220 to 230 V/240 V	3.15 A

The fuses are to be loaded inside the fuse holders.

If a fuse blows, locate the cause before replacing.

WARNING:

- *Before replacing a fuse, turn off the POWER switch and unplug the power cord from the AC outlet. Never replace a fuse with the power cord connected.*
- *Before turning on the power after replacing a fuse, check the protective grounding described in paragraph 2.2.1 and check that the AC supply voltage is suitable. There may be an electric shock hazard if the power is turned on without the protective grounding.*
  If the AC supply voltage is unsuitable, the equipment may be damaged.
  The fuse replacement procedure is described below.

Step	Procedure
1	Set the POWER switch on the front panel to STBY and the ~LINE switch on the rear panel to OFF, and unplug the power cord from the AC outlet.
2	Turn the fuse-holder cap counterclockwise and remove the cap together with the fuse.
3	Remove the blown fuse from the cap and replace it with a spare fuse of the same rating.
4	Refit the cap and turn it clockwise until it will turn no further.

CAUTION: If there are no spare fuses, check that the replacement you obtain is of the same type, rated voltage and current as the original.

- *If the fuse is not the same type, it may not fit the holder, contact may be poor, or the fusing time may be too long.*
- *If the rated voltage and current of the replacement fuse are too high and trouble reoccurs, the new fuse may not blow and the instrument could catch fire.*

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SECTION 3

PANEL LAYOUT AND PREPARATION

This section describes the control functions on the MG3633A front and rear panels and provides preparative instructions. As a reference, front and rear panel fold-out illustrations are located in APPENDIX A.

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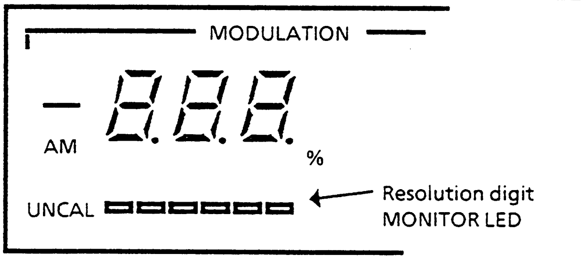
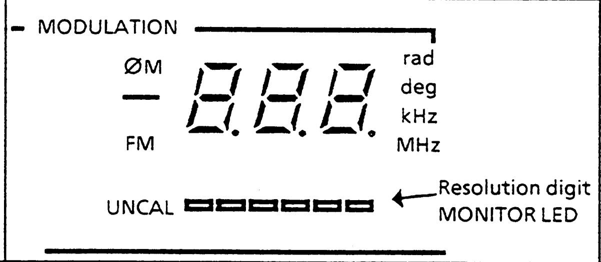
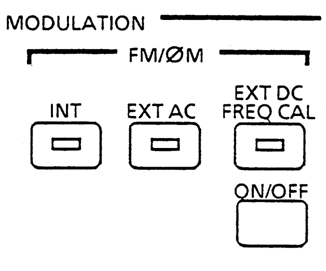
SECTION 3

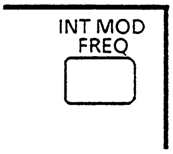
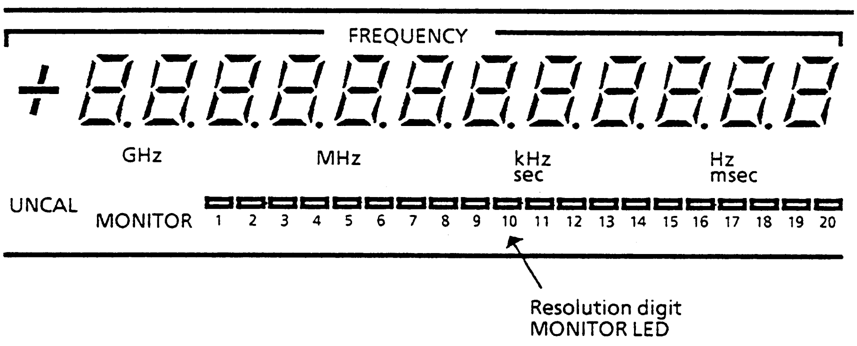
PANEL LAYOUT AND PREPARATION

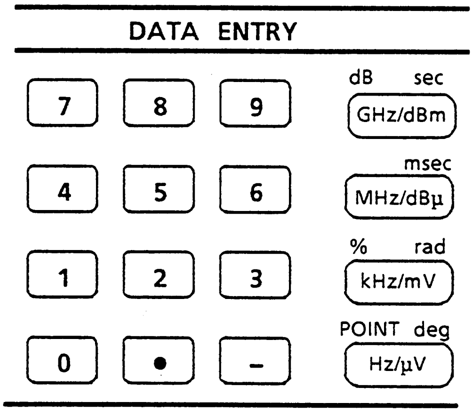
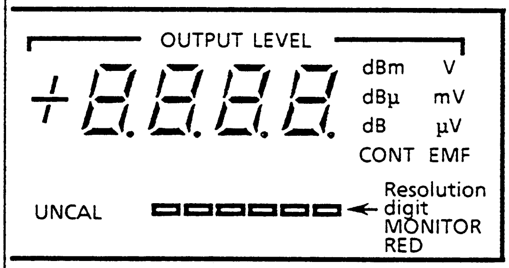
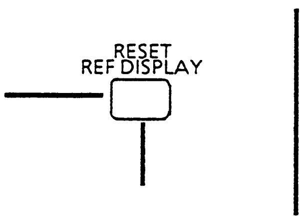
3.1 Layout and Function of Controls

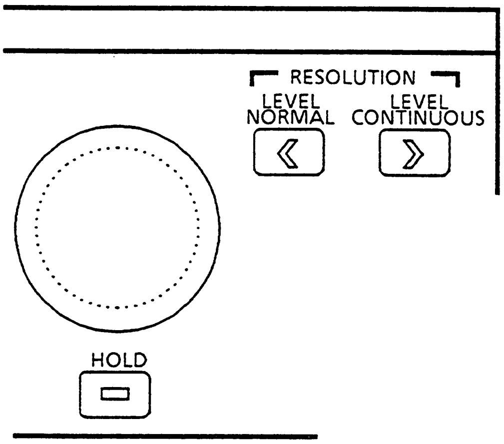
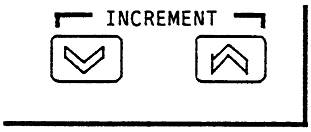
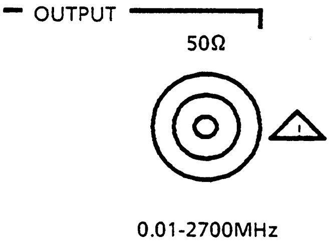
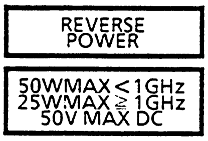
The front and rear panels are illustrated in a fold-out located on the last pages of this operation manual as Figs. A-1 and A-2 in APPENDIX A.

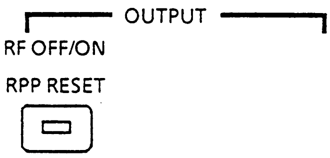
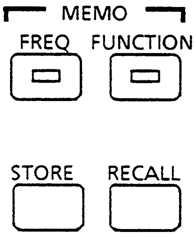
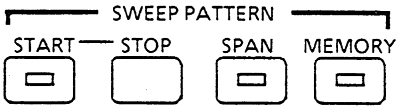
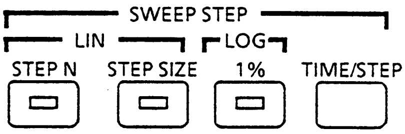
For easy reference, numbers in the following table correspond with control layout on the front and rear panel illustrations.

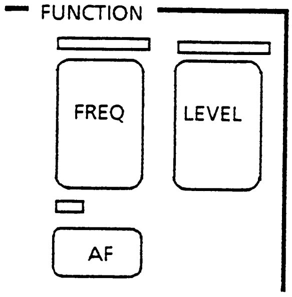
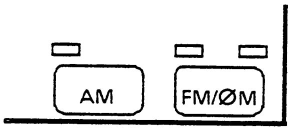
No.	Label	Explanation
1		[STATUS] key: When [STATUS] is pressed while its corresponding LED is blinking, an error message is indicated on the FREQUENCY display.
2		Displays the AM modulation factor (%). UNCAL LED lights at AM UNCAL.
3		Displays the FM frequency deviation or ØM phase deviation. UNCAL LED lights at FM and ØM UNCAL.
4		The keys in this section are used to set the FM or ØM modulation input mode at FM or ØM. FM or ØM mode is selected with a header key [FM/ØM] (22). • [INT] key: Sets the internal modulation mode. • [EXT AC] key: Sets to the external modulation AC mode. • [EXT DC] key: Sets to the external modulation DC mode. • [ON/OFF] key: Turns off the FM or ØM modulation. When the key is pressed again, the mode returns to the previously set status. • [FREQ CAL] key: When [EXT DC] is pressed after pressing [SHIFT] in the EXT DC mode, the carrier frequency can be calibrated.

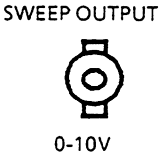
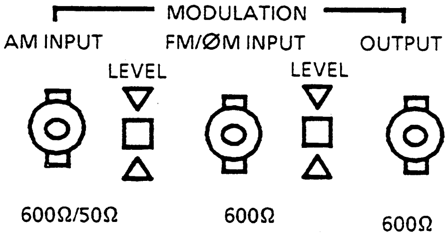
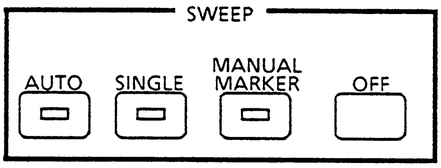
No.	Label	Explanation
5	INT MOD FREQ AF 1kHz 400Hz 	[INT MOD FREQ] key: Selects the internal modulation frequency. Every time it is pressed, the frequency is switched in the order of AF, 1 kHz, and 400 Hz.
6	▭ RELATIVE FREQ CUR FREQ DISPLAY	[RELATIVE FREQ] key: Used for displaying the relative frequency [CUR FREQUENCY] key: Used to display the real frequency when the relative frequency is displayed. Press [SHIFT], then [RELATIVE FREQ]. While it is pressed, the real frequency continues to be displayed.
7		Displays the carrier frequency or AF frequency, which are also used to display various error messages, etc. MONITOR LED is mainly used to announce a resolution digit, which is also used to monitor the number of the memory sweep step and the special function code.

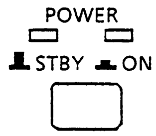
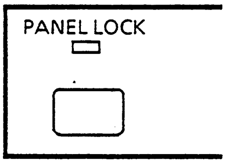
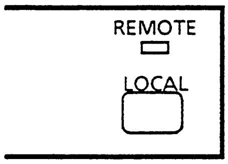
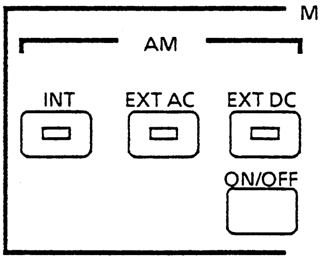
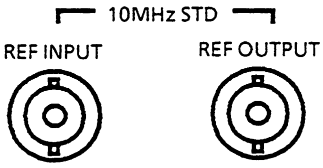
No.	Label	Explanation
8		● [0] to [9], [●], and [−] keys: Used for setting the numeric data. ● [GHz/dBm], [MHz/dBμ], [kHz/mV], and [Hz/μV] keys: Sets appropriate units after data is set.
9		● [RELATIVE LEVEL] key: Used for displaying the relative output level. ● [CUR LEVEL DISPLAY] key: Used to display the real output level when the relative output level is displayed. Press [SHIFT], then [RELATIVE LEVEL]. While it is pressed, the real output level continues to be displayed.
10		Displays the output level
11		● [RESET] key: Resets the amount changed with the rotary knob (12) and INCREMENT keys (13). ● [REF DISPLAY] key: Used to indicate the last value set with the data key or the reference value in the RELATIVE mode. Press [SHIFT], then[RESET]. While it is pressed, the value continues to be displayed.

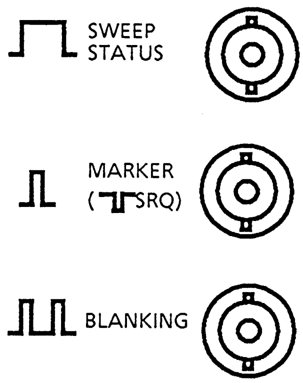
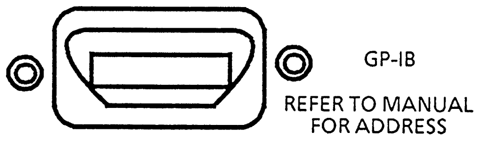
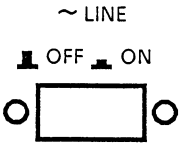
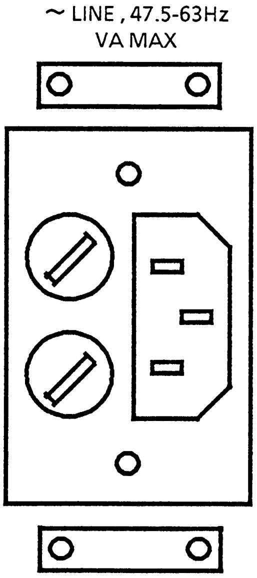
No.	Label	Explanation
12		● Rotary knob: Varies the displayed resolution digit corresponding to the Resolution digit MONITOR LED lighting in the display. ● [RESOLUTION] key: Sets resolution selected using the rotary knob. The resolution digit is indicated in the Resolution digit MONITOR LED. ● [LEVEL NORMAL] key: Returns output level to NORMAL mode. Press [SHIFT], then RESOLUTION [<]. ● [LEVEL CONTINUOUS] key: Sets output level to CONTINUOUS mode. Press [SHIFT], then RESOLUTION [>]. ● [HOLD] key: Invalidates rotary knob operation. LED lights to indicate HOLD mode.
13		● [INCREMENT] key: Increments or decrements the set data with a value set using [INCR SET] when the header key (21, 22) is set. However, this set value is incremented or decremented by 10% at AM and by 10 times or 1/10 at FM and ØM.
14		OUTPUT: Outputs 0.01 to 2700 MHz, −143 to +23 dBm signal with 50Ω output impedance
15		REVERSE POWER: Blinks if the reverse power protection (RPP) circuit operates due to reverse power input.

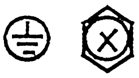
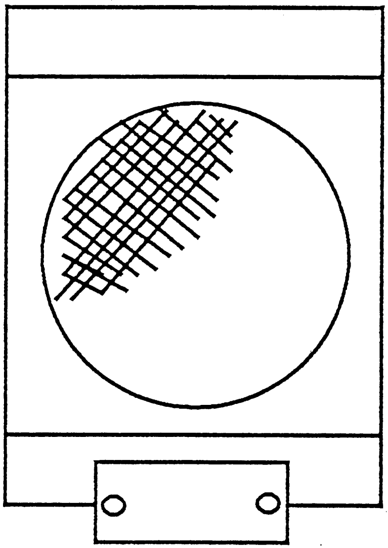
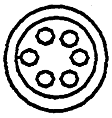
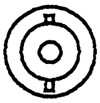
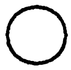
No.	Label	Explanation
16		• [RF OFF/ON] key: Turns off the output level. When it is pressed again, the output level before turning off is obtained. LED lights to indicate OFF setting. • [RPP RESET] key: When the reverse power protection (RPP) circuit operates due to the reverse power input, pressing this key releases RPP operation and returns to the normal status. Press [SHIFT], then [RF OFF/ON].
17		The keys in this section are used to operate the memory function. • [FREQ] key: Sets FREQ-memory mode. • [FUNCTION] key: Sets FUNCTION-memory mode. Either FREQ memory or FUNCTION memory is always set. • [STORE] key: Used as a data storage delimiter. Press this key after inputting an address. • [RECALL] key: Used as a data recall delimiter. Press this key after inputting an address.
18		The keys in this section are used to set the sweep patterns. • [START] key: Sets the START-STOP sweep and also serves as a header key to set the START point. • [STOP] key: Header key to set stop point. • [SPAN] key: Sets the CENTER-SPAN sweep and also serves as a header key to set the SPAN value. • [MEMORY] key: Sets the memory sweep.
19		The keys in this section are used to set the sweep steps. • [STEP N] key: Sets the sweep mode which specifies the number of steps. Also serves as a header key to set the number of steps. • [STEP SIZE] key: Sets the sweep mode which specifies the STEP SIZE and also serves as a header key to set the STEP SIZE • LOG [1%] key: Sets the LOG sweep • [TIME/STEP] key: Header key to set the sweep time.

No.	Label	Explanation
20		• [INCR SET] key: Header key to set the increment value when increment operation is performed with the [INCREMENT] (13).
21		• [FREQ] key: Header key for setting the carrier frequency. When LED on the [FREQ] lights, the numeric data key, [INCREMENT], and rotary knob are operated only for setting the carrier frequency. For sweep operation, it also selects the carrier frequency sweep. • [LEVEL] key: Header key for setting the output level. When LED on the [LEVEL] lights, the numeric data key, [INCREMENT] and the rotary knob are operated only for setting the output level. For sweep operation, it also selects the output level sweep. • [AF] key: Header key for setting the AF frequency. When LED on the [AF] lights, the numeric data key, [INCREMENT] and rotary knob are operated only for setting the AF frequency. For sweep operation, it also selects the AF-frequency sweep.
22		• [AM] key: Header key for setting the AM modulation factor. When LED on the [AM] lights, the numeric data key, [INCREMENT] and rotary knob are operated only for setting the AM modulation factor. Pressing this key turns on AM modulation. • [FM] key: Header key for setting the FM frequency deviation. When LED on the [FM] lights, the numeric data key, [INCREMENT] and rotary knob are operated only for setting the FM frequency deviation. Pressing this key turns on FM modulation. • [ØM] key: Header key for setting the ØM phase deviation. When LED on the [ØM] lights, the numeric data key, [INCREMENT] and rotary knob are operated only for setting the ØM phase deviation. Pressing this key turns on the ØM modulation.

No.	Label	Explanation
23		● [SHIFT] key: To select the blue-character key function on the front panel, press [SHIFT] before pressing the required blue-character key.
24		● [SPECIAL] key: To expand function in addition to the functions indicated on the front panel key, enter a two-digit numeric code after pressing [SPECIAL]. (This is called a special function.)
25		● [SWEEP OUTPUT] key: Outputs a 0 to 10 V staircase-sawtooth wave synchronous with the sweeping output
26		● AM INPUT: AM external modulation input terminal. Input the level so that the LEVEL indicator green LED may light. ● FM/ØM INPUT: FM/ØM external modulation input terminal. Input the level so that the LEVEL indicator green LED may light. ● OUTPUT: Output terminal for monitoring the modulation signal. The output signal differs depending on the modulation setting.
27		The keys in this section are used to set the sweep modes. ● [AUTO] key: Activates a repeated sweep with the preset sweep pattern. ● [SINGLE] key: Activates a single sweep with the preset sweep pattern. ● [MANUAL] key: Performs step-up or step-down sweep set manually with the rotary knob or [INCREMENT]. ● [OFF] key: Stops sweeping. ● [MARKER] key: When [MANUAL] is pressed after pressing [SHIFT] in AUTO or SINGLE mode, the marker is turned ON and the marker signal is output from the rear panel MARKER connector.

No.	Label	Explanation
28		● POWER switch: When this switch is set to the ON position, power is supplied to the MG3633A. When this switch is set to the STBY position, power is supplied only to the stable reference crystal oscillator circuit.
29		● [PANEL LOCK] key: Invalidates all operating instructions from the front panel. While the panel is locked, the panel lock LED is lit. When it is pressed again, the panel lock is released.
30		● [LOCAL] key: Shifts the REMOTE status to the LOCAL status. The trigger program can be stopped by pressing this key during trigger program execution.
31		The keys in this section are used to set the AM modulation input mode at AM. AM mode is selected with a header key [AM] (22). ● [INT] key: Sets the internal modulation mode. ● [EXT AC] key: Sets the external modulation AC mode. ● [EXT DC] key: Sets the external modulation DC mode. ● [ON/OFF] key: Turns on/off the AM modulation.
32		I/O connectors for the reference signal ● REF OUTPUT: Internal 10 MHz reference oscillator output connector. ● REF INPUT: Reference signal input connector, used usually to input the 10 MHz signal output from the REF OUTPUT connector using a U link. It can also be used to input an external reference signal. An external reference signal 10 MHz of TTL level can be used.

No.	Label	Explanation
33		The connectors in this section are used as auxiliary output connector related to sweeping. ● SWEEP STATUS: Status signal output connector indicating that sweeping is executed. "H" level is obtained during sweep execution. ● MARKER: Used for the marker function. When the current point and the marker point match, a positive pulse is generated. ● SRQ: Used for SRQ output when marker is OFF. A negative pulse is output when an SRQ is generated. ● BLANKING: A positive pulse is generated at each sweep step. The pulse polarity can be changed to negative using the special function.
34		● GP-IB: With GP-IB remote control, the GP-IB interface bus is connected to this connector. In the remote mode, the front panel REMOTE LED lights.
35		● ~LINE: Power switch on the power-transformer primary side. This switch turn on and off all power to the MG3633A (including the reference oscillator).
36		AC power inlet Fuse holders for two ***A fuses

No.	Label	Explanation
37		Ground this frame ground (FG) terminal to prevent accidental electric shock.
38		Exhausts heat from the MG3633A. Leave a space of at least 10 cm between the fan and other device.
39		• TRIGGER: Connector to input the program start pulse when the trigger function is used. When the negative logic pulse is input, the preset trigger program is performed at the falling edge of the pulse.
40	AUX 	• AUX: Power source for MA1610A Pulse Modulator
41	BUFFER OUTPUT 	• BUFFER OUTPUT: Outputs the buffered TTL-level external reference signal or the internal reference signal input into the REF INPUT.
42	OUTPUT (OPT) 	• OUTPUT (OPT): This is the SMA-type connector which is used to output the RF signal from the rear panel. It is provided when specifying the option 04, and when an output connector on the front panel is not provided.

3.2 Power On

This paragraph describes the power switches on the front and rear panels and their relationship to each other.

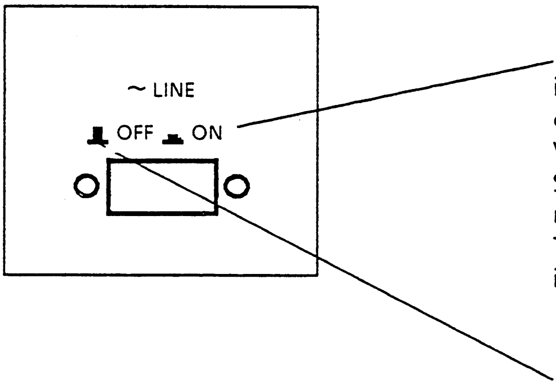
- ~LINE ON/OFF on the rear panel
- POWER ON/STBY on the front panel

3.2.1 ~LINE ON/OFF on rear panel

Before turning on the power to the MG3633A, ground the instrument as described in paragraph 2.2.1, then plug the power cord into an AC inlet.

WARNING: If the power is turned on without the frame grounded, there is a danger of electric stock. When a 3-pole (grounded type 2-pole) AC outlet is not available, always connect rhe rear panel frame groud (FG) terminal to earth potential.

*CAUTION: If the AC line voltage is incorrect, the instrument may be damaged. Before turning on the power to the MG3633A, check that the AC line voltage is **V + 10%/ – 15%.*



⊥ **ON:** When the front-panel POWER switch is ON, power is supplied to all the MG3633A circuits and the MG3633A enters ready status. When the front-panel POWER switch is set to STBY, AC power is supplied only to the internal reference crystal oscillator circuit to warm it up. The STBY LED on the front-panel POWER switch is lit.

⊥ **OFF:** The AC power is turned off even if the front-panel POWER switch is set to the ON.

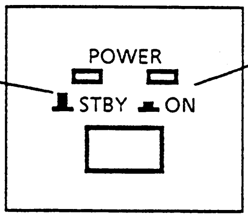
Fig. 3-1 Rear-Panel POWER Switch

3.2.2 POWER ON/STBY on front panel

The POWER switch on the front panel is used when the ~LINE switch on the rear panels set to ON.

Note: Succeeding pages describe the status with the rear-panel ~LINE switch set to ON unless otherwise specified except when all the MG3633A circuits must be turned off.

STBY : At STBY when the rear-panel ~LINE switch is ON, power is supplied only to the reference crystal oscillator circuit and the STBY LED is lit.



ON : When the rear-panel ~LINE switch is ON, LED is lit and power is supplied to all the MG3633A circuits and the MG3633A enters the ready state.

Fig. 3-2 Front-Panel POWER Switch

3.3 Preparation Before Operation

This paragraph details the necessary preparations for operation of the MG3633A.

- Using the internal reference oscillator
- Using an external reference oscillator

3.3.1 Using internal reference oscillator

The reference oscillator must be warmed-up before using the MG3633A.

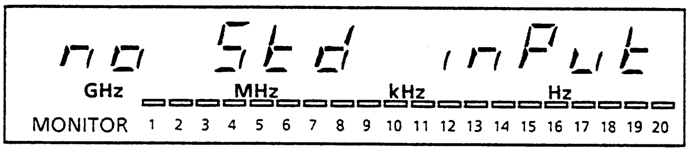
Step	Procedure
1	Ground the rear-panel FG terminal when the power cord is 2-pole (no ground) type.
2	Before plugging the power cord into an AC outlet, check that the AC line voltage is correct.
3	After checking that the rear-panel ~LINE switch is set to OFF and the front-panel POWER switch is set to STBY, plug the power cord into the AC outlet.
4	Set the rear-panel ~LINE switch to ON. (The internal reference oscillator circuit will be energized and the oscillator will be warmed-up. Always warm-up the oscillator properly for stable measurement.) The times required to warm-up the reference oscillator is listed in the table below.)

Reference Crystal Oscillator Stability

Item		Standard model	Option 01	Option 02	Option 03
Start-up characteristics	After 30-minute operation	$\leq 1\times10^{-7}$/day	$\leq 7\times10^{-8}$/day	———	———
	After 60-minute operation	$\leq 5\times10^{-8}$/day	$\leq 3\times10^{-8}$/day	$\leq 2\times10^{-8}$/day	———
Aging rate (After 24-hour operation)		$\leq 2\times10^{-8}$/day	$\leq 5\times10^{-9}$/day	$\leq 2\times10^{-9}$/day	$\leq 5\times10^{-10}$/day (after 48-hour operation)
Crystal oscillator stability against ambient temperature variations (25°C +/−25°C)		$\leq \pm 5\times10^{-8}$	$\leq \pm 5\times10^{-8}$	$\leq \pm 1.5\times10^{-8}$	$\leq \pm 5\times10^{-9}$

Step	Procedure
5	Set the front-panel POWER switch to ON. (The initial display of 10 MHz and 0 dBm is obtained at the first power-on because the MG3633A, when shipped from the factory, is set to a 10 MHz output frequency and a 0 dBm output level. When power-on, the previous settings are displayed. To obtain initial settings, execute SP00 (paragraph 4.11.2).)

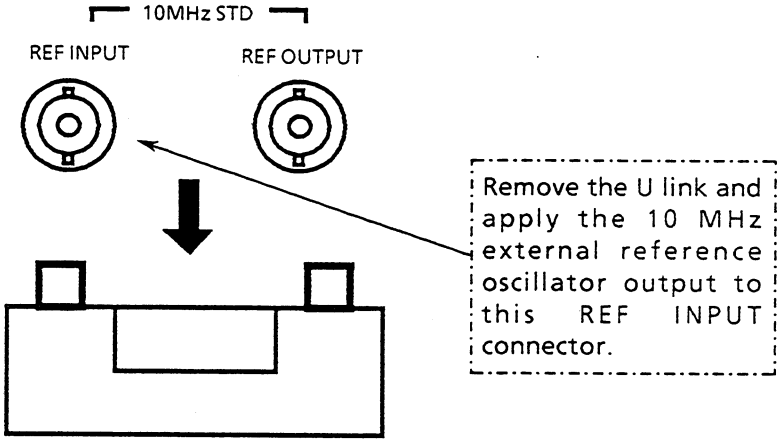
Note: When the internal reference oscillator is used, check that the rear-panel RFF OUTPUT and RFF INPUT connectors are connected with the U-link.
If the U-link is not connected, the UNCAL LED in the FREQUENCY display lights and the [STATUS] LED blinks to indicate that the reference signal is not input. At this time, when [STATUS] is pressed, the error message (no std input) is displayed.



3.3.2 Using external reference oscillator

An external reference oscillator can be used instead of the internal device. To use an external oscillator, make the initial POWER ON settings as described previously, then follow the procedure below.

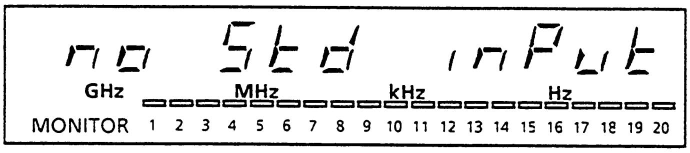
Step	Procedure
1	Check that the external reference oscillator frequency output is 10 MHz ±100 Hz.
2	Check that the output from the external reference oscillator is at the TTL level.
3	Remove the U link and connect the external reference oscillator output to the REF INPUT connector.



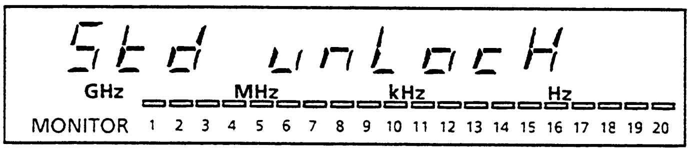
Remove the U link and apply the 10 MHz external reference oscillator output to this REF INPUT connector.

U link

Note: If the [STATUS] LED blinks and the UNCAL LED in the FREQUENCY display lights after an external reference oscillator has been connected, the MG3633A is not synchronized with the external reference oscillator signal.
Press [STATUS] and read the error message to check the cause. If “no Std input” is displayed, the external reference oscillator input level is not appropriate.



If “Std unlock” is displayed, the external reference oscillator input frequency is not set within the accuracy of 10 MHz ±100 Hz.



The MG3633A outputs a buffered 10 MHz reference frequency from the BUFFER OUTPUT connector. It is used to synchronize the MG3633A frequency with that of other devices.

Note: Be sure to put the BNC cover to the BUFFER OUTPUT (BNC) connector when the 10 MHz buffered output is not used.

SECTION 4
OPERATING INSTRUCTIONS

The MG3633A Synthesized Signal Generator can be operated directly or by GP-IB remote control. The operation and function of hand controls on the front and rear panels are described in this section. For a description of the GP-IB remote system, refer to the separate GP-IB manual.

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SECTION 4

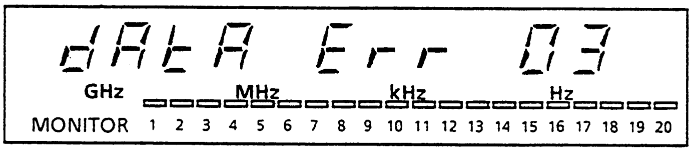
OPERATING INSTRUCTIONS

4.1 Using the Data Keys, Rotary Knob, and INCREMENT [∧] [∨] Keys for Data Setting

This paragraph explains the general data setting method using the data keys, rotary knob, and INCREMENT [∧] [∨]. This method is used to set the carrier frequency, output level, AF frequency, AM, FM, and ∅M.

Examples are described in other paragraphs corresponding to each item.

Trying to set a value outside the allowable range will result in the [STATUS] LED blinking, and the redisplaying of the value immediately prior to the incompatible input. When a new header or value is input again, the [STATUS] LED will go out. If [STATUS] is pressed while the [STATUS] LED is blinking, the error message 03 is generated on the FREQUENCY display. (When [STATUS] is released, both message and LED go out.)



The error message 03 is displayed if an attempt is made to set a MG3633A function item exceeding the specified range. Attention should be given to the MG3633A specifications for setting range (paragraph 4.12.1 [3]).

When deviation is incorrectly set to exceed the maximum value of the frequency on FM/∅M setting, the [STATUS] LED blinks. Pressing the key displays the error message on the FREQUENCY display and the maximum deviation on the MODULATION display.

Since the MG3633A displays various messages using a 7-segment code, meanings of messages may not be apparent. See paragraph 4.14 for details for definitions of these codes.

4.1.1 Setting using the data keys

Press header key, numeric keys, and unit key in this sequence to set carrier frequency, output level, AF frequency, AM, FM, and ØM. When the unit key is pressed, the set value is output. When the header key is pressed, the display does not change.

Each time numerical data is entered via the numeric keys, the corresponding value is displayed successively from the leftmost digit. The input decimal point is also displayed while the data is being input.

Notes: *1.* When the following operation is performed, the previous value is re-displayed without setting the new value.

- When the unit key is pressed without inputting numerical data.
- When a key other than a unit key is pressed while or after the numerical data is input.
- When the number of numerical data of AM/FM/ØM exceeds three digits.

2. When a header key is pressed, the corresponding LED is lit to indicate that the item can be set. While this LED is lit, the item can be set sequentially by repeating an input of the numerical data and units. The header need not be input at each setting. The header LED goes out when another header key is pressed.

3. If a digit lower than the minimum resolution is attempted to be set, the digit is truncated.

4. When a unit key (mV, µV, dBm, and dBµ for output level/rad and deg for ØM) is pressed without inputting numerical data, the output value remains unchanged but the displayed units changes. However, when [mV] or [µV] is pressed, a suitable unit (mV, µV, or V) is automatically selected and displayed.
Also, for more than 17.5 rad, the value does not changed to the value in degrees.

5. When [mV] or [µV] is selected during level setting, the appropriate unit among µV, mV, and V is selected automatically and displayed. For an example, when 3603 µV is input, 3.60 mV is displayed. Minimum resolution is always 0.1 dB irrespective of unit.

6. Leading 0 and ending 0 can be omitted.

Item	Key Strokes			Remarks
	Header	Numerical Data	Unit	
Carrier frequency	[FREQ]	0.000 010 000 00 to 2.700 000 000 00	[GHz]	
		0.010 000 00 to 2 700.000 000 00	[MHz]	
		10.000 00 to 2 700 000.000 00	[kHz]	
		10 000.00 to 2 700 000 000.00	[Hz]	
Output level	[LEVEL]	−143.0 to 23.0	[dBm]	
		−30.0 (−36.0) to 136.0 (130)	[dBμ]	
		1000 to 6320 (3160)	[mV]	Displays 1.00V to 6.32 (3.16)V.
		100 to 999	[mV]	
		99.9 to 10.0		
		9.99 to 1.00		
		100 to 999	[μV]	
		99.9 to 10.0		
		9.99 to 1.00		
		0.032 (0.016) to 0.999		
		Note: ( ) is terminated value.		
AF frequency	[AF]	0.000 000 000 1 to 0.000 100	[GHz]	
		0.000 000 1 to 0.100	[MHz]	
		0.000 1 to 100	[kHz]	
		0.1 to 100 000	[Hz]	
FM	[FM]	0.000 000 00 to 0.003 20	[GHz]	Display unit:
		0.000 00 to 3.20	[MHz]	kHz for ≦ 999 kHz
		0.00 to 3 200	[kHz]	MHz for ≧ 1 MHz
		0 to 3 200 000	[Hz]	
AM	[AM]	0.0 to 100	[%]	
ØM	[ØM]	0.00 to 9.99	[rad]	
		10.0 to 99.9		
		100 to 640		
		0.0 to 99.9	[deg]	
		100 to 999		

4.1.2 Setting using the rotary knob

Press a header key to select the item to be set and RESOLUTION [∧] [∨] to set rotary-knob resolution digit. Then turn the rotary knob to set carrier frequency, output level, AF frequency, AM, FM, and ØM.

The resolution digit is indicated by two MONITOR LEDs.

Notes: 1. Holding rotary knob with [HOLD]

- When [HOLD] is pressed, the [HOLD] LED lights and the value remains unchanged even if the rotary knob is turned.
- When [HOLD] is pressed again, the [HOLD] LED goes out and the rotary-knob hold is released.
  Even if another header is pressed, the hold state does not change.

2. [RESET/REF DISPLAY] functions

- The amount adjusted and set by the rotary knob can be canceled and the original value (set with the data keys) returned by pressing [RESET/REF DISPLAY].
- While [RESET/REF DISPLAY] is pressed after pressing [SHIFT], the original value is displayed. (When released, [SHIFT] turns off.)

3. When the output level is changed from 999 μV to 1000 μV, the units are automatically changed from μV (999 μV) to mV (1.00 mV). The minimum resolution is also changed from 1 μV to 10 μV.
   As described above, the output level units and resolution depend on the output level value.

4. When voltage output level or modulation factor/deviation is decreased using the rotary knob, only one resolution digit MONITOR LED at the left most position may light. This indicates that the rotary-knob resolution exceeds the most upper digit of the display. So, turning the rotary knob counterclockwise does not decrease the set value any more. To decrease the value, minimize the rotary-knob resolution.

5. When the step time for a 1 dB step setting is shortened by 100 msec with the rotary knob, the programmable attenuator will not respond to this rapidly control signal.

Item	Header	Resolution Digit	Remarks
Carrier frequency	[FREQ]	0.01 Hz to 10 MHz	
Output level	[LEVEL]	0.1, 1, 10 dB	NORMAL mode
		0.1 dB fixed (Within ±10 dB range)	CONTINUOUS mode
AF frequency	[AF]	0.1 Hz to 10 kHz	
FM	[FM]	0.01 kHz to 1 MHz	
AM	[AM]	0.1, 1, 10%	
ØM	[ØM]	0.01 to 100 rad 0.1 to 100 deg	

4.1.3 Setting using INCREMENT [∧] [∨]

Press a header key to select the item to be set, and then [INCR SET]/numeric keys/unit key in this sequence to set increment value.

Press INCREMENT [∧] [∨] to increase or decrease the set value. Hold it down to change continuously.

When [INCR SET] is pressed, the FREQUENCY (for carrier and AF frequencies)/OUTPUT LEVEL (for level) display changes to the message ı n c r (INCR). Each time numerical data is entered via the numeric keys, the corresponding value is displayed successively from the leftmost digit. When the unit key is pressed, the display returns to the header display. Hold [INCR SET] down for approx. 0.5 second or more to display and check the increment value. When [INCR SET] is released, the display returns to the header display.

Notes: *1.* AM increment value is 10% (fixed).

2. FM/ØM increment value is fixed.
Pressing [∧] or [∨] makes FM/ØM value 10 or 1/10 times the set value.

Truncating and recovering digits:

When scaling down the frequency/phase deviation by a factor of ten, non-significant digits are truncated. However, when the deviation is gained scaled-up, the original digits are recovered.

(Example: 3.55 kHz (or rad) →0.35 kHz (or rad)→0.03 kHz (or rad)→
1/10 1/10 1×0

0.35 kHz (or rad)→3.55 kHz (or rad))
×10

3. [RESET/REF DISPLAY] functions

- The adjusted amount set by INCREMENT [∧] [∨] can be canceled and the original value (set with the data keys) returned by pressing [RESET/REF DISPLAY].
- While [RESET/REF DISPLAY] is pressed and held after pressing [SHIFT], the original value is displayed. (When released, [SHIFT] turns off.)

4. Level is incremented in dB only.

Item	Header	Increment Value	Remarks
Carrier frequency	[FREQ]	0.01 Hz to 2.7 GHz	
Output level	[LEVEL]	0.1 dB to 166.0 dB	If display unit is μV, mV or V; incremented in dB only.
AF frequency	[AF]	0.1 Hz to 99.999 9 kHz	
FM	[FM]	[∧] : ×10 times [∨] : ×1/10 times	
ØM	[ØM]		
AM		10% (fixed)	

4.2 Setting Carrier Frequency

The MG3633A is equipped with three different types of of controls for setting carrier frequency (paragraph 4.1).

- Data keys
- Rotary Knob
- INCREMENT [∧] [∨] keys

4.2.1 Example: setting frequency using the data keys

Example: Set the frequency to 360.3 MHz using the following four methods.

Method		Procedure	
1	[FREQ]	[0] [•] [3] [6] [0] [3]	[GHz/dBm]
2	[FREQ]	[3] [6] [0] [•] [3]	[MHz/dBμ]
3	[FREQ]	[3] [6] [0] [3] [0] [0]	[kHz/mV]
4	[FREQ]	[3] [6] [0] [3] [0] [0] [0] [0] [0]	[Hz/μV]
	HEADER*	DATA	UNIT

* When the [FREQ] LED is already lit, the [FREQ] need not be pressed here.

4.2.2 Example: setting frequency using the rotary knob

Example: Set the frequency to 360.3 MHz. Adjust the frequency using the rotary knob at 10 Hz resolution to set to the precise value.

Step		Procedure
1*	[FREQ]	Select frequency setting mode. (The [FREQ] LED comes on.)
2	[3] [6] [0] [•] [3] [MHz/dBμ]	Set frequency to 360.3 MHz.
3	**RESOLUTION** [《] or [》]	Press RESOLUTION [<] or [>] until the resolution digit MONITOR LED of the FREQUENCY display lights at 10 Hz digit.
4	**ROTARY KNOB**	Change the frequency continuously and set it.

* When the [FREQ] LED is already lit, [FREQ] need not be pressed here.

4.2.3 Example: setting frequency using INCREMENT [∧] [∨]

Example: Set the center frequency to 360.3 MHz, then increase and decrease the frequency in 12.5 kHz steps.

Step		Procedure
1*	[FREQ]	Select frequency setting mode. (The [FREQ] LED comes on.)
2	[3] [6] [0] [•] [3] [MHz/dBμ]	Set frequency to 360.3 MHz.
3	[INCR SET] [1] [2] [•] [5] [kHz/mV]	Set increment value to 12.5 kHz
4	[︽]	Press [∧] once. The 360.3 MHz setting increases in value by 12.5 kHz to become 360.3125 MHz.
5	[︾]	Press [∨] once. The 360.3125 MHz setting decreases in value by 12.5 kHz to become 360.3 MHz.

*When the [FREQ] LED is already lit, [FREQ] need not be pressed here.

4.2.4 Displaying relative frequency

(1) Setting relative-frequency display mode

When [RELATIVE FREQ] is pressed while an output frequency is shown on the FREQUENCY display, the display value is set to 0. This is the relative frequency display reference value 0. At this time, the [RELATIVE FREQ] LED lights to notify the relative frequency display mode.

If [RELATIVE FREQ] is pressed when the header [FREQ] is not selected, the header [FREQ] is automatically selected from another header.

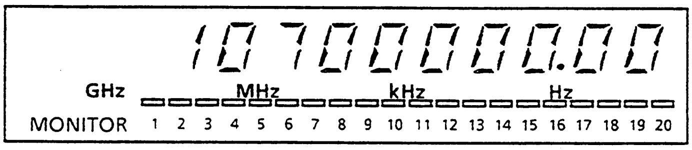
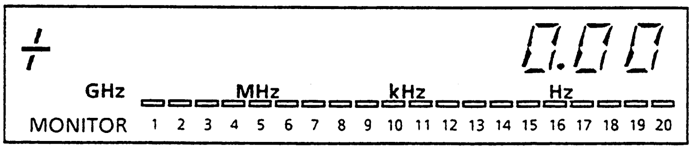
The actual output frequency in the relative-frequency display mode can be obtained using the following equation.

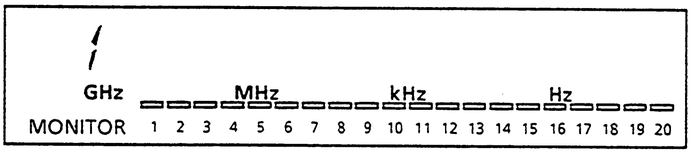
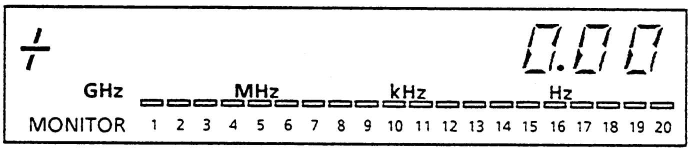
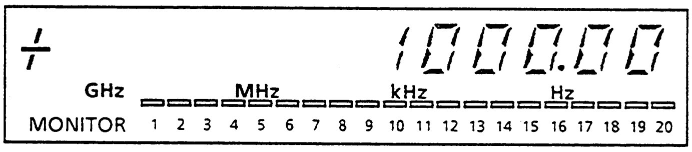
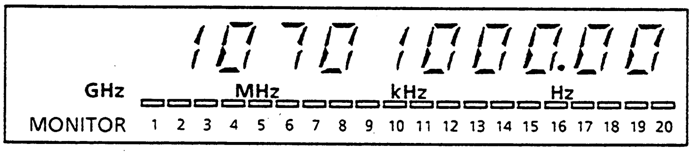
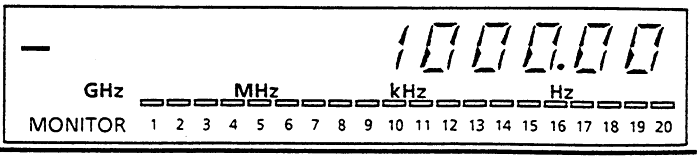
Actual output frequency = Frequency when [RELATIVE FREQ] pressed + Current relative value displayed.

(2) Checking the actual output frequency in the relative-frequency display mode

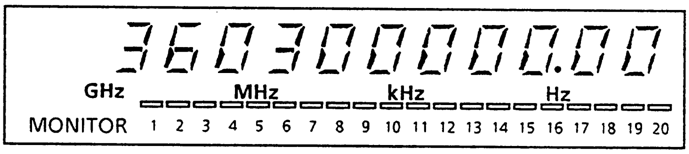
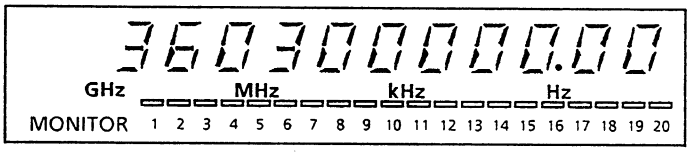
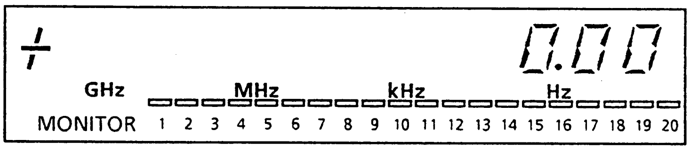
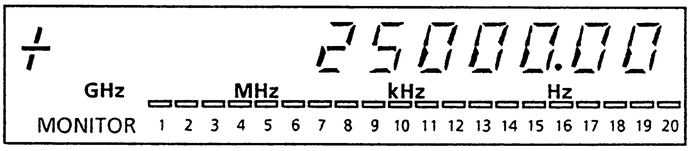
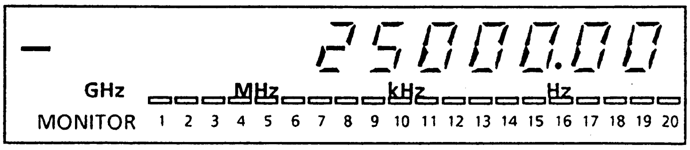
When an output frequency check is required in the relative frequency display mode, press and hold [RELATIVE FREQ/CUR FREQ DISPLAY] after pressing [SHIFT]. The actual output frequency is displayed while key is pressed and is returned to the relative frequency display when released.

Example: Set the center frequency to 10.7 MHz and adjust the setting in ±1 kHz steps using INCREMENT [∧] [∨].

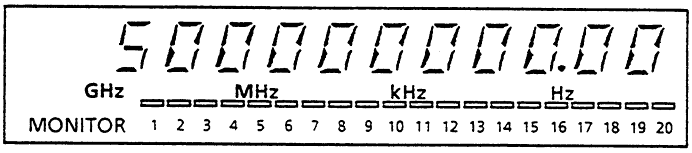
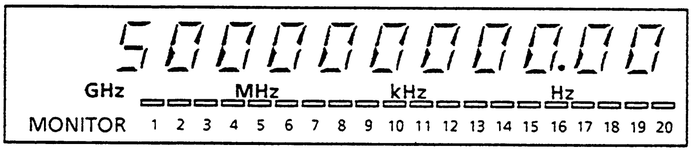
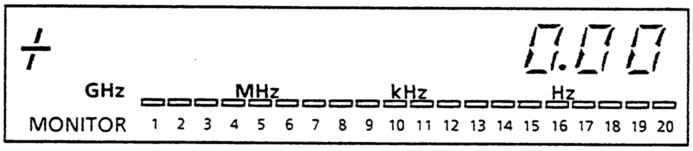
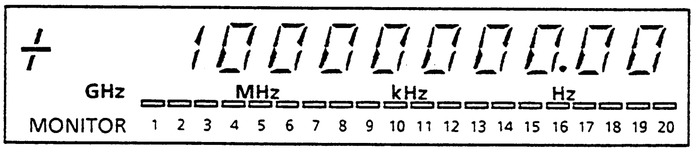
Step		Procedure
1	[FREQ]	Select frequency setting mode. (The [FREQ] LED comes on.)
2	[1] [0] [•] [7] [MHz/dBμ]	Set center frequency to 10.7 MHz
		
3	[RELATIVE FREQ CUR FREQ DISPLAY]	Set relative-frequency display mode. (The [RELATIVE FREQ] LED comes on and reference value "0" is displayed for 10.7 MHz.)
		

Step		Procedure
4	[INCR SET] [1]	Set increment value to 1 kHz. Check that the data is input before pressing the unit key. 
5	[kHz/mV]	Press unit key. (The increment value is set to 1 kHz and the display is returned to the relative frequency display.) 
6	**INCREMENT [∧]**	Press [∧] once. (10.7 MHz increases by 1 kHz and +1 kHz is displayed.) 
7	[SHIFT] [RELATIVE FREQ CUR FREQ DISPLAY]	Press [SHIFT] then press and hold [RELATIVE FREQ]. (10.7 MHz + 1 kHz = 10.701 MHz is monitored while pressed.) 
8	**INCREMENT [∨]**	Press [∨] twice. (10.701 MHz decreases by 2 kHz. Therefore, reference value "0" = 10.7 MHz decreases by 1 kHz.) 

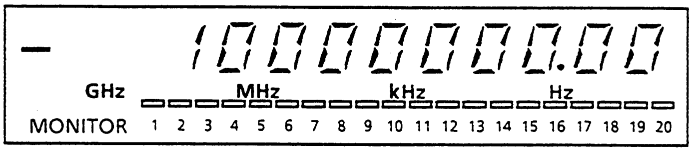
Example 2: Set the center frequency to 360.3 MHz and adjust the setting by ±25 kHz using the rotary knob at 1 kHz resolution.

Step	Procedure
1 [FREQ]	Select frequency setting mode. (The [FREQ] LED comes on.)
2 [3] [6] [0] [•] [3] [MHz/dBμ]	Set center frequency to 360.3 MHz. 
3 **RESOLUTION** [《] or [》]	Press [<] or [>] until 1 kHz resolution is obtained at the resolution digit MONITOR LED to obtain rotary knob resolution of 1 kHz. 
4 [RELATIVE FREQ CUR FREQ DISPLAY]	Set relative-frequency display mode. (The [RELATIVE FREQ] LED comes on and reference value "0" is displayed for 360.3 MHz.) 
5 **ROTARY KNOB**	● Set to 360.3 MHz + 25 kHz by turning the rotary knob clockwise until +25 kHz is obtained.  ● Set to 360.3 MHz −25 kHz by turning the rotary knob counterclockwise until −25 kHz is obtained. 

Example 3: Set the center frequency to 500 MHz and adjust the setting by ±10 MHz with the data keys, and fine tune using the rotary knob at 10 Hz resolution.

Step		Procedure
1	[FREQ]	Select frequency setting mode. (The [FREQ] LED comes on.)
2	[5] [0] [0] [MHz/dBμ]	Set the center frequency to 500 MHz. 
3	**RESOLUTION** [《] or [》]	To obtain a rotary knob resolution of 10 Hz, press [<] or [>] until 10 Hz resolution is obtained at the resolution digit MONITOR LED. 
4	[RELATIVE FREQ / CUR FREQ DISPLAY]	Select relative-frequency display mode. (The [RELATIVE FREQ] LED comes on and reference value of "0" is displayed for 500 MHz.) 
5	[5] [1] [0] [MHz/dBμ]	Set 510 MHz as 500 MHz + 10 MHz. 
6	**ROTARY KNOB**	Fine tune using 10 Hz resolution.

(Continued)

Step		Procedure
7	[4] [9] [0] [MHz/dBμ]	Set 490 MHz as 500 MHz −10 MHz. 
8	**ROTARY KNOB**	Fine tune using 10 Hz resolution.

Note: When [RESET/REF DISPLAY] is pressed in the relative-frequency display mode in which a relative value (not 0) is displayed, the value is returned to the reference value "0" frequency. This does not exit the relative frequency display mode.
When [RESET/REF DISPLAY] is pressed and held after pressing [SHIFT], the actual frequency of the reference frequency is displayed (the frequency set when the relative frequency display mode is selected).

(3) Exiting the relative frequency display mode

Press [RELATIVE FREQ] again to exit the relative frequency display mode. The [RELATIVE FREQ] LED goes out to indicate the mode is disengaged. At this time, the output frequency is that which was displayed just before the relative frequency display mode is exited.

Note: When [RESET/REF DISPLAY] is pressed after the relative frequency display mode is exited, the frequency returns to the last value set with the data keys before selecting the relative-frequency display mode. It does not return to the one set with the data keys during the relative frequency display mode.

4.3 Setting Output Level

The MG3633A is equipped with three different types of controls for setting output levels (paragraph 4.1).

- Data keys
- Rotary Knob
- INCREMENT [∧] [∨] keys

4.3.1 EMF voltage display and terminated voltage display

The MG3633A displays the output level in the following units:

- Output levels for power are displayed in dBm units.
- Output levels for voltage are displayed in dBμ, V, mV, and μV units.
- Relative output levels are displayed in dB

For the voltage unit display, EMF (open-circuit) voltage display or terminated voltage display can be selected. The EMF voltage display and terminated voltage display are switched using special functions, as follows.

① EMF voltage display

[SPECIAL] [**0**] [**3**]

② Terminated voltage display

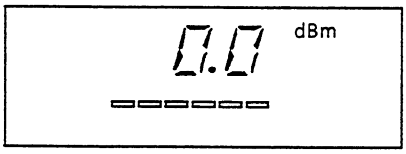
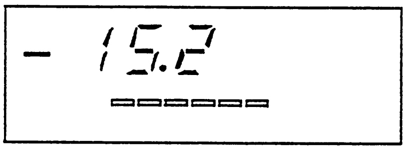
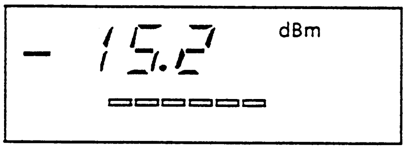
[SPECIAL] [**0**] [**4**]

The MG3633A is powered-up in an EMF voltage unit, which was set at the factory.

The letters "EMF" are indicated below the units on the OUTPUT LEVEL display (paragraph 4.11.4.).

4.3.2 Example: setting output level using the data keys

Example: Set the output level to −15.2 dBm.

Step	Procedure
1 [LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on. The output level display still shows the previously set status.) 
2 [−] [1] [5] [•] [2]	Input the desired output level data. The values input are displayed starting from the leftmost digit of the display. 
3 [GHz/dBm]	Complete the data entry by pressing appropriate unit key. 

4.3.3 Example: setting output level using the rotary knob

There are two general procedures for setting output level with the rotary knob.

<table>
<tr><th>NORMAL mode</th><th>CONTINUOUS mode</th></tr>
<tr>
<td>
This method involves changing and setting output levels in a range of values using the rotary knob. The resolution of the knob can be set as follows.
<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td>1</td><td>Set the resolution to the 0.1, 1, or 10 dB digit by pressing RESOLUTION [<] or [>].</td></tr>
<tr><td>2</td><td>Turn the rotary knob to change and set the output level.</td></tr>
</table>
</td>
<td>
Pressing [SHIFT], then RESOLUTION [>] (LEVEL CONTINUOUS) enters the CONTINUOUS mode. When CONTINUOUS mode is initiated, a 0.1 dB level resolution is automatically set. In this mode the rotary knob can be used to vary the output level over a continuous set of values in a range of ±10 dB of that which was set when the mode was entered. The advantage to this method of selecting operating parameters is that it enables variable adjustment of output level while preventing the output level from sudden changes by fixing the attenuator within the ±10 dB range.
<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td>1</td><td>To set a CONTINUOUS mode at 0.1 dB digit resolution, press [SHIFT] and then press the RESOLUTION [>] (LEVEL CONTINUOUS).</td></tr>
<tr><td>2</td><td>Turn the rotary knob to change and set the output level continuously within ±10 dB from the current output level.</td></tr>
</table>
</td>
</tr>
</table>

(1) Setting output level during NORMAL mode

Example 1: Set the output level to 0 dBm, and adjust and set the values by using the rotary knob at 1 dB resolution.

Step		Procedure
1*	[LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on.)
2	[0] [GHz/dBm]	Set 0 dBm.
3	**RESOLUTION** [《] or [》]	Press RESOLUTION [<] or [>] until the resolution digit MONITOR LED, of the OUTPUT LEVEL display, lights the 1 dB digit.
4	**ROTARY KNOB**	Make fine adjustments at 1 dB resolution.

* When the [LEVEL] LED is already lit, [LEVEL] need not be pressed.

Example 2: Set the output level to 980 µV and then to 1.10 mV using the rotary knob at minimum resolution.

Step		Procedure
1	[LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on.)
2	[9] [8] [0] [Hz/µV]	Set 980 µV.
3	**RESOLUTION** [》]	Press RESOLUTION [>] until the right end resolution digit MONITOR LED of the OUTPUT LEVEL display lights (1 µV digit).
4	**ROTARY KNOB**	Turn the rotary knob clockwise until the output level is 1.10 mV.

(2) Setting output level during CONTINUOUS mode

Set the output level with [LEVEL], [SHIFT], [>/LEVEL CONTINUOUS], numerical data keys, unit key, RESOLUTION [>/LEVEL CONTINUOUS], and the rotary knob, as described below.

(a) Selecting CONTINUOUS mode

[SHIFT]   [LEVEL CONTINUOUS]

Press [SHIFT] and [>/LEVEL CONTINUOUS] to select CONTINUOUS mode.
When the output level is set to CONTINUOUS mode, it can be varied continuously using the rotary knob within ±10 dB from the level at the time when the CONTINUOUS mode is set. The resolution is fixed at 0.1 dB (for µV, mV, or V unit, the lowest digit of the output level display is selected).
The LED "CONT" comes on below the unit on the OUTPUT LEVEL display to indicate the CONTINUOUS mode.

(b) Exiting CONTINUOUS mode

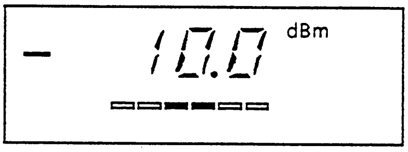
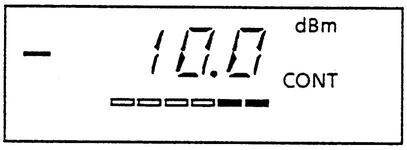
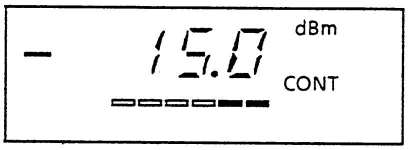
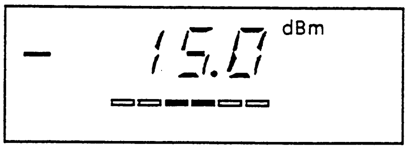
[SHIFT]   [LEVEL NORMAL]

To exit CONTINUOUS mode, press [SHIFT] and then RESOLUTION [</LEVEL NORMAL] and the system is returned to NORMAL mode. As a result, the output level is set to the current output level again and the resolution returns to the digit position indicated immediately before CONTINUOUS mode was selected.

Note:

- When data keys are pressed during CONTINUOUS mode to reset output level, the output level is reset immediately after a momentary level loss. The CONTINUOUS mode restarts at the reset level.
- When INCREMENT [∧] or [∨] is pressed during CONTINUOUS mode to set the output level, both the current level and that at the time when the CONTINUOUS mode was set are increased by the increment value after a momentary level loss.
- When [RESET/REF DISPLAY] is pressed during CONTINUOUS mode, the output level returns to that which was indicated when the CONTINUOUS mode was set. The CONTINUOUS mode is not released.
- When [RESET/REF DISPLAY] is pressed after exiting CONTINUOUS mode, the output level returns to the last level which was set with the data keys before the CONTINUOUS mode was selected. The output level does not return to the one set with the data keys during the CONTINUOUS mode.

Example: Set CONTINUOUS mode to −10 dBm output level with a 1 dB resolution, and change its level by −5 dB. Then exit the CONTINUOUS mode.

Step		Procedure
		The display shows −10 dBm and 1 dB resolution. 
1	[SHIFT]	Press [SHIFT]. (The [SHIFT] LED comes on.)
2	**RESOLUTION [⟫]** **(LEVEL CONTINUOUS)**	Press [>]. (The [SHIFT] LED goes out and the "CONT" LED of the OUTPUT LEVEL display is lit. At this time the resolution is set to 0.1 dB. Thus the CONTINUOUS mode is obtained.) 
3	**ROTARY KNOB**	Turn the rotary knob counterclockwise until −15.0 dBm is obtained. 
4	[SHIFT]	Press [SHIFT]. (The [SHIFT] LED comes on.)
5	**RESOLUTION [⟪]** **(LEVEL CONTINUOUS)**	Press [<]. (The [SHIFT] LED goes out, and the resolution digit MONITOR LED of the OUTPUT LEVEL display is lit at 1 dB digit, and the "CONT" LED goes out. Thus the CONTINUOUS mode is exited, the NORMAL mode is obtained, and the resolution is returned to 1 dB.) 

4.3.4 Example: setting output level using INCREMENT [∧] [∨]

Example 1: Set the output level to 0 dBm and then decrease its output level in 6 dB steps from 0 dBm to −60 dBm.

Step		Procedure
1*	[LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on.)
2	[0] [GHz/dBm]	Set 0 dBm.
3	[INCR SET] [6] [dB]	Set increment value to 6 dB.
4	INCREMENT [∨]	Press [∨] 10 times. (The output level is decreased from 0 dBm to −60 dBm in 6 dB steps.)

* When the [LEVEL] LED is already lit, [LEVEL] need not be pressed.

Example 2: Set the output level to 1 mV and then increase its output level in 10 dB steps from 1 mV to 1V.

	Step	Procedure
1	[LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on)
2	[1] [kHz/mV]	Set to 1 mV
3	[INCR SET] [1] [0] [dB]	Set the increment value to 10 dB
6	INCREMENT [∧]	Press [∧] 6 times (The output level can be increased up to 1V in steps as a factor of 3.16 {$\sqrt{10}$, 10 dB}.) 1.00 mV 3.16 mV 10.0 mV 31.6 mV 100 mV 316 mV ↓ 1.00 V

4.3.5 Displaying relative level

(1) Setting relative-level display mode

When [RELATIVE LEVEL] is pressed while an output level is displayed on the OUTPUT LEVEL display, the value is set to 0 dB. That level becomes the relative-level-mode reference value 0 dB. At this time, the [RELATIVE LEVEL] LED is lit to indicate the relative-level display mode.

When [RELATIVE LEVEL] is pressed with the header [LEVEL] not selected, the header [LEVEL] is automatically selected by moving header from other key.

The actual output level at the relative-level display mode can be obtained using the following equation.

Actual output level = Output level when [RELATIVE FREQ] pressed + Current relative value displayed

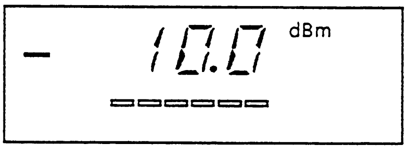
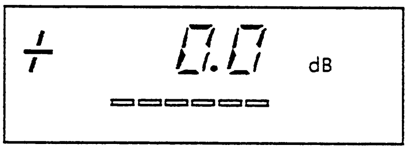
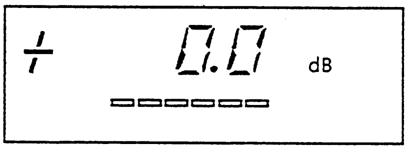
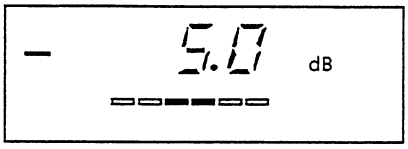
When the relative-level display mode is selected even if the output level unit before setting the relative-level display mode is V, mV, or µV; the unit changes to dB.

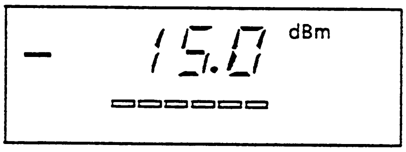
Level setting with [INCREMENT] is possible.

(2) Checking actual output level during relative-level display mode

When the actual output level requires checking during the relative-level display mode, continue to press the [RELATIVE LEVEL/CUR LEVEL DISPLAY] after pressing [SHIFT]. The actual output level is displayed while this key is pressed, and when released, the relative output level is displayed again.

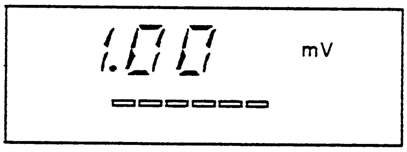
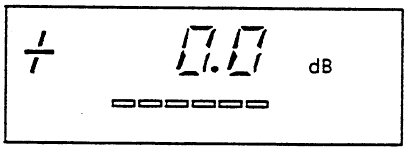
Example 1: Set −10 dBm to the relative-level-mode reference value 0 dB, then set its relative level to −5 dB by rotary knob at 1 dB resolution, and check the actual output level.

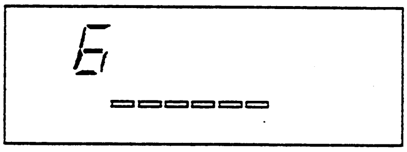
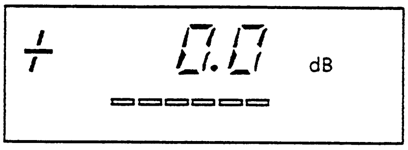
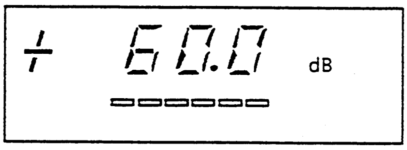
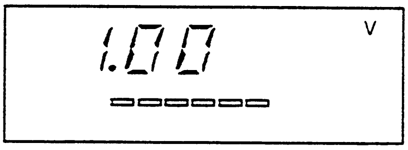
Step	Procedure
1* [LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on.)
2 [−] [1] [0] [GHz/dBm]	Set to −10 dBm 
3 [RELATIVE FREQ CUR FREQ DISPLAY]	Press [RELATIVE LEVEL]. (The [RELATIVE LEVEL] LED comes on and the reference value "0 dB" is displayed for −10 dBm.) 
4 **RESOLUTION** [《] or [》]	Press [<] or [>] until 1 dB resolution is obtained at the resolution digit MONITOR LED. 
5 **ROTARY KNOB**	Turn the rotary knob counterclockwise until −5 dB is obtained. 

Step		Procedure
6	[SHIFT]	Press [SHIFT]. (The [SHIFT] LED is lit.)
7	[RELATIVE LEVEL CUR FREQ DISPLAY]	Press and hold [RELATIVE LEVEL]. (−10 dBm −5 dB = −15 dBm can be monitored while it is pressed. When released, the relative level is displayed again and the [SHIFT] LED goes out.) 

* When the [LEVEL] LED is already lit, [LEVEL] need not be pressed.

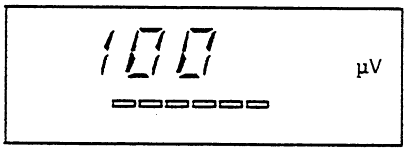
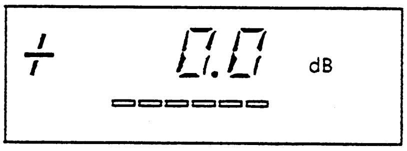
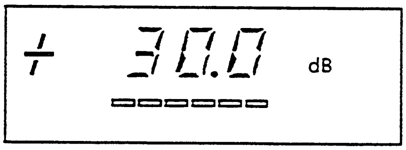
Example 2: Set 1 mV to the relative-level-mode reference value 0 dB, then increase its relative level in 6 dB steps from 0 dB to 60 dB, and check the actual output level.

Step		Procedure
1*	[LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on.)
2	[-] [kHz/mV]	Set 1 mV. 
3	[RELATIVE LEVEL CUR FREQ DISPLAY]	Press [RELATIVE LEVEL]. (The [RELATIVE LEVEL] LED comes on and reference value “0 dB” is displayed for 1 mV.) 

Step	Procedure
4 [INCR SET] [6]	Set the increment value to 6 dB. Check that the data is input before pressing the unit key. 
5 [dB]	Press a unit key. (The increment value is set to 6 dB and the display is returned to the relative-output level display.) 
6 INCREMENT [⩓]	Press [⋀] 10 times. (The relative level increases by 6 dB from 0 dB to 60 dB.) 
7 [SHIFT] [RELATIVE LEVEL CUR LEVEL DISPLAY]	Press [SHIFT], then press and hold [RELATIVE LEVEL]. (1 mV × 1000 (60 dB) = 1V can be monitored while it is pressed.) 

* When the [LEVEL] LED is already lit, the [LEVEL] need not be pressed.

Example 3: Set 100 µV to the relative-level-mode reference value of 0 dB, and set 3.16 mV with the data keys to find the level increase in dB units.

Step	Procedure
1* [LEVEL]	Select the output level setting mode. (The [LEVEL] LED comes on.)
2 [1] [0] [0] [Hz/µV]	Set the output level to 100 µV. 
3 [RELATIVE LEVEL CUR LEVEL DISPLAY]	Press [RELATIVE LEVEL]. (The [RELATIVE LEVEL] LED comes on and the reference value of "0 dB" is displayed for 100 µV.) 
4 [3] [•] [1] [6] [kHz/mV]	Set the output level to 3.16 mV. (The increase from 100 µV is displayed in the unit of dB immediately after the unit key is pressed.) Increase $= 20 \log \frac{3.16\times10^{-3}}{100\times10^{-6}} = 30.0$ dB 

* When the [LEVEL] LED is already lit, the [LEVEL] need not be pressed.

Note: When [RESET/REF DISPLAY] is pressed in the relative-level display mode, a value (reference level) is displayed which corresponds to that which was set at the time the mode was engaged. However, the system is kept in the relative level display mode. When [RESET/REF DISPLAY] is pressed and held after pressing [SHIFT], the reference level is displayed.

(3) Exiting relative-level display mode

Press [RELATIVE LEVEL] again to exit the relative-level display mode. The [RELATIVE LEVEL] LED goes out to indicate the relative-level display mode is disengaged.

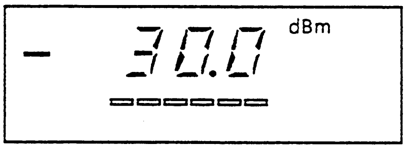
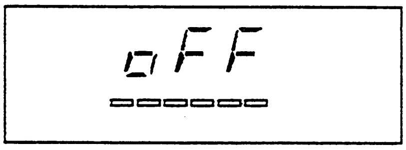
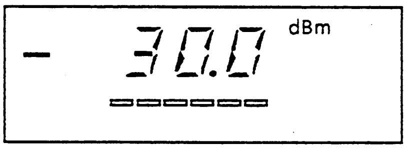
The output level at this time is the output level indicated immediately before the relative-level display mode is exited. The unit returns to the one which was set just before the relative-level display mode was selected.

Note: When [RESET/REF DISPLAY] is pressed after the relative-level display mode is disengaged, the output level returns to that which was set with the data keys immediately before the relative-level display mode was selected. It does not return to the one set with the data keys during the relative-level output display mode.

4.3.6 Turning output level ON/OFF

The output level can be turned on and off using [RF OFF/ON].

Example: Set the output level to −30 dBm, then turn off −30 dBm, and turn it on again.

Step	Procedure
1* [LEVEL]	Select output level setting mode. (The [LEVEL] LED comes on.)
2 [−] [3] [0] [GHz/dBm]	Set −30 dBm. 
3 [RF OFF/ON]	Press [RF OFF/ON]. (The [RF OFF/ON] LED comes on and the OUTPUT LEVEL display displays "OFF" to turn off the output level.) 
4 [RF OFF/ON]	Press [RF OFF/ON]. (The [RF OFF/ON] LED goes out and the OUTPUT LEVEL display displays "−30.0 dBm" again. 

* When the [LEVEL] LED is already lit, the [LEVEL] need not be pressed here.

The output level OFF can also be released by following the three procedures described below.

(1) Releasing output level OFF using data key

The output level OFF can be released by pressing the [LEVEL] and unit key. The OUTPUT LEVEL display after releasing is displayed in the unit of the pressed unit key.

When the [LEVEL], numeric keys, and unit key are pressed, the output level OFF can be released and the new output level can be set.

(2) Releasing output level OFF using rotary knob

When the rotary knob is turned either clockwise or counterclockwise by one click with the [LEVEL] LED lit, the output level OFF can be released. When it is turned by two clicks or more, the usual rotary knob operation is obtained.

(3) Releasing output level OFF using INCREMENT [∧] [∨]

When either INCREMENT [∨] or [∧] is pressed once, the output level OFF can be released. When it is pressed the second time or thereafter, the usual INCREMENT operation is obtained.

Note: The programmable output attenuator is set to maximum attenuation in the output level OFF setting, and the ALC output circuit enters a status where the output level is minimized. Therefore, −143 dBm or less is output with the 50Ω impedance.

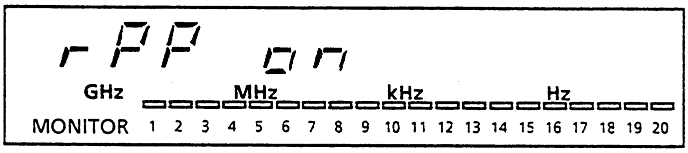
4.3.7 Operating reverse power protection circuit (RPP)

The MG3633A is provided with a reverse power protection (RPP) circuit in the output section to protect the internal circuit from excessive reverse power. When the RPP operates, the REVERSE POWER and the [STATUS] LEDs blink. Press [SHIFT] and then [RF OFF/ON]/[RPP RESET] to release the operation of the RPP circuit.

CAUTION:

- ***Since RPP circuit uses a mechanical switch, the contact may be worn out and damaged if excess reverse power is applied repeatedly. Therefore, do not apply reverse power repeatedly.***
- ***Never release the RPP circuit with reverse power applied, otherwise it will cause trouble with the RPP circuit.***
- ***The RPP circuit can protect internal circuits against reverse power surges of up to 50 Vdc, 50W (to 1 GHz), and 25W (1 to 2.7 GHz). Never apply a reverse power exceeding these limits.***
- ***Since the OUTPUT connector is opened while the RPP circuit is operating, care should also be taken not to damage the transmitter or the device under test.***
- ***When the output level is increased to approx. +20 dBm or more while the connected load is mismatched (open or short-circuited), the RPP circuit may operate as a result of its own signal reflection. In this case, match the output load correctly or reduce the output level before resetting the RPP circuit.***

While [STATUS] is pressed and the RPP circuit is operating, the following message is generated on the FREQUENCY display.



(rPP on)

4.4 Outline of Modulation Setting

The MG3633A is provided with AM, FM and ØM modulation functions, and simultaneous modulation is also possible as shown in the table below.

Combined Modulations

		AM			FM			ØM		
		INT	EXT AC	EXT DC	INT	EXT AC	EXT DC	INT	EXT AC	EXT DC
AM	INT		○	○	○*	○	○	○*	○	○
	EXT AC			×	○	○	○	○	○	○
	EXT DC				○	○	○	○	○	○
FM	INT					○	○	×	×	×
	EXT AC						×	×	×	×
	EXT DC							×	×	×
ØM	INT								○	○
	EXT AC									×

* The simultaneous modulation in which the same modulation frequency is used.

○ : Enabled

× : Disengaged

A 400 Hz (low distortion), 1 kHz (low distortion), or AF (0.1 Hz to 100 kHz) oscillator can be selected as the internal modulation oscillator.

4.4.1 Outline of modulation setting procedure

There are two different procedures for setting MG3633A modulation functions.

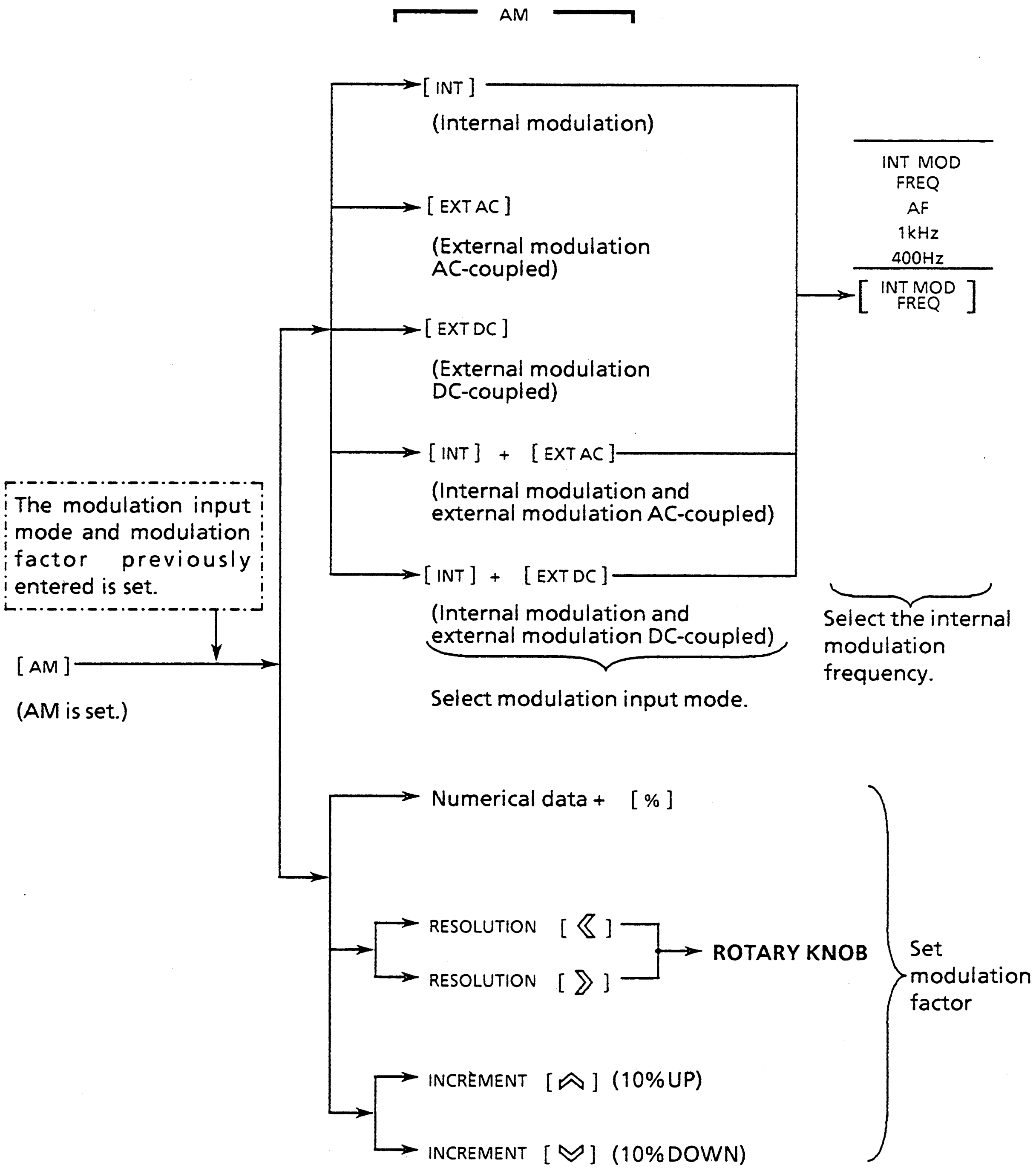
- Setting procedure starting from FUNCTION (header) key:
  Turn on the desired modulation function using the FUNCTION (header) key, then set the modulation factor/deviation, select the modulation input mode, and select the internal modulation frequency.
- Setting procedure starting from MODULATION (input mode) key:
  Set the required modulation input mode using the MODULATION (input mode) key, then select the modulation function, set the modulation factor/deviation, and select the internal modulation frequency.

The modulation function is set to the status immediately before the preceding modulation function is turned off.

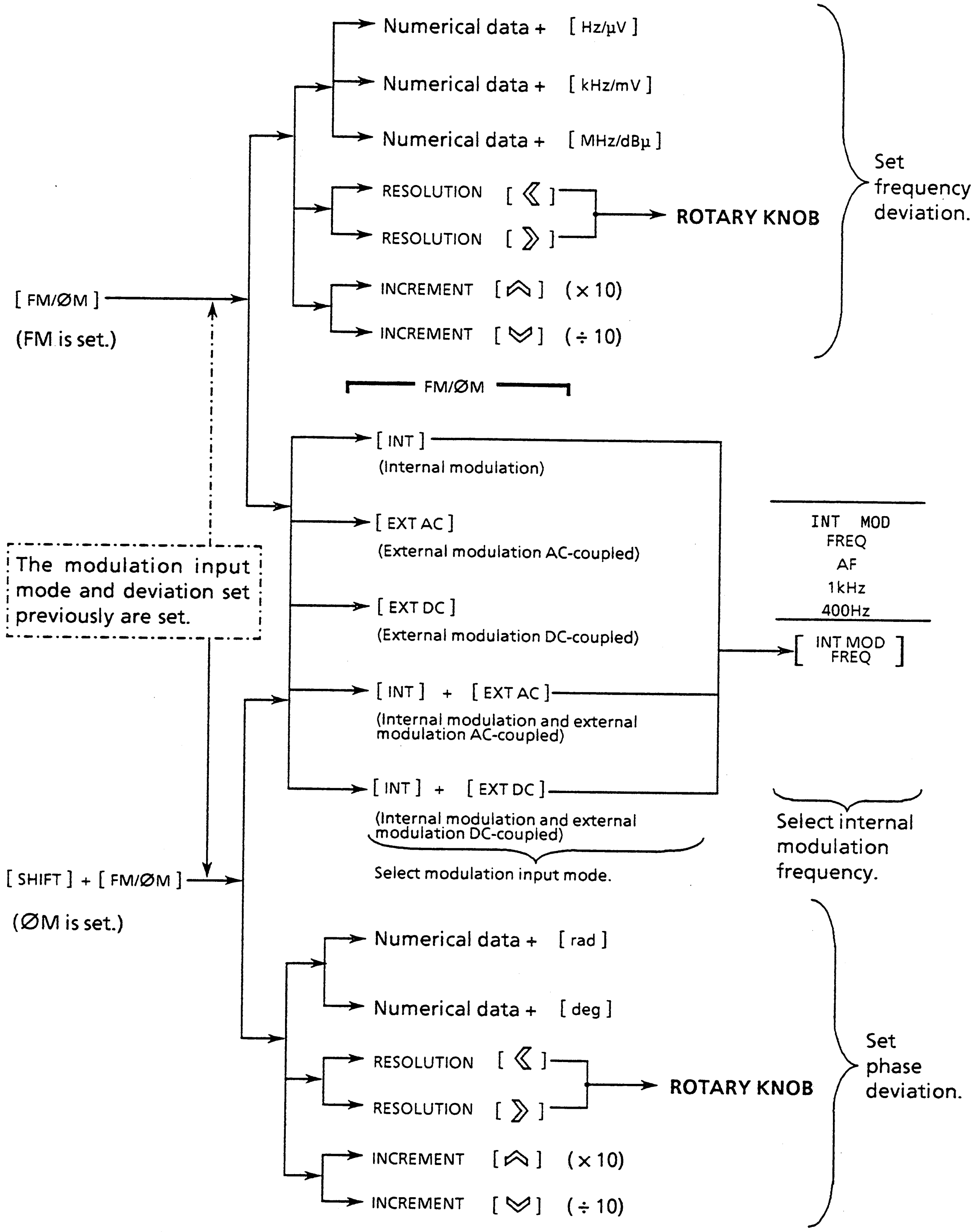
(1) Setting procedure starting from FUNCTION (header) key

Make a setting according to the following procedure.

(a) AM setting



(b) FM/ØM setting

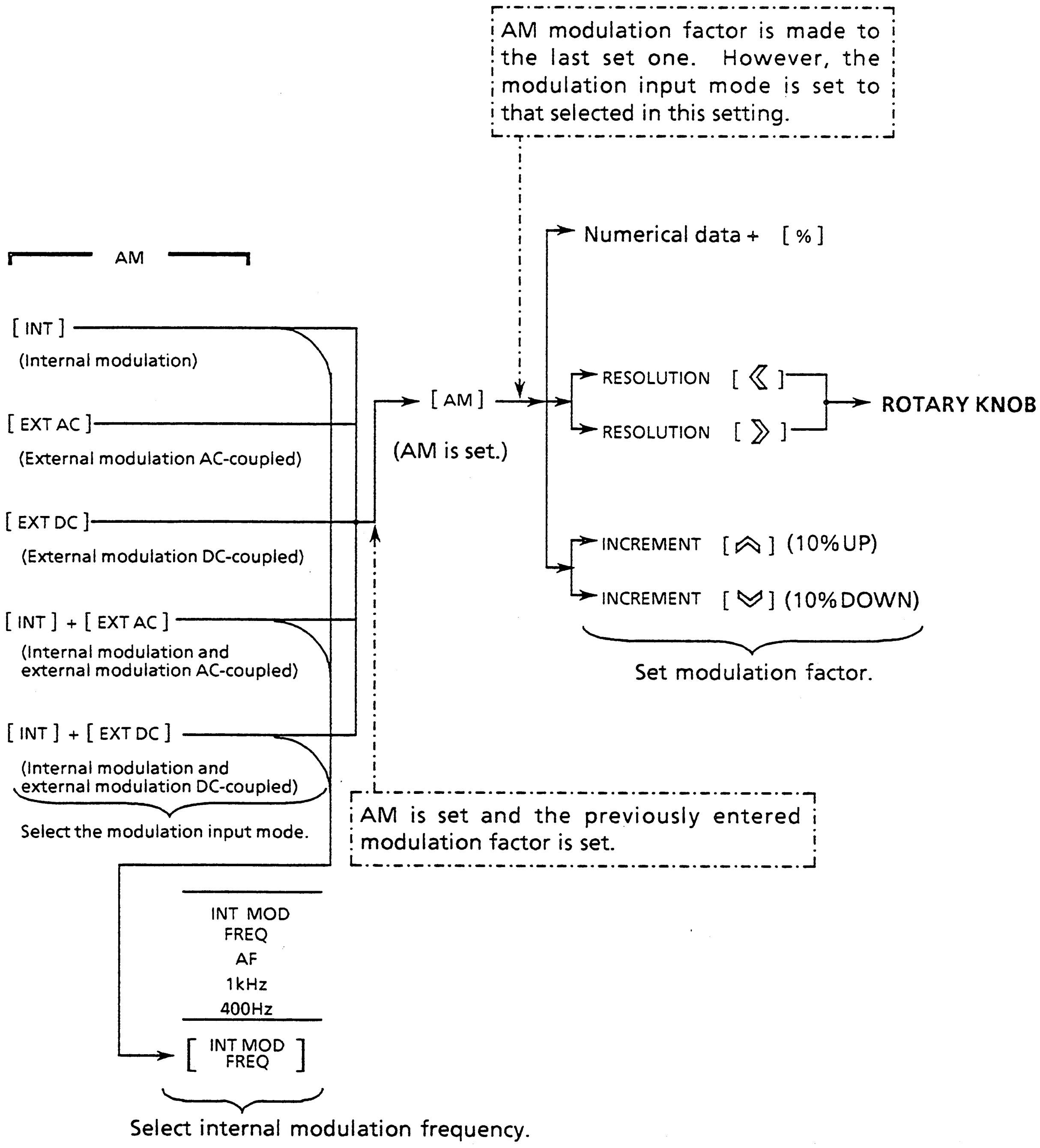


Note: FM and ØM modulation functions cannot be operated at the same time.

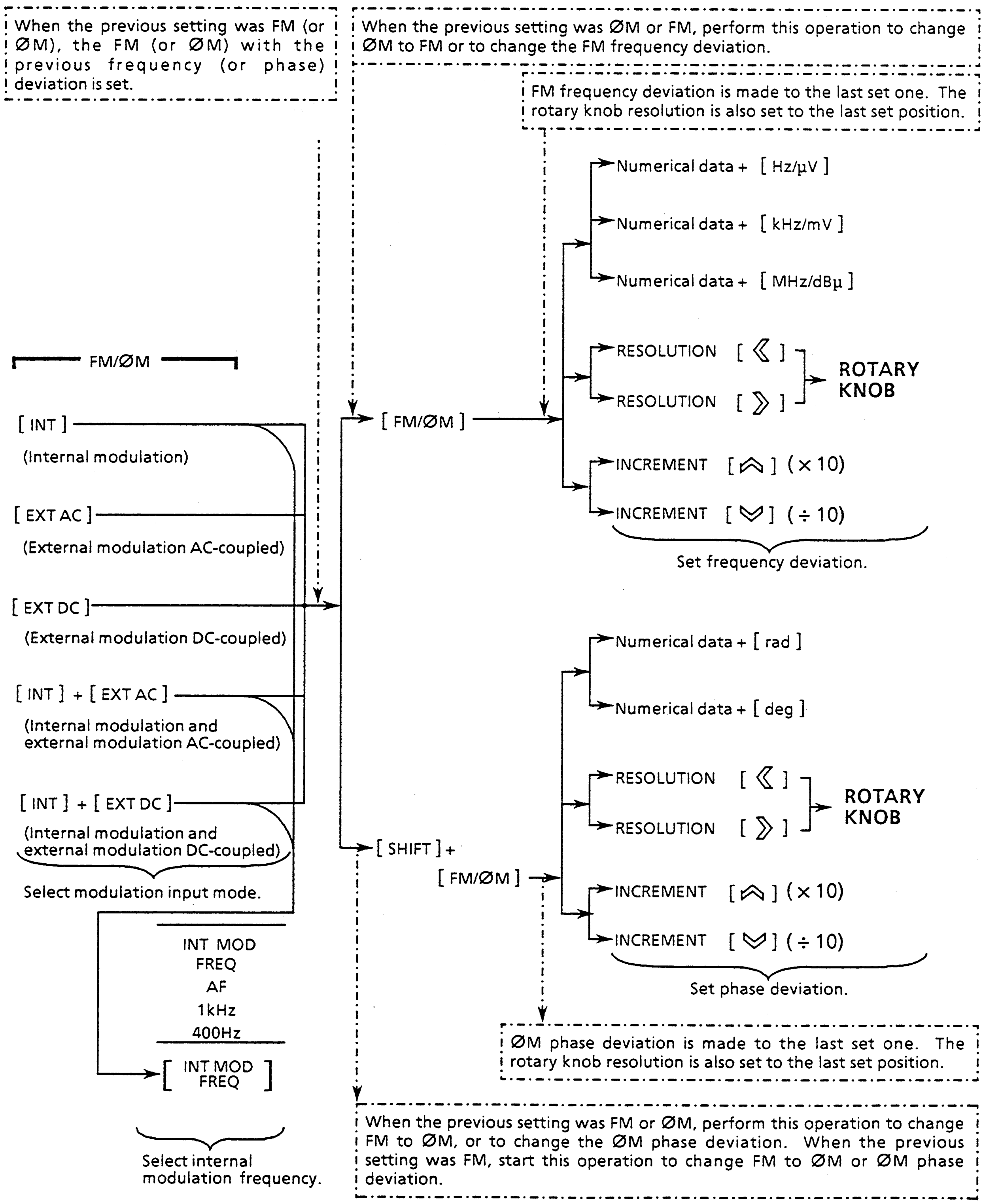
(2) Setting procedure starting from MODULATION (input mode) key

Make a setting according to the following procedure.

(a) AM setting



(b) FM/ØM setting



When the previous setting was FM (or ØM), the FM (or ØM) with the previous frequency (or phase) deviation is set.

When the previous setting was ØM or FM, perform this operation to change ØM to FM or to change the FM frequency deviation.

FM frequency deviation is made to the last set one. The rotary knob resolution is also set to the last set position.

ØM phase deviation is made to the last set one. The rotary knob resolution is also set to the last set position.

When the previous setting was FM or ØM, perform this operation to change FM to ØM, or to change the ØM phase deviation. When the previous setting was FM, start this operation to change FM to ØM or ØM phase deviation.

Note: FM and ØM function cannot be operated at the same time.

(3) Ending modulation function

To turn off AM function, press [ON/OFF] in the AM section.

To turn off FM or ∅M function, press [ON/OFF] in the FM/∅M section.

When the AM section [ON/OFF] or FM/∅M section [ON/OFF] is pressed again, it is returned to the status set before turning off the modulation function.

The appropriate modulation input mode can be turned off by pressing the input mode key ([INT], [EXT AC], [EXT DC]) whose LED is lit for previously-set modulation input. When all the modulation input mode key LEDs are turned off, all of the modulation function is automatically turned off. In this case, when the modulation header key ([AM] or [FM/∅M]) LED in the FUNCTION section is lit, the LED goes out, and the [FREQ] LED is lit to enter the frequency setting mode.

4.4.2 Selecting modulation input mode

There are three types of modulation input modes as shown below.

1. INT mode: Modulation signals are applied using the internal oscillators [400 Hz fixed (low distortion), 1 kHz fixed (low distortion), and 0.1 Hz to 100 kHz variable].
2. EXT AC mode: Modulation signals are applied using the signal supplied via each MODULATION INPUT connector on the front panel. The input-signal DC component is cut by a capacitor.
3. EXT DC mode: Modulation signals are applied using the signal supplied via each MODULATION INPUT connector on the front panel. The input signal is directly connected to the modulation circuit without passing through a capacitor. This enables DC modulation.

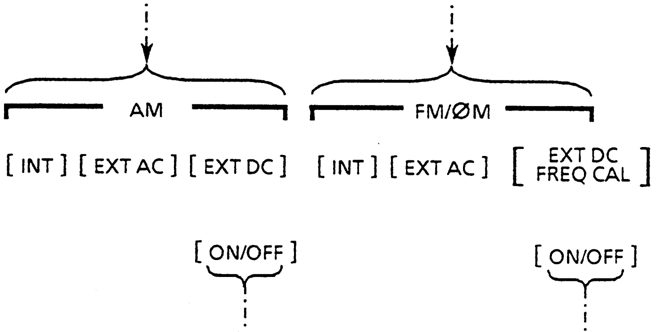
Single or simultaneous modulation is possible according to the following combination.

- Single modulation only in INT mode
- Single modulation only in EXT AC mode
- Single modulation only in EXT DC mode
- Simultaneous modulation in INT and EXT AC modes
- Simultaneous modulation in INT and EXT DC modes

Note: When a simultaneous modulation in INT and EXT modes is performed, total deviation is the sum of the INT and EXT deviations. Take care not to exceed the maximum deviation.

This modulation input mode is set using the input mode keys shown below.

When appropriate key is pressed, the pressed-key LED is lit and the modulation input mode is turned on. When the key lighting LED is pressed again, the LED goes out and the modulation input mode is turned off. Both EXT AC and EXT DC cannot be turned on at the same time. The one pressed later is turned on.



The modulation function is turned off. When pressed again, modulation setting condition before turning it off is recovered. However, when the modulation function OFF is obtained by turning off all the modulation input modes (INT, EXT AC, EXT DC), it remains OFF even if this key is pressed.

4.4.3 Selecting internal modulation frequency

There are three kinds of internal modulation frequencies as shown below.

- 400 Hz (400 Hz fixed, low distortion)
- 1 kHz (1 kHz fixed, low distortion)
- AF (0.1 Hz to 100 kHz, resolution: variable to 0.1 Hz)

Only when the modulation input mode is set to the INT mode, can the internal modulation frequency be set from among these three kinds.

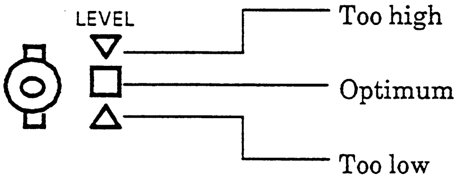
4.4.4 External modulation

For external AM/FM/ØM modulation, select [EXT AC] or [EXT DC] and apply an approx. 2 Vp-p/600Ω external modulation signal to the AM or FM/ØM INPUT connector.

The modulation signal frequency range is:

- EXT AC ··· 20 Hz to 50 kHz (AM), 100 kHz (FM), 5 kHz (ØM)
- EXT DC ··· DC to 50 kHz (AM), 100 kHz (FM), 5 kHz (ØM)

The external modulation signal level must be adjusted to an appropriate level using the LEVEL indicator on the right of the INPUT connector.



When the external modulation signal frequency is approx. 100 Hz or less, adjust the level so that △ and ▽ lamps are lit alternately around □ lamp. When both EXT AC or EXT DC and INT modes are set, modulation can be applied with a signal obtained by summing-up the internal and external modulation signals.

4.4.5 Modulation signal output

The currently applied modulation signal is output from the MODULATION OUTPUT connector on the front panel for monitoring. The INT modulation signal is output at INT and EXT AC or EXT DC simultaneous modulation. The FM or ØM modulation signal is output at AM and FM or ØM simultaneous modulation. The modulation signal output are as follows:

AM		FM/ØM			
INT	EXT	INT	EXT		
INT	AM-EXT	INT	FM/ØM EXT	Single modulation	
	INT	INT	INT	INT	AM
		INT	FM/ØM EXT	EXT	
			INT	INT	FM/ØM

In the case of external modulation, the output level is almost the same as the input level of the external modulation signal. In the case of internal modulation, it is approx. 2 Vp-p. Use special functions (c.f. 35 to 38) to output a desired external or internal modulation signal.

(See paragraph 4.11.15)

4.5 Setting AF Frequency

The MG3633A is equipped with three different types of controls for setting AF variable oscillator frequencies.

- Data keys
- Rotary Knob
- INCREMENT [∨] [∧] keys

Note: The AF frequency setting is basically the same as that of the carrier frequency, but the relative frequency cannot be displayed.
The [RELATIVE FREQ] becomes an invalid key.

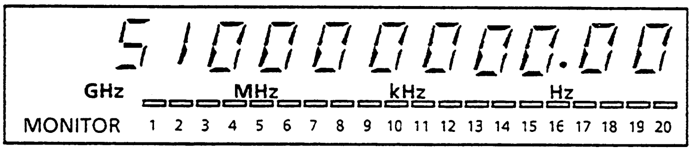
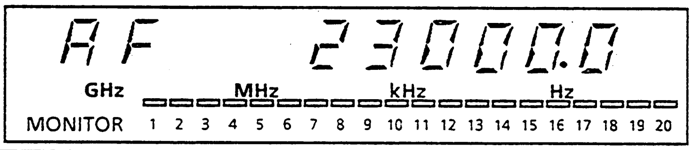
4.5.1 Reading AF frequency

Since the AF frequency share the same FREQUENCY display with the carrier frequency, select the indication contents by pressing [AF].

The [AF] LED is lit and the AF frequency is displayed on the FREQUENCY display. Characters "AF" are displayed on the leftmost FREQUENCY display to indicate the AF frequency.

When header [LEVEL], [AM], or [FM/ØM] keys are pressed, the [FREQ] or [AF] LED goes out, but the contents of the FREQUENCY display do not change.

Example: Set the carrier frequency to 510 MHz, then display the previously-set 23 kHz frequency.

Step	Procedure
1* [FREQ]	Select frequency setting mode. (The [FREQ] LED comes on.)
2 [**5**] [**1**] [**0**] [MHz/dBμ]	Set 510 MHz. 
3 [AF]	Press [AF]. (The AF frequency is displayed. The [AF] LED is lit.) 

*When the [FREQ] LED is already lit, the [FREQ] need not be pressed here.

4.5.2 Example: setting AF frequency using the data keys

Example: Set AF frequency to 12.3 kHz. Four methods are described below.

Method	Procedure		
1	[AF]	[0] [•] [0] [0] [0] [0] [1] [2] [3]	[GHz/dBm]
2	[AF]	[0] [•] [0] [1] [2] [3]	[MHz/dBµ]
3	[AF]	[1] [2] [•] [3]	[kHz/mV]
4	[AF]	[1] [2] [3] [0] [0]	[Hz/µV]
	HEADER	DATA	UNIT

4.5.3 Example: setting AF frequency using the rotary knob

Example: Set the AF frequency to 400 Hz, then increase and decrease the AF at 0.1 Hz resolution.

Step		Procedure
1*	[AF]	Select AF frequency setting mode. (The [AF] LED comes on.)
2	[4] [0] [0] [Hz/µV]	Set 400 Hz AF frequency.
3	**RESOLUTION [≫]**	Press RESOLUTION [>] until the resolution digit MONITOR LED of the FREQUENCY display lights at 0.1 Hz digit.
8	**ROTARY KNOB**	Change the AF frequency continuously and set it.

*When the [AF] LED is already lit, the [AF] need not be pressed here.

4.5.4 Example: setting AF frequency using INCREMENT [∧] [∨]

Example: Set the AF frequency to 400 Hz, then increase or decrease it in 100 Hz steps.

Step	Procedure	
1*	[AF]	Select AF frequency setting mode. (The [AF] LED comes on.)
2	[4] [0] [0] [Hz/μV]	Set 400 Hz.
3	[INCR SET] [1] [0] [0] [Hz/μV]	Set increment value to 100 Hz.
4	[∧]	Press [∧] once. The 400 Hz setting increases by 100 Hz to 500 Hz.
5	[∨]	Press [∨] once. The 500 Hz setting decreases by 100 Hz to 400 Hz.

*When [AF] LED is already lit, [AF] need not be pressed.

4.6 Setting FM Modulation

The MG3633A is provided with the following three different procedures to set FM frequency deviation (paragraph 4.1).

- Data keys
- Rotary knob
- INCREMENT [∨] and [∧]

(1) Frequency deviation setting range

Frequency deviation setting range: 0 Hz to 3.2 MHz.

The maximum frequency deviation (not UNCAL) depends on the carrier frequency range as shown in the table below.

Carrier frequency range	Maximum frequency deviation
f<40 MHz	400 kHz
40 MHz≦f<80 MHz	100 kHz
80 MHz≦f<160 MHz	200 kHz
160 MHz ≦f<320 MHz	400 kHz
320 MHz ≦f<640 MHz	800 kHz
640 MHz ≦f<1280 MHz	1.60 MHz
1280 MHz ≦f	3.20 MHz

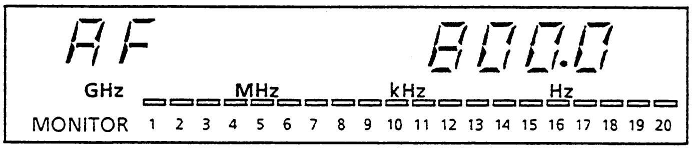
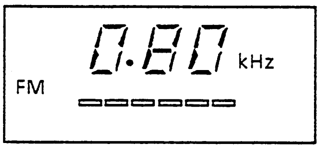
(2) Minimum resolution of the frequency deviation

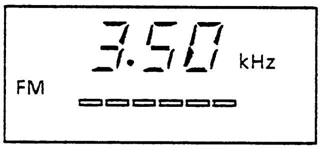
The minimum resolution of the frequency deviation depends on the frequency deviation range, as follows:

Frequency deviation range	Minimum resolution
0 to 9.99 kHz	0.01 kHz
10.0 to 99.9 kHz	0.1 kHz
100 to 999 kHz	1 kHz
1.00 to 3.20 MHz	10 kHz

4.6.1 Example: setting frequency deviation using the data keys

Example: Set both the internal modulation AF frequency and the frequency deviation to 800 Hz. Then, set the internal modulation frequency to 400 Hz and the frequency deviation to 3.5 kHz.

Step	Procedure	
	Setting AF frequency to 800 Hz	
1	[AF]	Select AF frequency setting mode. (The [AF] LED comes on.)
2	[8] [0] [0] [Hz/µV]	Set AF frequency to 800 Hz. 
	Setting frequency deviation to 800 Hz	
3	[FM/ØM]	Select FM deviation setting mode. (The [AF] LED goes out and the left (FM side) LED above the [FM/ØM] is lit.
4	[8] [0] [0] [Hz/µV]	Set FM frequency deviation to 800 Hz. (The MODULATION display indicates the deviation in kHz, as below.) 
5	FM/ØM [INT] [EXT AC] [EXT DC FREQ CAL]	Press each key to light the [INT] LED only. (The FM modulation input mode is set only to the INT mode. Only INT mode is selected at initialization.)

Step		Procedure
6	[INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the [AF] LED is lit. (The internal modulation frequency is set to AF.) INT MOD FREQ ▨ AF 1kHz 400Hz
	<u>Setting frequency deviation to 3.5 kHz</u>	
7	[3] [•] [5] [kHz/mV]	The frequency deviation is set to 3.5 kHz. 
	<u>Setting modulation frequency to 400 Hz</u>	
8	[INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until 400 Hz LED is lit. (The internal modulation frequency is set to 400 Hz.) INT MOD FREQ AF 1kHz ▨ 400Hz

4.6.2 Example: setting frequency deviation using the rotary knob

Example: Set frequency deviation to 95 kHz and internal modulation frequency to 1 kHz. Then, vary the frequency deviation up to 105 kHz by using the rotary knob at minimum resolution.

Step		Procedure
1	[FM/ØM]	Select frequency deviation setting mode. (The left FM side LED above the [FM/ØM] is lit.)
2	[9] [5] [kHz/mV]	Set frequency deviation to 95 kHz.
3	FM/ØM [INT] [EXT AC] [EXT DC FREQ CAL]	Press each key to light the [INT] LED only. (The FM modulation input mode is set only to the INT mode. Only INT mode is also selected at initialization.)
4	[INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the [INT] LED only is lit. (The internal modulation frequency is set to 1 kHz. 1 kHz is also set at initialization.) INT MOD FREQ AF 1kHz 400Hz
5	**RESOLUTION [≫]**	Press RESOLUTION [>] until the resolution digit MONITOR LED of the MODULATION display is lit at the right end digit (0.1 kHz digit).
6	**ROTARY KNOB**	Turn the rotary knob clockwise until the frequency deviation is 105 kHz.

*When the left FM side LED above the [FM/ØM] is already lit, the [FM/ØM] need not be pressed here.

4.6.3 Example: setting frequency deviation using INCREMENT [∧] [∨]

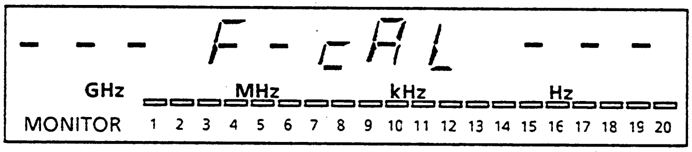
Example: Set the frequency deviation to 350 Hz. Then, increase the frequency in multiples of ten until it becomes 35 kHz.

Step		Procedure
1	[FM/∅M]	Select frequency deviation setting mode. (The left FM side LED above the [FM/∅M] is lit.)
2	[3] [5] [0] [Hz/μV]	Set frequency deviation to 350 Hz.
2	INCREMENT [⩓]	Press INCREMENT [∧] twice. (The frequency deviation increases to 35 kHz (350 Hz→3.5 kHz→35 kHz))

*When the left FM side LED above the [FM/∅M] is already lit, [FM/∅M] need not be pressed.

4.6.4 Calibrating carrier frequency at DC-FM modulation

DC-FM modulation can be obtained by eliminating a portion of the PLL circuit. Therefore, both frequency accuracy and stability are generally deteriorated compared to that obtained in CW and AC-FM modes. The MG3633A is provided with a frequency calibration function so that frequency accuracy is also obtained in the DC-FM mode. The frequency is calibrated automatically when [EXT-DC] is pressed under FM mode. To calibrate the frequency during EXT-DC FM mode, press [SHIFT] then press [EXT DC/FREQ CAL]. At this time, the following appears on the FREQUENCY display.



Frequency calibration takes approx. 0.2 second. FM modulation cannot be applied during that time.

4.7 Setting AM Modulation

The MG3633A is equipped with three different types of controls for setting AM modulation (paragraph 4.1).

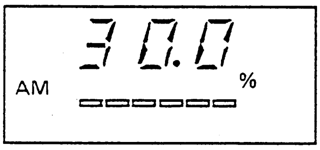
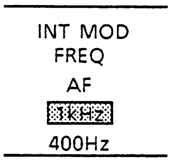
- Data keys
- Rotary knob
- INCREMENT [∧] [∨] keys

Note: AF frequency can be set up to 100 kHz. However, maximum AF frequency is limited as shown below to satisfy AM specification.

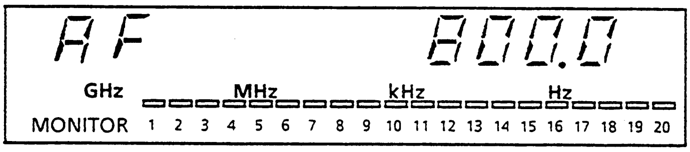
Modulation factor (%) / Carrier frequency (MHz)	0 to 30	30.1 to 80
$0.25 \leqq fc < 0.5$	5 kHz	5 kHz
$0.5 \leqq fc < 80$	20 kHz	10 kHz
$80 \leqq fc$	50 kHz	20 kHz

4.7.1 Example: setting AM modulation factor using the data keys

Example: Set internal modulation frequency to 1 kHz and AM modulation factor to 30%. Then, change the internal modulation frequency to 800 Hz and the AM modulation factor to 55%.

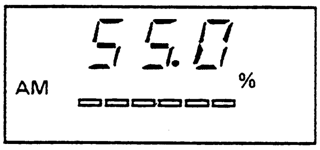
Step	Procedure	
	Setting AM modulation factor to 30%	
1	[AM]	Select AM modulation setting mode . (The [AM] LED is lit.)
2	[3] [0] [%]	Set AM modulation factor to 30%. 
3	AM [INT] [EXT AC] [EXT DC]	Press each key to light the [INT] LED only. (The AM modulation input mode is set only to the INT mode. Only the INT mode is also selected at initialization.)
	Setting modulation frequency to 1 kHz	
4	[INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the 1 kHz LED is lit. (The internal modulation frequency is set to 1 kHz [low distortion]. It is also set to 1 kHz at initialization.) 
	Setting modulation frequency to AF 800 Hz	
5	[AF]	Select AM frequency setting mode. (The [AM] LED goes out and the [AF] LED is lit. The FREQUENCY display indicates AF frequency.)

Step	Procedure
6 [8] [0] [0] [Hz/µV]	Set AF frequency to 800 Hz.

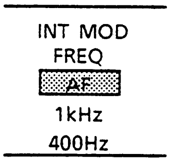


Setting AM modulation factor to 55%

Step	Procedure
7 [AM]	Select AM modulation factor setting mode. (The [AF] LED goes out and the [AM] LED is lit.)
8 [5] [5] [%]	Set AM modulation factor to 55%.



Step	Procedure
9 [INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until [AF] LED is lit. (The internal modulation frequency is set to AF frequency. The [AF] LED is lit.)



4.7.2 Example: setting AM modulation factor using the rotary knob

Example: Set AM to 50%, then vary it up to 55% in 1% steps.

Step		Procedure
1*	[AM]	Select AM modulation factor setting mode. (The [AM] LED is lit.)
2	[5] [0] [%]	Set AM modulation factor to 50%.
3	**RESOLUTION** [«] or [»]	Press RESOLUTION [<] or [>] until the resolution digit MONITOR LED of the MODULATION display is lit at the 1% digit.
4	**ROTARY KNOB**	Turn the rotary knob clockwise until the AM modulation factor becomes 55%.

*When the [AM] LED is already lit, [AM] need not be pressed.

4.7.3 Setting modulation factors using INCREMENT [∧] [∨]

Example: Set AM at 30%, then vary it up to 100% in 10% steps.

Step		Procedure
1*	[AM]	Select AM modulation factor setting mode. (The [AM] LED is lit.)
2	[3] [0] [%]	Set AM modulation factor to 30%.
3	**INCREMENT** [︽]	Press INCREMENT[∧] 7 times to increase the AM modulation factor to 100% in 10% steps.

*When the [AM] LED is already lit, the [AM] need not be pressed.

4.8 Setting ∅M Modulation

The MG3633A is equipped with three different types of controls for setting ∅M modulation (paragraph 4.1).

- Data keys
- Rotary Knob
- INCREMENT [∧] [∨] keys

(1) Phase-deviation range

Phase-deviation range is 0 to 640 rad. (0 to 999 in degrees units)

The maximum phase deviation within specifications depends on the carrier frequency range and modulation frequency as shown in the table below.

Carrier frequency	Maximum phase deviation [rad] *
f<40 MHz	80
40 MHz≦f<80 MHz	20
80 MHz≦f<160 MHz	40
160 MHz≦f<320 MHz	80
320 MHz≦f<640 MHz	160
640 MHz≦f<1280 MHz	320
1280 MHz ≦f	640

*: At 5 kHz modulation frequency

Note: AF frequency can be set up to 100 kHz.
However, the maximum AF frequency is 5 kHz to satisfy ∅M specifications.

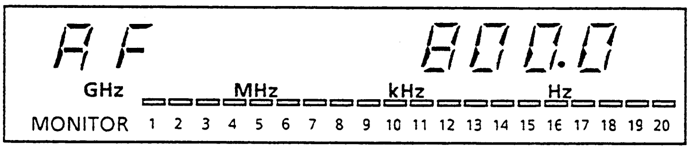
(2) Minimum phase deviation resolution

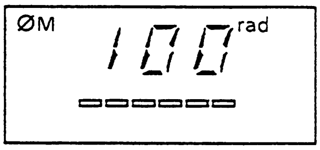
The minimum phase deviation resolution depends on the phase deviation range, as follows.

Phase deviation range	Minimum resolution
0 to 9.99 rad	0.01 rad
10.0 to 99.9 rad	0.1 rad
100 to 640 rad	1 rad
0 to 99.9 deg	0.1 deg
100 to 999 deg	1 deg

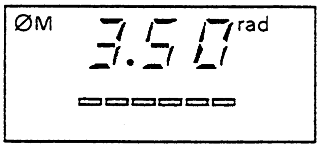
4.8.1 Example: setting phase deviation using the data keys

Example: Set internal modulation AF frequency to 800 Hz and the phase deviation to 100 rads. Then, set the internal modulation frequency to 400 Hz and the phase deviation to 3.5 rads.

Step		Procedure
	Setting the AF frequency to 800 Hz	
1	[AF]	Select AF frequency setting mode. (The [AF] LED comes on.)
2	[8] [0] [0] [Hz/µV]	Set AF frequency to 800 Hz. 
	Setting phase deviation to 100 rads	
3	[SHIFT]	Press [SHIFT]. (The [SHIFT] LED is lit.)
4	[FM/ØM]	Select phase deviation setting mode. (The [AF] and [SHIFT] LEDs are lit and the right ØM side LED above the [FM/ØM] is lit.)

Step	Procedure
5 [1] [0] [0] [rad]	Select a phase deviation of 100 rads. 
6 FM/ØM [INT] [EXT AC] [EXT DC FREQ CAL]	Press each key to light the [INT] LED only. (The ØM input mode is set only to the INT mode. Only INT mode is also selected at initialization.)
7 [INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the [AF] LED is lit. (The internal modulation frequency is set to AF.) INT MOD FREQ AF 1kHz 400Hz

Setting phase deviation to 3.5 rad

Step	Procedure
8 [3] [•] [5] [rad]	Set phase deviation to 3.5 rads. 

Setting the modulation frequency to 400 Hz.

Step	Procedure
9 [INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until 400 Hz LED is lit. (The internal modulation frequency is set to 400 Hz.) INT MOD FREQ AF 1kHz 400Hz

4.8.2 Example: setting phase deviation using the rotary knob

Example: Set phase deviation to 9.5 rad and internal modulation frequency to 1 kHz, then vary it up to 10.5 rad at minimum resolution.

Step		Procedure
1*	[SHIFT]	Press [SHIFT]. (The [SHIFT] LED is lit.)
2	[FM/ØM]	Select phase deviation setting mode. (The [SHIFT] LED goes out and the right ØM side LED above the [FM/ØM] is lit.)
3	[9] [•] [5] [rad]	Set phase deviation to 9.5 rad.
4	FM/ØM [INT] [EXT AC] [EXT DC FREQ CAL]	Press each key to light the [INT] LED only. (The ØM input mode is set only to the INT mode. Only INT mode is also selected at initialization.)
5	[INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the 1 kHz LED is lit. (The internal modulation frequency is set to 1 kHz. It is also set to 1 kHz at initialization.)
6	**RESOLUTION** [≫]	Press RESOLUTION [>] until the resolution digit MONITOR LED of the MODULATION display is lit for the right end digit (0.01 rad digit).
7	**ROTARY KNOB**	Turn the rotary knob clockwise until the phase deviation is 10.5 rad.

*When the right ØM side LED above the [FM/ØM] is already lit, [SHIFT] and [FM/ØM] need not be pressed.

4.8.3 Example: setting phase deviation using INCREMENT [∧] [∨]

Example: Set the phase deviation to 0.35 rad, then increase by a multiple of 10 until it becomes 35 rad.

Step		Procedure
1*	[SHIFT]	Press [SHIFT]. (The [SHIFT] LED is lit.)
2	[FM/ØM]	Select phase deviation setting mode. (The [SHIFT] LED goes out and the right ØM side LED above the [FM/ØM] is lit.)
3	[0] [•] [3] [5] [rad]	Set phase deviation to 0.35 rad.
4	INCREMENT [∧]	Press INCREMENT [∧] twice. (The phase deviation increases up to 35 kHz in 10-time steps (0.35→3.5→35).)

*When the right ØM side LED above the [FM/ØM] is already lit, [SHIFT] and [FM/ØM] need not be pressed.

4.9 Memory

There are two types of memories. A FREQ memory is used to store carrier frequencies. A FUNCTION memory stores all front panel settings.

A 10 MHz and initial parameter setting is stored in the FREQ and FUNCTION memories, respectively before other information is stored.

4.9.1 FREQ memory

The FREQ memory can store up to 1000 carrier frequencies. The memory addresses is 0 to 999.

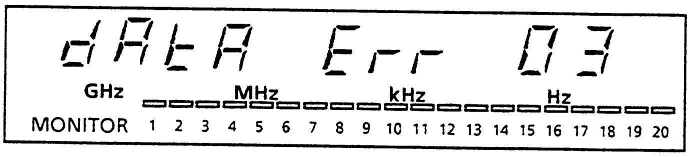
(1) Storing

Press MEMORY [FREQ] to enter the FREQ memory mode, then store the currently-set frequency at the specified address by pressing the numeric key (for memory address) and [STORE].

(2) Recalling

Press MEMORY [FREQ] to enter the FREQ memory mode, then recall the frequency stored in the specified address by pressing the numeric key (for memory address) and [RECALL].

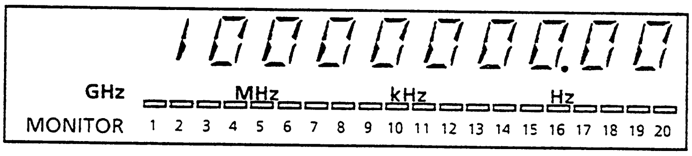
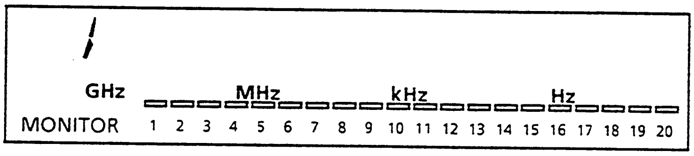
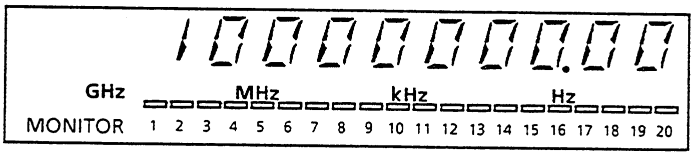
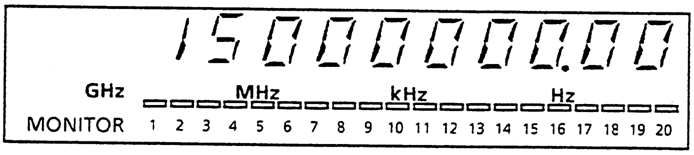
Notes: *1.* When a numeric other than a 1 to 3 digit integer is input as a memory address, the [STATUS] LED blinks to notify an inappropriate address setting when [STORE] or [RECALL] is pressed. At this time, when [STATUS] is pressed, the following error message is displayed.



(data error 03)

2. When [STORE] is pressed without inputting a memory address, the current frequency is stored in the FREQ memory addressed 0.
When [RECALL] is pressed without inputting memory address, the contents of FREQ memory addressed 0 is recalled.
This is useful for temporarily storing the current frequency.

Example: Store 10 MHz in FREQ-memory address 1, 15 MHz in address 2, and 20 MHz in address 3, then recall 15 MHz from address 2.

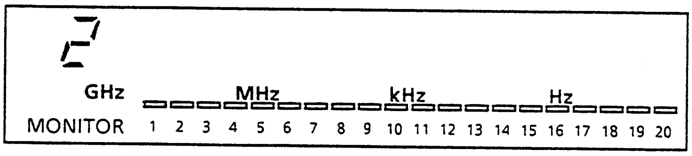
Step		Procedure
1	[FREQ]	Press the MEMORY [FREQ]. (The FREQ memory mode is selected. The MEMORY [FREQ] LED is lit. The FREQ memory mode is also selected at initialization.)
2*	[FREQ]	Select frequency setting mode. (The [FREQ] LED is lit.)
3	[1] [0] [MHz/dBμ]	Set 10 MHz. 
4	[1]	Input FREQ-memory address "1". 
5	[STORE]	Press [STORE]. (10 MHz is stored in address 1.) 
6	[1] [5] [MHz/dBμ]	

*When the [FREQ] LED is already lit, the [FREQ] need not be pressed.

Step **Procedure**

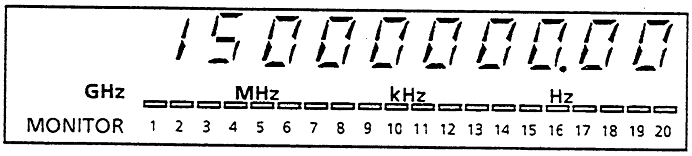
7 [2]

Input FREQ-memory address “2”.



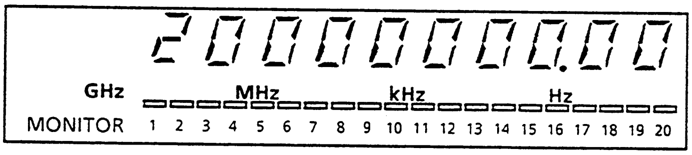
8 [STORE]

Press [STORE].
(15 MHz is stored in address 2.)



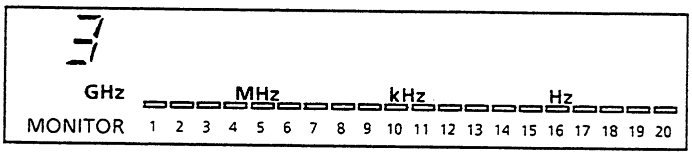
9 [2] [0] [MHz/dBμ]

Set 20 MHz.



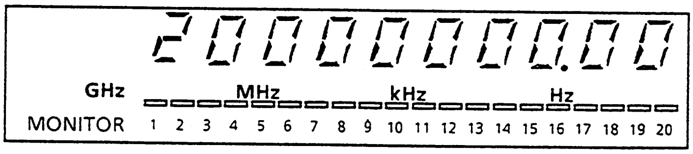
10 [3]

Input FREQ memory address “3”.



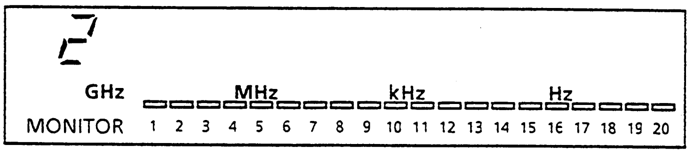
11 [STORE]

Press [STORE].
(20 MHz is stored in address 3.)

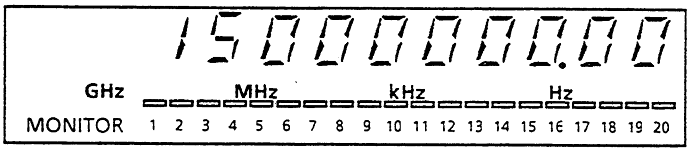


(With the above operations, the memory store is completed. The current frequency is 20 MHz set last.)

Step		Procedure
12	[2]	Input FREQ memory address “2”.



Step		Procedure
13	[RECALL]	Press [RECALL]. (15 MHz stored at address 2 is recalled and displayed.)



(3) Store using auto-address mode

By setting start and stop addresses, the frequencies can be stored in a series of memory address without the need of specifying each address. After pressing the [FREQ] in the FUNCTION section, perform the following operations to set the start and stop addresses.

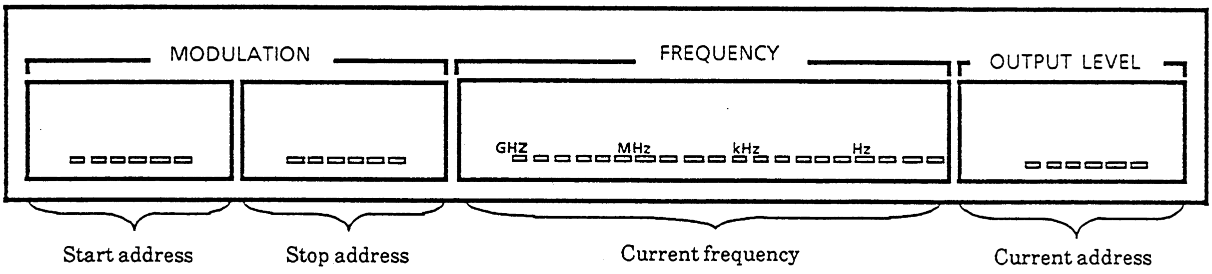
- Key operations for setting start address

Step	Procedure
1	Press [START] in the SWEEP PATTERN section.
2	Press numeric keys (start address).
3	Press [FREQ] in the MEMORY section.

- Key operations for setting stop address

Step	Procedure
1	Press [STOP] in the SWEEP PATTERN section.
2	Press numeric keys (stop address).
3	Press [FREQ] in the MEMORY section.

When stop address setting is completed, auto-address mode is obtained automatically. By pressing [STORE] in the MEMORY section, the frequencies are stored sequentially from the start address. At this time the display is as follows:

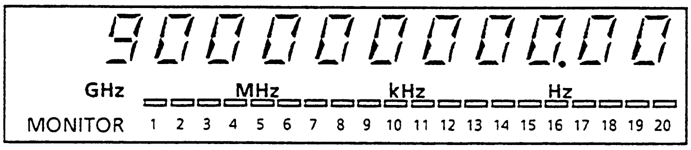
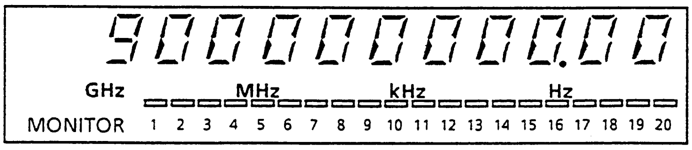


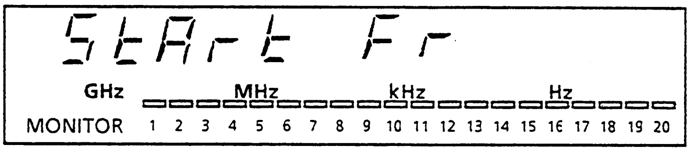
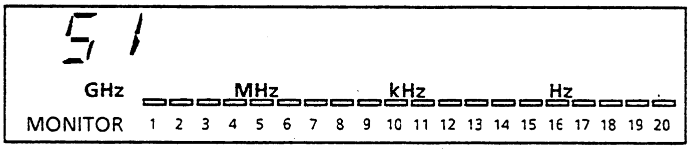
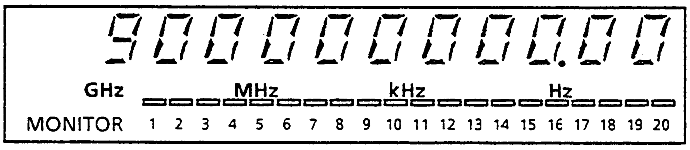
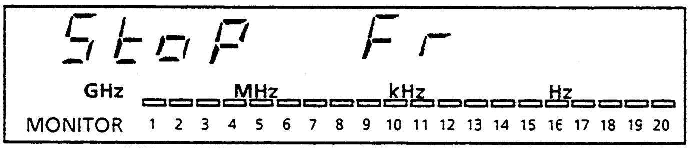
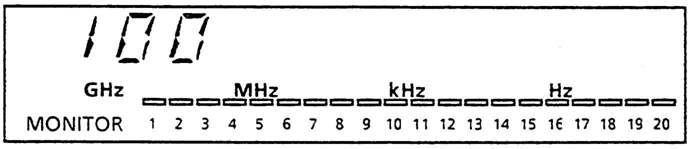
When the memory address to be stored reaches the stop address, a buzzer sounds and the MG3633A returns to the normal display. If a memory-address specification store is performed or if a key inputting is not performed for approx. 30 seconds or more during the auto-address store, the auto-address store mode is released and the MG3633A returns to the usual operation status.

When the MG3633A is set to the auto-address store mode, it is changed to FREQ-memory mode even if it is set at the FUNCTION-memory mode before the setting.

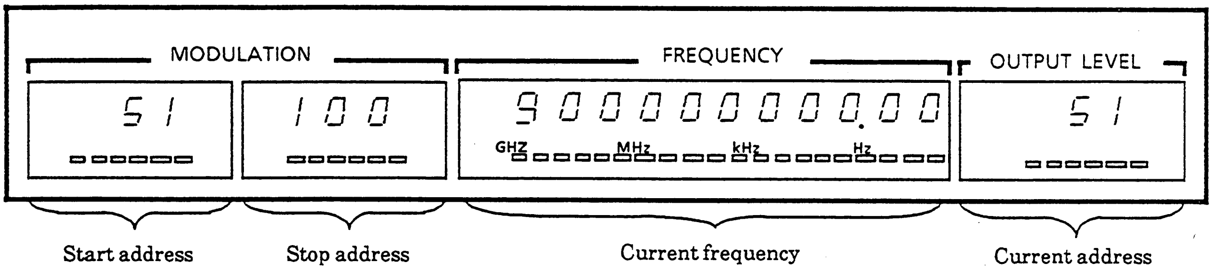
When a series of frequency-memory contents stored in the auto-address mode are required to be recalled continuously, the FREQ-memory sweep is useful (paragraph 4.10.3).

Example: Store 50 frequencies from 900 MHz in 12.5 kHz steps in FREQ-memory addresses 51 to 100.

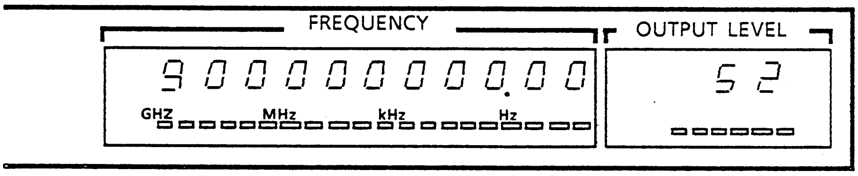
Step		Procedure
1	[FREQ]	Select frequency setting mode. (The [FREQ] LED is lit.)
2	[9] [0] [0] [MHz/dBμ]	Set 900 MHz. 
3	[INCR SET] [1] [2] [•] [5] [kHz/mV]	Set increment value to 12.5 kHz. (When setting is completed, the current frequency is displayed.) 

Step		Procedure
4	[START]	Select start address setting mode. (The [START] LED is lit.) 
5	[5] [1]	Key-input start address 51. 
6	[FREQ](In the MEMORY section)	Press MEMORY [FREQ]. (The start address 51 is input. The [START] LED goes out and the current frequency is displayed.) 
7	[STOP]	Select stop address setting mode. 
8	[1] [0] [0]	Key-input stop address 100. 

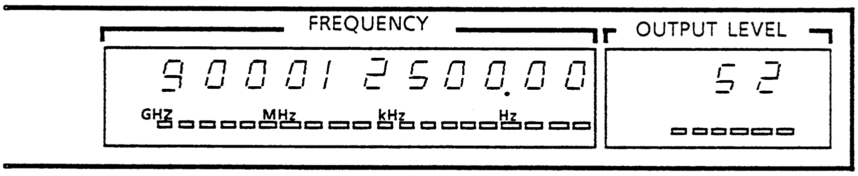
Step		Procedure
9	[FREQ] (In the MEMORY section)	Press MEMORY [FREQ]. (The stop address 100 is input.) The display is as follows:



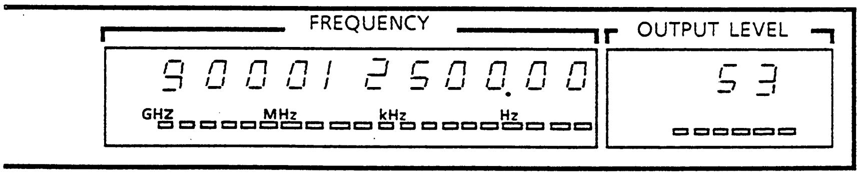
10	[STORE]	Press [STORE]. (900 MHz is stored in FREQ-memory address 51.)



11	**INCREMENT** [⩓]	Increase frequency by 12.5 kHz.

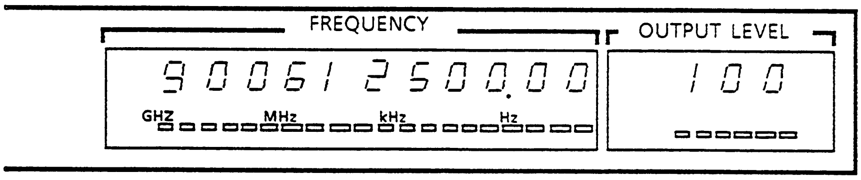


12	[STORE]	Press [STORE]. (900.0125 MHz is stored in FREQ-memory address 52.)



13 Continue the procedure of pressing INCREMENT [⩓] and [STORE] to store frequencies in addresses 53 to 99.

Step	Procedure
14 INCREMENT [︽]	Increase frequency by 12.5 kHz.



15 [STORE]	Press [STORE]. (900.6125 MHz is stored in FREQ-memory address 100. A buzzer also sounds and the auto-address mode is released. The normal display is obtained.)

4.9.2 FUNCTION memory

The FUNCTION memory can store up to 100 panel conditions. The memory addresses are 0 to 99.

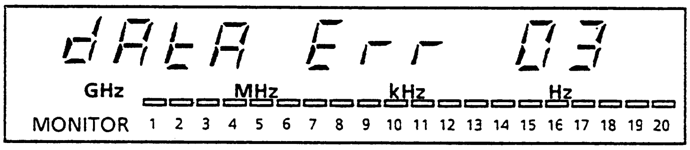
(1) Storing

Press MEMORY [FUNCTION] to enter the FUNCTION memory mode, then store the current panel conditions at the specified address by pressing numeric key (for memory address) and [STORE].

(2) Recalling

Press the MEMORY [FUNCTION] to enter the FUNCTION memory mode, then recall the panel conditions stored in the specified address by pressing numeric key (for memory address) and [RECALL].

Notes: *1.* When a numeric other than a 1 to 2 digit integer is input as a memory address, the [STATUS] LED blinks to notify an inappropriate address setting when [STORE] or [RECALL] is pressed. At this time, when [STATUS] is pressed, the following error message is displayed. When [STATUS] is released, both message and light are turned off.



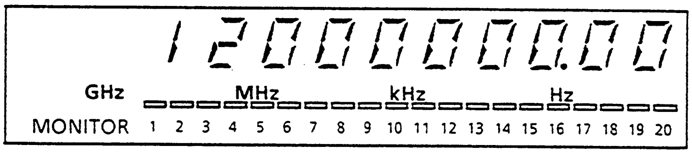
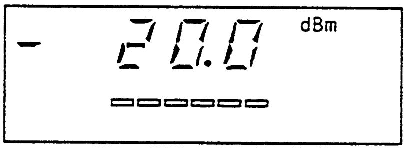
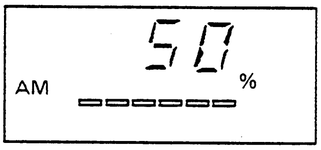
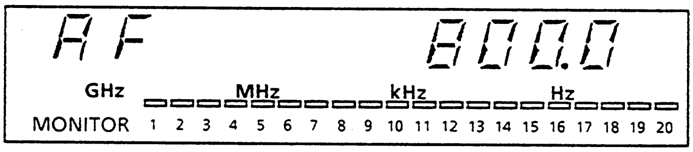
(data error 03)

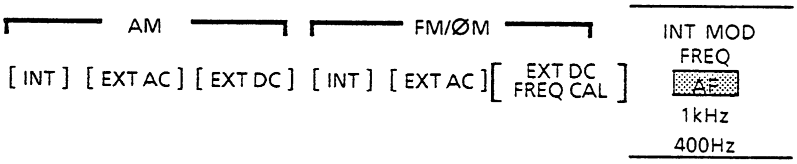
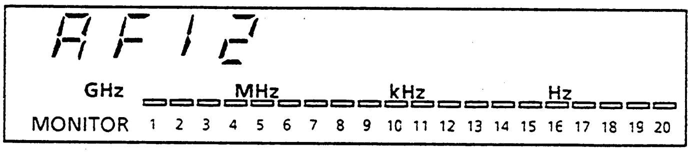
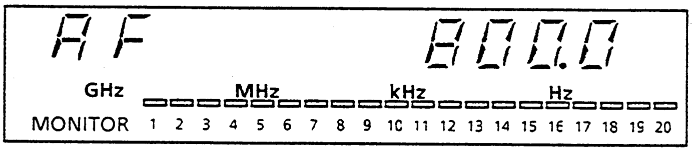
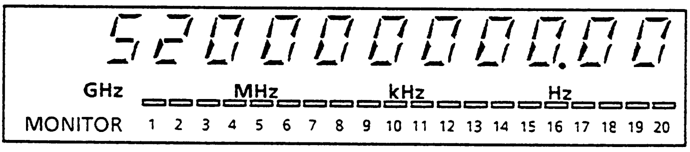
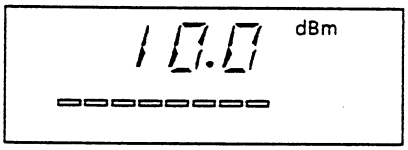
2. When [STORE] is pressed without inputting a memory address, the current panel conditions are stored in the FUNCTION memory addressed 0.
When [RECALL] is pressed without inputting a memory address, the contents of the FUNCTION memory addressed 0 are recalled.

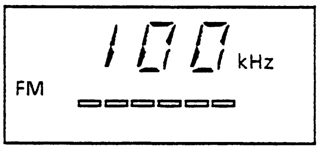
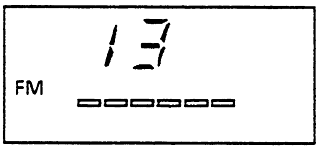
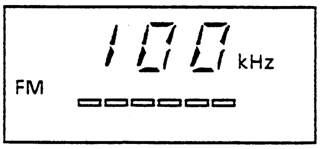
This is useful for temporarily storing the current panel conditions.

Example: Store the three panel conditions mentioned below in FUNCTION memory addresses 12, 13, and 14, then recall the contents at address 12.

	Frequency	Output level	Modulation	Modulation input
Address 12	12 MHz	−20 dBm	AM 50%	INT AF 800 Hz
Address 13	520 MHz	10 dBm	FM 100 kHz	INT 1 kHz
Address 14	1.5 GHz	−30 dBm	FM 100 kHz	INT 1 kHz+EXT AC

Step		Procedure
1	[SPECIAL] [0] [0]	Initial setting (See paragraph 4.11.2 for details)
	Setting panel conditions for address 12	
2	[FREQ] [1] [2] [MHz/dBμ]	Set 12 MHz. 
3	[LEVEL] [−] [2] [0] [GHz/dBm]	Set −20 dBm. 
4	[AM] [5] [0] [%]	Set AM 50%. 
5	[AF] [8] [0] [0] [Hz/μV]	Set AF 800 Hz. 

Step	Procedure
6 [INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the [AF] LED is lit. 
7 [FUNCTION]	Select FUNCTION memory mode. (The [FUNCTION] LED is lit.)
8 [1] [2]	Input FUNCTION memory address 12. 
9 [STORE]	Press [STORE]. (The current panel conditions are stored in address 12.) 
Setting panel conditions for address 13	
10 [FREQ] [5] [2] [0] [MHz/dBµ]	Set 520 MHz. 
11 [LEVEL] [1] [0] [GHz/dBm]	Set 10 dBm. 

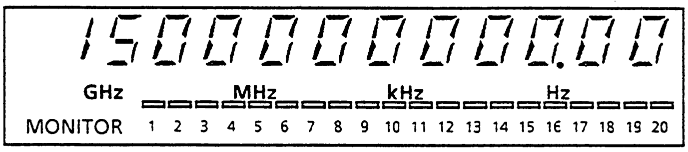
Step	Procedure
12 [FM/ØM] [1] [0] [0] [kHz/mV]	Set FM 100 kHz. 
13 AM [ON/OFF]	Turn off AM and set FM INT. AM: [INT] [EXT AC] [EXT DC] FM/ØM: [INT] [EXT AC] [EXT DC FREQ CAL] INT MOD FREQ AF 1kHz 400Hz
14 [INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the 1 kHz LED is lit. INT MOD FREQ AF 1kHz 400Hz
15 [1] [3]	Input FUNCTION memory address 13. 
16 [STORE]	Press [STORE]. (The current panel conditions are stored in address 13.) 

Step **Procedure**

Setting panel conditions for address 14

17 Set 1.5 GHz.

[FREQ] [1] [•] [5] [GHz/dBm]



18 Set – 30 dBm.

[LEVEL] [–] [3] [0] [GHz/dBm]

Set FM 100 kHz and INT 1 kHz + EXT AC.

FM/ØM

[EXT AC]

AM

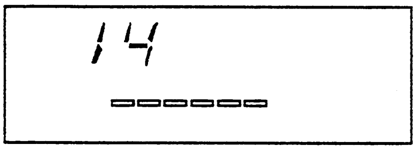
[INT] [EXT AC] [EXT DC]

FM/ØM

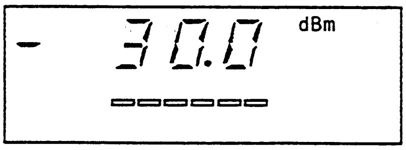
[INT] [EXT AC] [EXT DC / FREQ CAL]

INT MOD
FREQ
AF
▨ 1kHz
400Hz

19 [1] [4] Input FUNCTION-memory address “14”.



20 [STORE] Press [STORE].
(The current panel conditions are stored in address 14.)

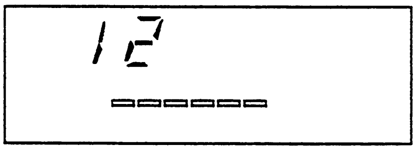


With the operation above, the memory store is completed.

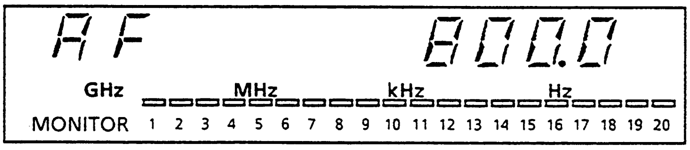
Step **Procedure**

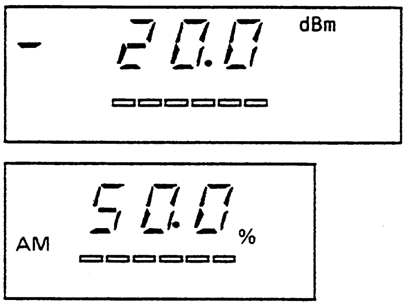
Recalling contents at address 12

21 [1] [2] Input FUNCTION memory address "12".

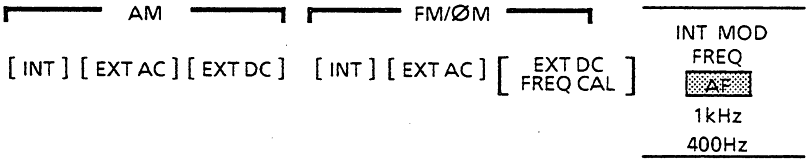


22 [RECALL] Press [RECALL].
(Contents of FUNCTION memory address 12 is recalled and the following setting is made.)





(Since the FREQUENCY display shows the AF frequency at storage, (Steps 5 and 9), the AF frequency is displayed after recalling.)



4.9.3 Protecting memory contents

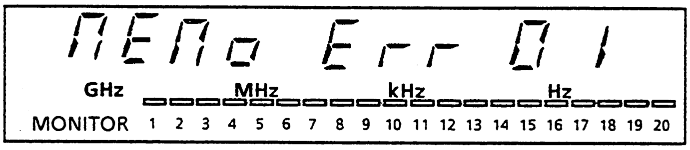
When the following operation is performed, the contents of the FREQ and FUNCTION memories cannot be deleted or rewritten.

- FREQ memory protection: [SPECIAL] [**1**] [**4**]
- FUNCTION memory protection: [SPECIAL] [**1**] [**6**]

Perform the following operation to release this protection.

- FREQ memory protection release: [SPECIAL] [**1**] [**3**]
- FUNCTION memory protection release: [SPECIAL] [**1**] [**5**]

When an attempt is made to store or delete during memory protection, the [STATUS] LED blinks to indicate that the memory is being protected. When [STATUS] is pressed at this time, the following error message is displayed.



(memo err 01)

Memory protection is not discarded even if initialization ([SPECIAL] [0] [0]) is performed.

The memory protection is released at factory shipment.

4.9.4 Deleting memory contents

The entire contents of the FREQ and FUNCTION memories can be deleted with the following operation.

- Delete FREQ memory contents: [SPECIAL] [**8**] [**1**]

  (The contents of all memories becomes 10 MHz.)

- Delete FUNCTION memory contents: [SPECIAL] [**8**] [**2**]

  (The contents of all memories becomes the status at initialization [paragraph 4.11.2].)

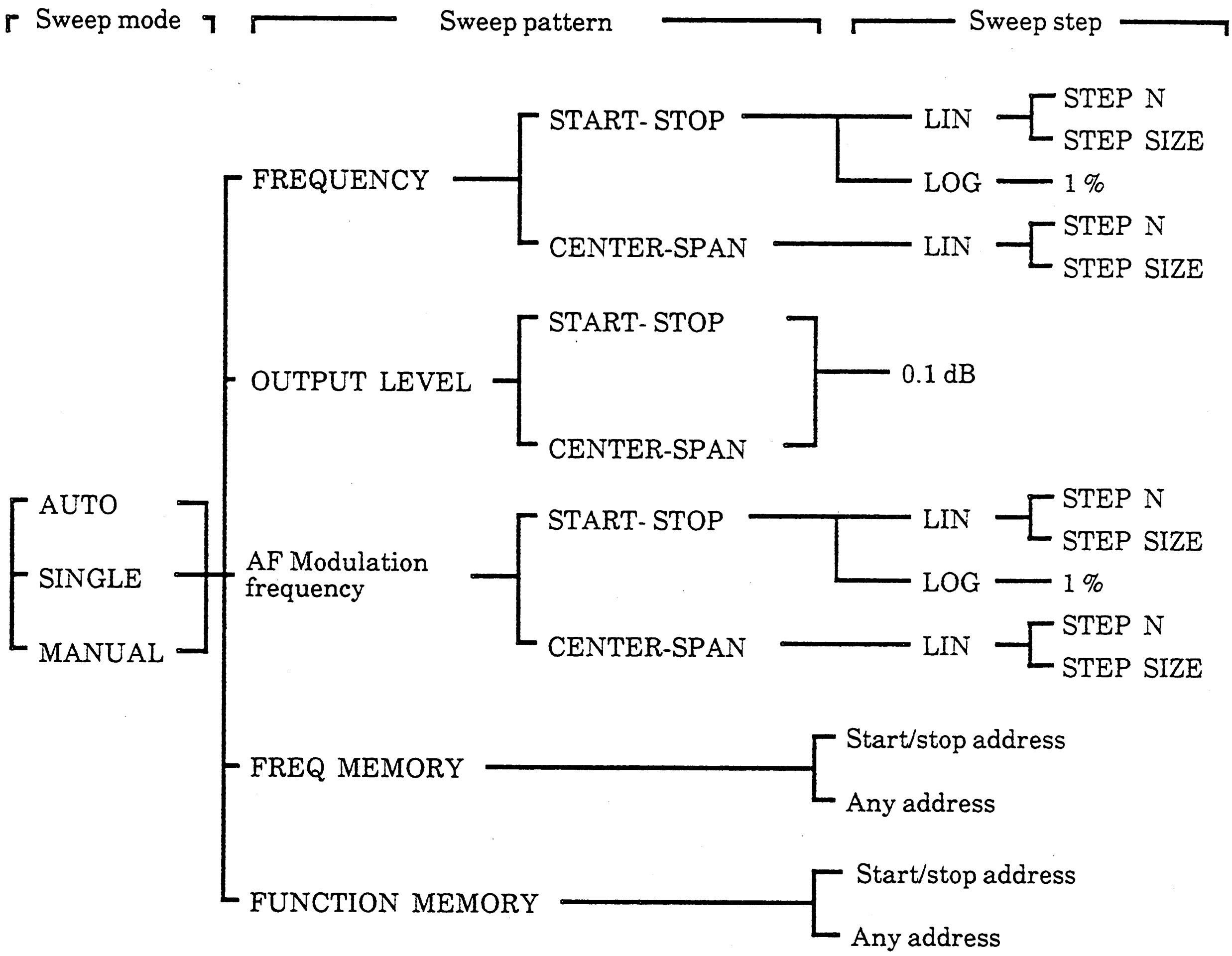
While the memory contents are being protected, the memory contents cannot be deleted. Release protection before deleting it.

Even if the initialization is performed regardless of the presence of memory protection, FREQ and FUNCTION memory contents are protected and do not change.

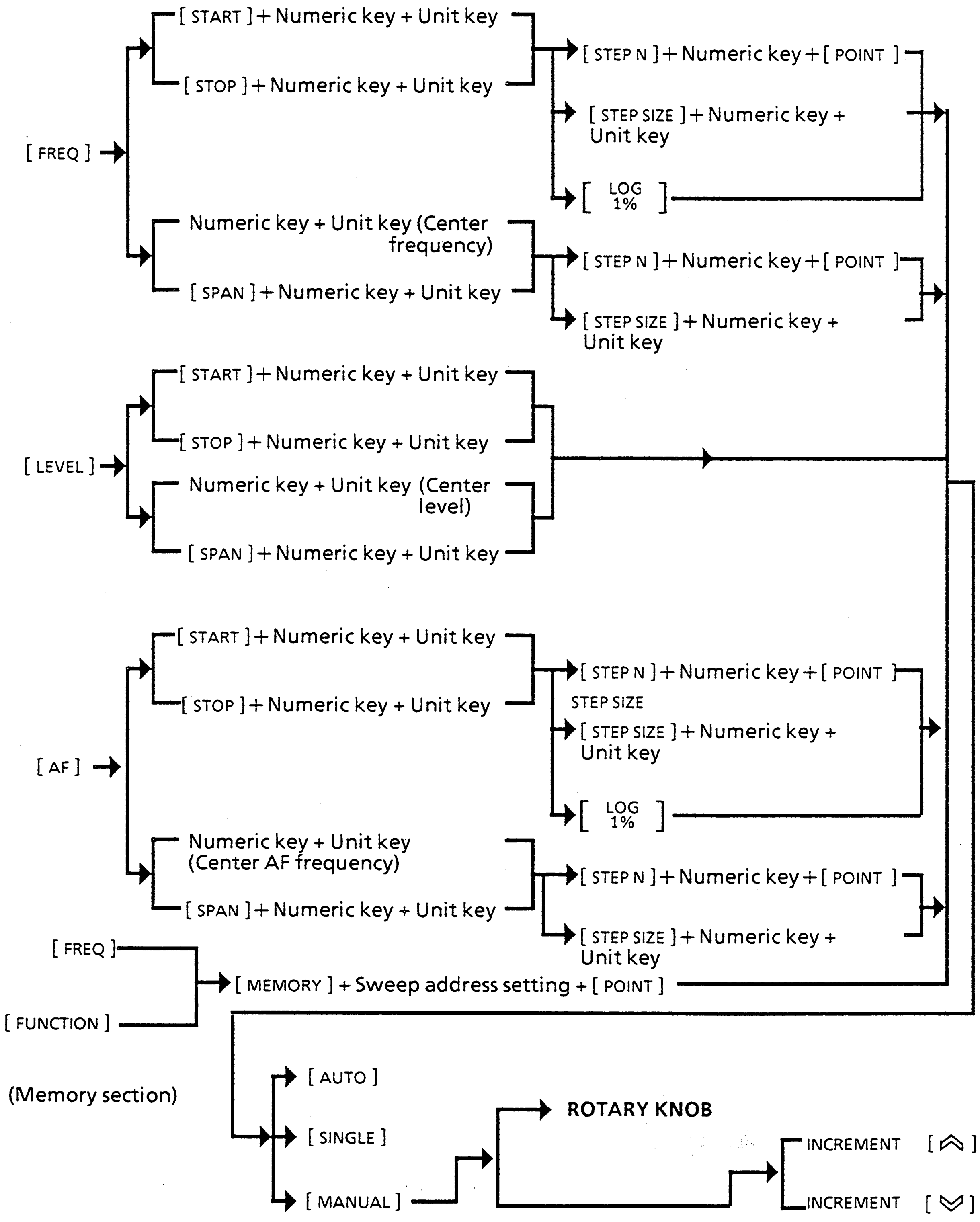
4.10 Setting Sweep Function

4.10.1 Outline

The MG3633A is provided with three different sweep modes: AUTO, SINGLE, and MANUAL. The START-STOP (linear and log) and CENTER-SPAN (linear only) sweep patterns are prepared for the carrier frequency, output level, and AF frequency. Also, there are FREQ-memory sweep and FUNCTION-memory sweep to be swept in any address order.



The following flow pattern outlines the MG3633A key operations for sweeping.



■ Outlining sweep start and stop

- Prior to starting sweep operations, when any header key for FUNCTION [FREQ], [LEVEL], or [AF] is set (frequency, level, or AF sweep) or the [MEMORY] LED in the SWEEP PATTERN section is lit (memory sweep), the sweep is ready for operation.
- If not, sweep fails to start and the [STATUS] LED blinks to indicate that the sweep is not possible.
- When an other header key is pressed during sweep, the sweep stops and settings corresponding to the pressed header key are obtained. When the header key performing the sweep is pressed again, the sweep is resumed.
- When [OFF] in the SWEEP section is pressed, the sweep stops and all the SWEEP section LEDs go out.

■ Outlining operation of SWEEP PATTERN section keys

In the SWEEP PATTERN section keys, the [START], [SPAN], and [MEMORY] LEDs are lit at START-STOP sweep (linear and log), CENTER-SPAN sweep (linear only), and FREQ/FUNCTION memory sweep, respectively.

When the [FREQ], [LEVEL], and [AF] headers are not set, the above-mentioned LEDs are not lit and the [STATUS] LED blinks to indicate the setting is not possible when [START] or [SPAN] is pressed.

■ Operating the SWEEP STEP section keys

In the SWEEP STEP section keys, [STEP N], [STEP SIZE], and [LOG 1%] LEDs are lit at step number specified linear sweep, step size specified linear sweep, and log 1% sweep, respectively.

When any header of [FREQ] and [AF] is not set or when the SWEEP PATTERN [MEMORY] LED is lit, the above-mentioned LEDs are not lit and the [STATUS] LED blinks to indicate the setting is not possible if the [STEP N], [STEP SIZE], and [LOG 1%] are pressed.

■ Confirming parameters

When each key in the SWEEP PATTERN and SWEEP STEP sections continues to be pressed for approx. 0.5 second or more, the current set value is displayed. When the key is released after display, it is returned to the previous sweep pattern and sweep step. The same operation is possible during sweeping without interrupting sweeping.

4.10.2 Sweep mode

Three types of sweep modes can be selected: AUTO, SINGLE, and MANUAL.

(1) AUTO mode

When [AUTO] is pressed, the [AUTO] LED blinks and the sweep is repeated as specified (sweep start to the sweep end value) until [OFF] is pressed. When [AUTO] is pressed during sweep, the sweep is suspended. When pressed again, the sweep is resumed from that point.

(2) SINGLE mode

When [SINGLE] is pressed, the [SINGLE] LED blinks and the single sweep is performed as specified with each parameter from the sweep start value to the sweep end value.

When [SINGLE] is pressed during sweeping, the sweep is suspended. When pressed again, the sweep is resumed from that point.

(3) MANUAL mode

When [MANUAL] is pressed, the [MANUAL] LED is lit and the manual sweep using the rotary knob and INCREMENT [∨] [∧] can be performed as specified with each parameter from the sweep start value to the sweep end value.

(4) Stopping sweep

When a set SWEEP [AUTO] or [SINGLE] is pressed during auto or single sweep, the sweep is suspended to enter the manual mode.

The rotary knob or INCREMENT [∨] [∧] permits manual sweep to be performed during suspension.

When [AUTO] or [SINGLE] is pressed during suspension, the sweep is resumed in that AUTO or SINGLE sweep mode from the current point.

When SWEEP [OFF] is pressed, the sweep is completed and all the SWEEP section key LEDs go out.

When any one of the SWEEP section keys is pressed after the sweep is completed, the sweep is started again from the sweep start point.

4.10.3 Carrier frequency/output level/AF frequency sweep

Note: When the output level sweep is set, the output level automatically enters the CONTINUOUS mode (paragraph 4.3.3). Therefore, the sweep range is within 20 dB and the STEP SIZE is 0.1 dB fixed (the lowest digit of the display for units of μV, mV, and V).

(1) START-STOP sweep

Press [START] to set START-STOP sweep mode.

This is a sweep method in which the START and STOP values are set to sweep between them. After pressing a header FUNCTION [FREQ] /[LEVEL]/[AF], set the START and STOP values as follows.

Item	Setting range
Carrier frequency	0 Hz≦START<STOP≦2.7 GHz ↑ (10 kHz for log sweep)
Output level	−143 dBm≦START<STOP≦ +23 dBm
AF frequency	0.1 Hz≦START<STOP≦100 kHz

- Setting START value: [START], numeric keys, unit key
- Setting STOP value: [STOP], numeric keys, unit key

When [START] is pressed, the [START] LED is lit to indicate that the START-STOP sweep pattern is obtained.
While [START] or [STOP] is held down for approx. 0.5 second or more, the set START or STOP value is displayed. When released, it is returned to its previous status.

The sweep step interval can be selected from the following three types.

- Specifying linear-sweep STEP number N

A linear sweep is performed in the carrier and AF frequencies STEP numbered N from the START value to the STOP value. To set STEP number N, press [STEP N], numeric keys (1 or more, integer for N), and POINT[Hz/μV] in this order.

In LOG sweep, STEP number N is automatically determined and [STEP N] has no relation.

- Specifying linear sweep STEP SIZE

  A linear sweep is performed in the carrier and AF frequencies step interval specified as STEP SIZE, from the START value to the value just before exceeding the STOP value.

  To set STEP SIZE, press [STEP SIZE], numeric keys (for STEP SIZE value), and unit key in this order.
  (0.01 Hz≦STEP SIZE≦2.7 GHz)

Item	Range
Carrier frequency	0.01 Hz≦STEP SIZE≦2.7 GHz
AF frequency	0.1 Hz≦STEP SIZE≦99.999 9 kHz

- LOG sweep (1% fixed)

  A LOG sweep is performed on the carrier and AF frequencies in steps increasing by a factor of 1.01 so as not to exceed the STOP value. To set LOG sweep, press [LOG 1%].

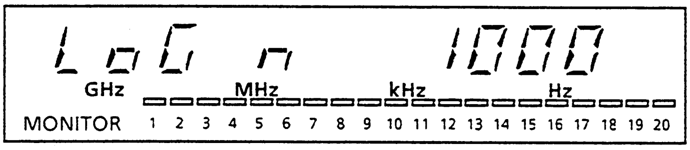
  While the [LOG 1%] is pressed, the number of sweep steps in the LOG sweep is displayed on the FREQUENCY display.

  [STEP N] and [STEP SIZE] have no relation to the LOG sweep.

  Level cannot be sweeped in LOG mode.

  To terminate LOG sweep, press [STEP N] or [STEP SIZE] to set linear sweep.

  In CENTER-SPAN mode, LOG sweep cannot be performed.



Note: When either STEP N or STEP SIZE is set in linear sweep, the other set value is changed to the value which satisfies the following equation.

STEP N × STEP SIZE = Sweep width (|START − STOP| or SPAN)

(2) CENTER-SPAN sweep

Press [SPAN] to set CENTER-SPAN sweep mode.

This is a sweep method in which the width specified as SPAN is swept with the center value set using the data keys.

In LOG sweep, this mode cannot be selected. To exit LOG sweep and enter this mode, press [STEP N] or [STEP SIZE] to set linear mode and then press [SPAN].

After pressing a header FUNCTION [FREQ]/[LEVEL]/[AF], set the SPAN as follows.

Item	Setting range
Carrier frequency	0.02 Hz≦SPAN≦2.7 GHz
Output level	0.2 dB≦SPAN≦20 dB
AF frequency	0.2 Hz≦SPAN≦99.999 9 kHz

- Setting SPAN: [SPAN], numeric keys, and unit key

  When [SPAN] is pressed, the [SPAN] LED is lit to indicate that the CENTER-SPAN sweep pattern is obtained.
  While [SPAN] is being pressed for approx. 0.5 second or more, the SPAN is displayed. When released, it is returned to previous status.

The step interval can be specified from the following two types.

- Specifying linear sweep STEP number N

  A linear sweep is performed in the carrier and AF frequencies STEP numbered N from the CENTER-SPAN/2 to CENTER+SPAN/2 with a center value set by the data keys.

  To set STEP number N, press [STEP N], numeric keys (1 or more, integer for N), and POINT[Hz/μV] in this order.

- Specifying linear sweep STEP SIZE

  A linear sweep is performed in the carrier and AF frequencies step interval specified as STEP SIZE, from the CENTER-SPAN/2 up to the value not exceeding CENTER+SPAN/2 with the center value set using data keys.

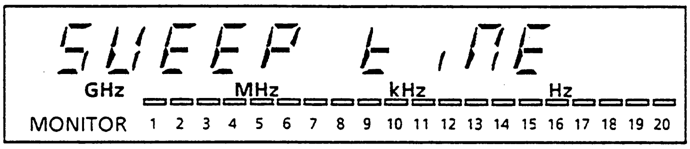
  To set STEP SIZE, press [STEP SIZE], numeric keys, and unit key in this order.

Item	Setting range
Carrier frequency AF frequency	0.01 Hz≦STEP SIZE≦2.7 GHz 0.1 Hz≦STEP SIZE≦99.999 9 kHz

Note: In the CENTER-SPAN sweep, the CENTER value is set with the data keys. When the value moved with the rotary knob or INCREMENT [∧] [∨] is required as the CENTER value, press [SHIFT] and then [SPAN].

(3) Setting sweep time (TIME/STEP)

After pressing a header key and [START] or [SPAN], press [TIME/STEP], numeric keys, and unit key in this order to set sweep time.

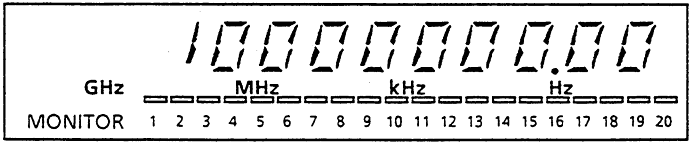


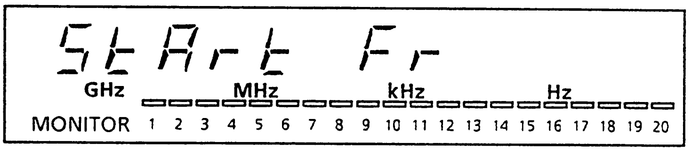
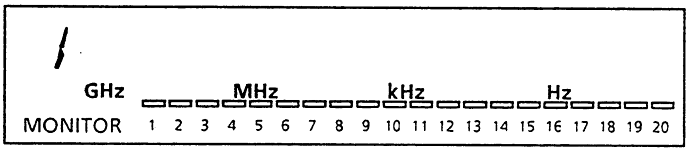
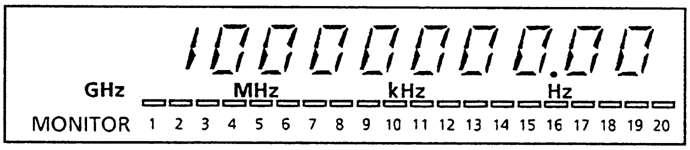
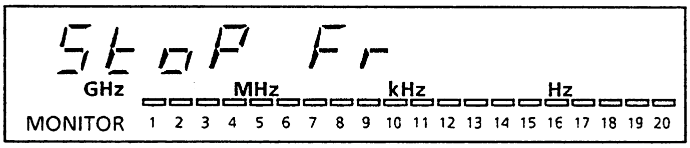
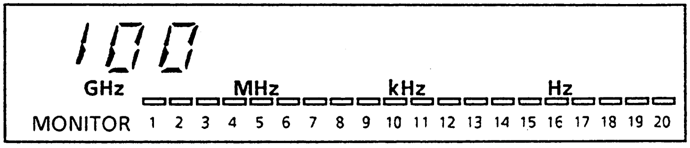
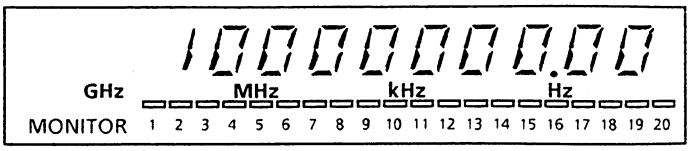
Displayed before pressing numeric keys.

The sweep time set here represents the time per step, not entire SPAN time.
The sweep time is common to all the sweep patterns.
Sweep time range is 100 μs to 600 s with a resolution of 10 μs.

(4) Examples

Example 1: Perform a SINGLE sweep from 1 to 100 MHz in 50 steps over a 100 ms sweep time.

Step		Procedure
1	[FREQ]	Select frequency setting mode. (The FUNCTION [FREQ] LED is lit. The FREQUENCY display remains unchanged.) 

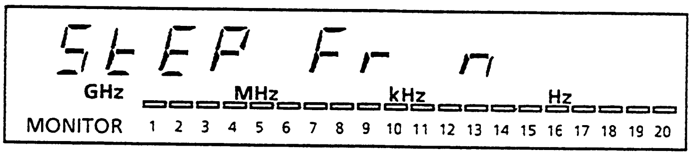
Step		Procedure
	Setting START frequency	
2	[START]	Select START frequency setting mode. (The [START] LED is lit.) 
3	[1]	Press [1]. 
4	[MHz/dBμ]	Press [MHz]. (The START frequency is set to 1 MHz and the FREQUENCY display returns to the previous 10 MHz display.) 
	Setting STOP frequency	
5	[STOP]	Select STOP frequency setting mode. 
6	[1] [0] [0]	Press [1] [0] [0]. 
7	[MHz/dBμ]	Press [MHz]. (The STOP frequency is set to 100 MHz and the FREQUENCY display returns to the previous 10 MHz display.) 

Step **Procedure**

Setting STEP frequency

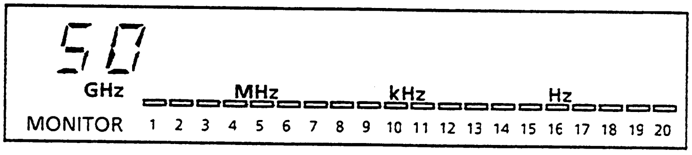
8 [STEP N]

Select STEP frequency setting mode.
(The [STEP N] LED is lit.)



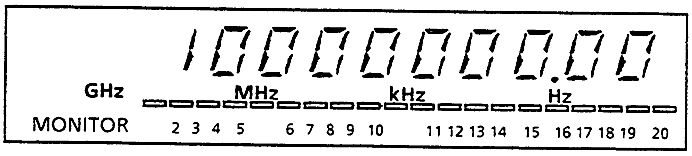
9 [5] [0]

Press [5] [0].



10 [POINT]

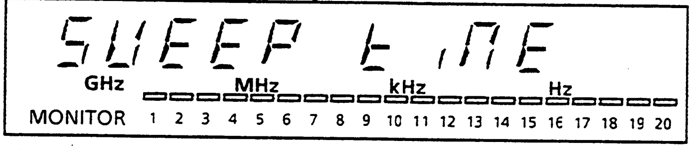
Press [POINT]. (The number of steps is set to 50 and the FREQUENCY display returns to the previous 10 MHz display.)



Setting sweep time

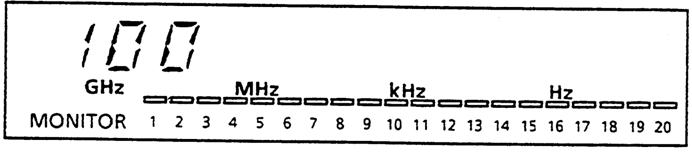
11 [TIME/STEP]

Select sweep time setting mode.



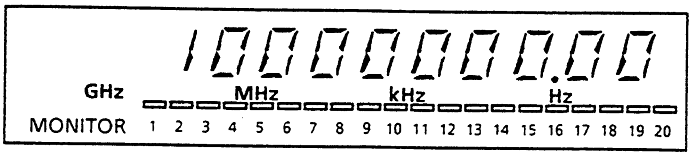
12 [1] [0] [0]

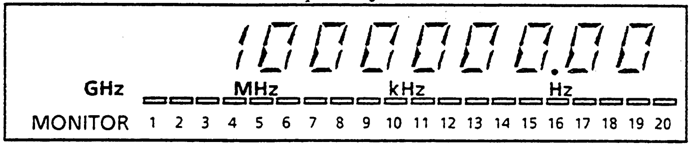
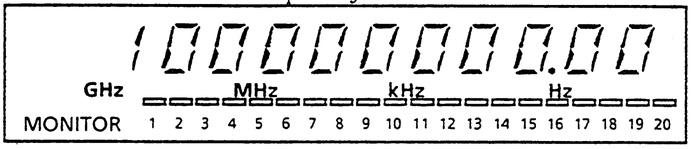
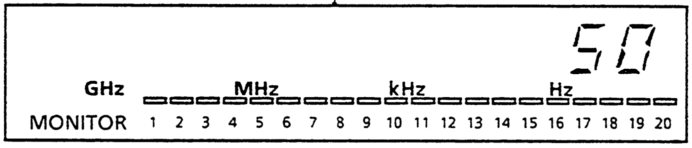
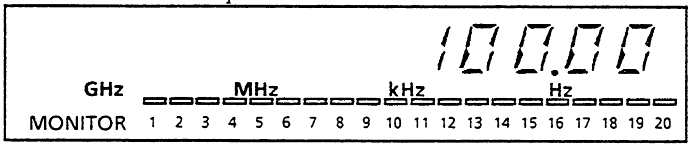
Press [1] [0] [0].



13 [msec]

Press [msec]. (The sweep time is set to 100 ms and the FREQUENCY display returns to the previous 10 MHz display.)

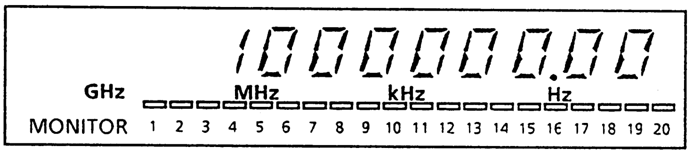


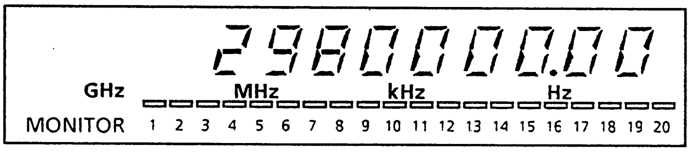
Step	Procedure
<u>Confirming set value</u>	
14 [START] ← Press and hold.	Confirm the START frequency. 
15 [STOP] ← Press and hold.	Confirm the STOP frequency. 
16 [STEP N] ← Press and hold.	Confirm the number of steps. 
17 [TIME/STEP]← Press and hold.	Confirm the sweep time. 

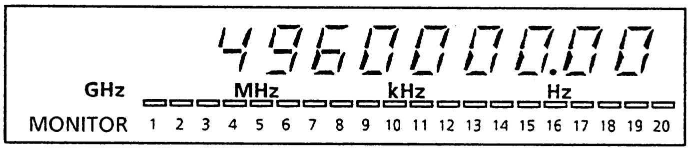
Step **Procedure**

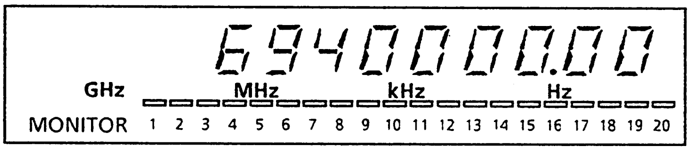
18 [SINGLE]

Press [SINGLE]
(The SINGLE mode sweep starts. The [SINGLE] LED blinks.)









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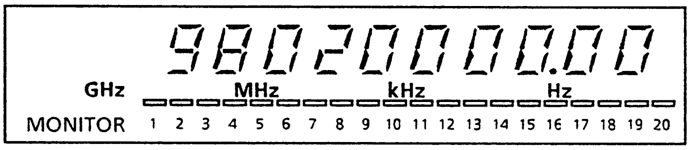
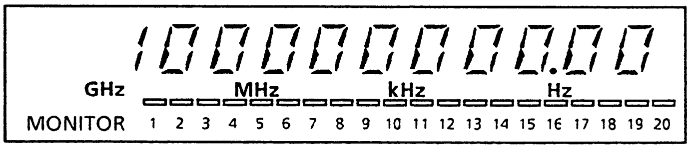




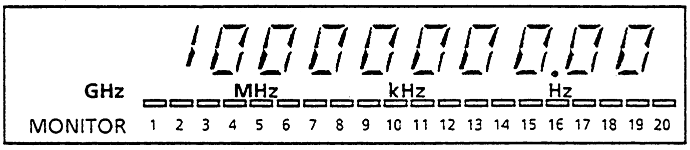
(The sweep stops at 100 MHz and the [SINGLE] LED goes out.)

Example 2: Perform AUTO sweep from 1 to 500 MHz in LOG 1% and sweep time 200 ms.

Step **Procedure**

1 [FREQ]

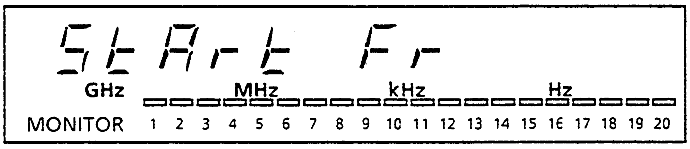
Select frequency setting mode.
(The FUNCTION [FREQ] LED is lit.
The FREQUENCY display remains unchanged.)



Setting START frequency

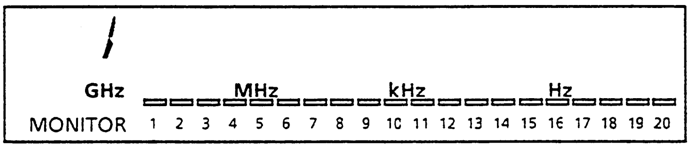
2 [START]

Select START frequency setting mode.
(The [START] LED is lit.)



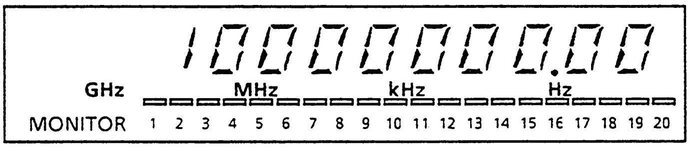
3 [1]

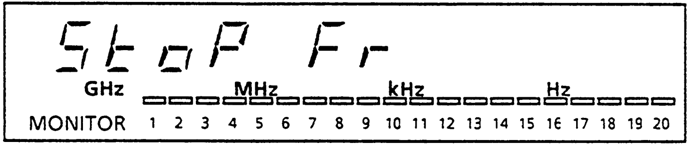
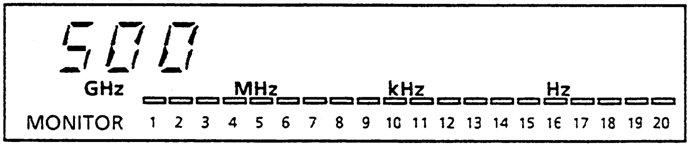
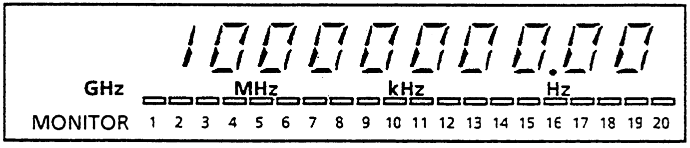
Press [1].

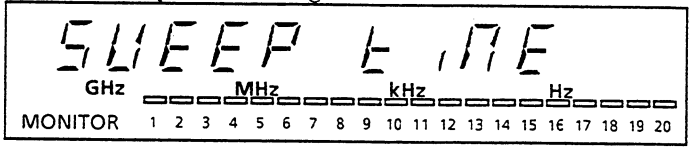
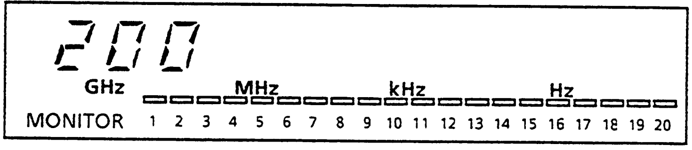
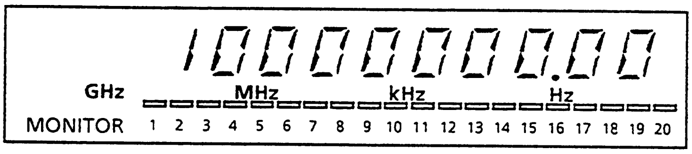


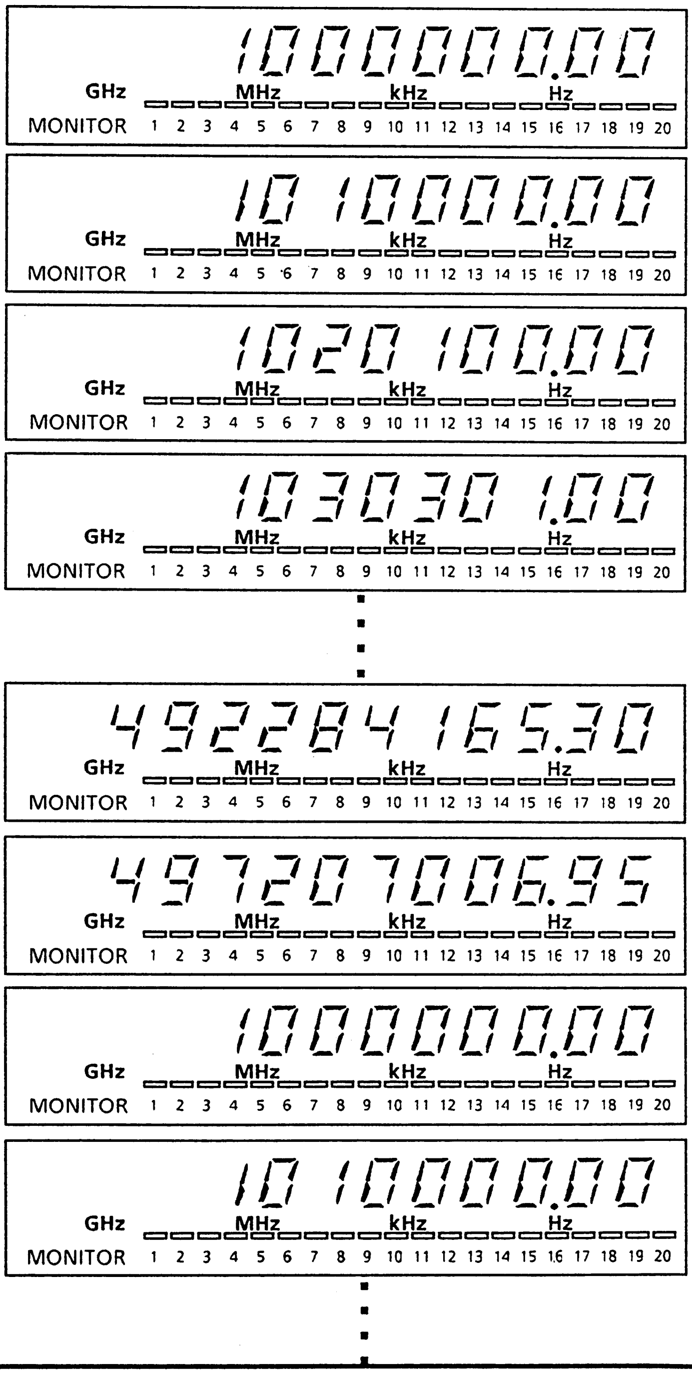
4 [MHz/dBµ]

Press [MHz]. (The START frequency is set to 1 MHz and the FREQUENCY display returns to the previous 10 MHz display.)

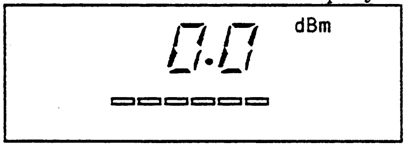
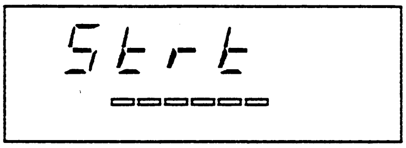
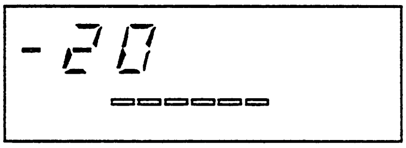
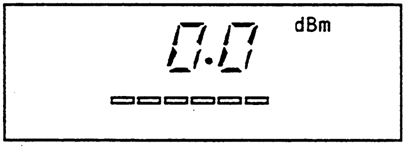


Step		Procedure
	Setting STOP frequency	
5	[STOP]	Select STOP frequency setting mode. 
6	[5] [0] [0]	Press [5] [0] [0]. 
7	[MHz/dBμ]	Press [MHz]. (The STOP frequency is set to 500 MHz and the FREQUENCY display returns to the previous 10 MHz display.) 
	Setting LOG 1%	
8	[LOG 1%]	Press [LOG 1%]. (The sweep pattern is set to LOG 1 %. The [LOG 1%] LED is lit).

Step		Procedure
	Setting sweep time	
9	[TIME/STEP]	Select sweep time setting mode. 
10	[2] [0] [0]	Press [2] [0] [0]. 
11	[msec]	Press [msec]. (The sweep time is set to 200 ms and the FREQUENCY display returns to the previous 10 MHz display.) 

Step	Procedure
12 [AUTO]	Press [AUTO]. (The AUTO mode sweep starts. The [AUTO] LED blinks.) 

Example 3: Perform the single sweep from −20 to −5 dBm in a 50 ms sweep time.

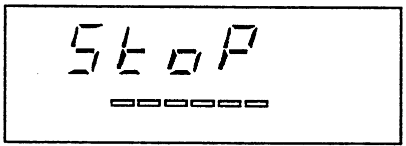
Step		Procedure
1	[LEVEL]	Select level setting mode. (The [LEVEL] LED is lit. The OUTPUT LEVEL display remains unchanged.) 
	Setting START level	
2	[START]	Select START level setting mode. (The [START] LED is lit.) 
3	[−] [2] [0]	Press [−] [2] [0]. 
4	[GHz/dBm]	Press [dBm]. (The START level is set to −20 dBm and the OUTPUT LEVEL display returns to the previous 0 dBm display.) 

Step **Procedure**

Setting STOP level

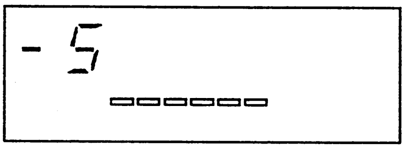
5 [STOP]

Select STOP level setting mode.



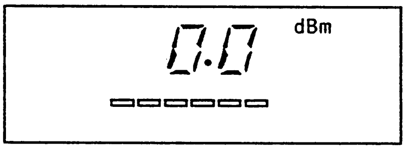
6 [–] [5]

Press [–] [5].



7 [MHz/dBμ]

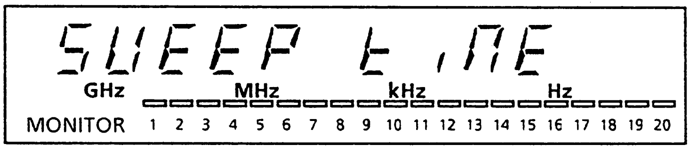
Press [dBm].
(The STOP level is set to –5 dBm and the OUTPUT LEVEL display returns to the previous 0 dBm display.)



Setting sweep time

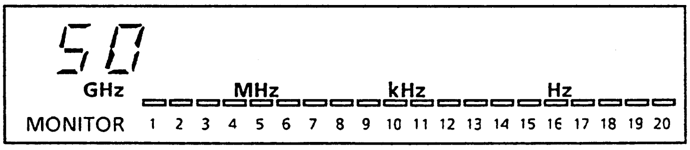
8 [TIME/STEP]

Select sweep time setting mode.



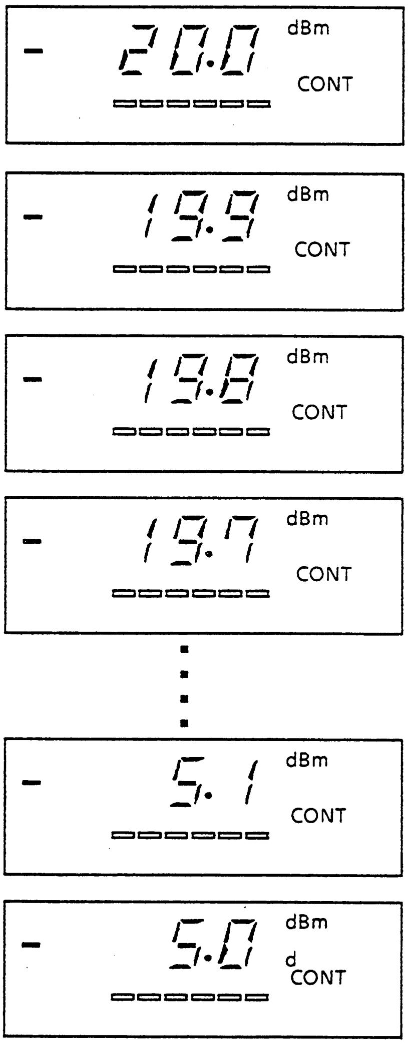
9 [5] [0]

Press [5] [0].

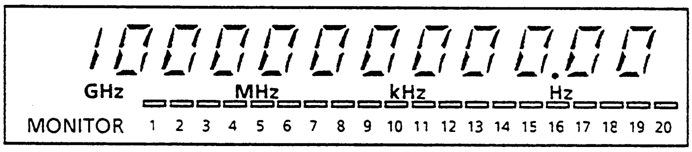
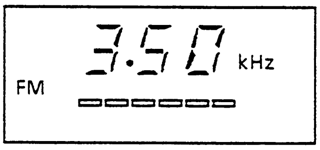
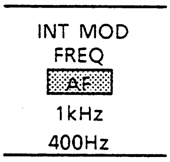
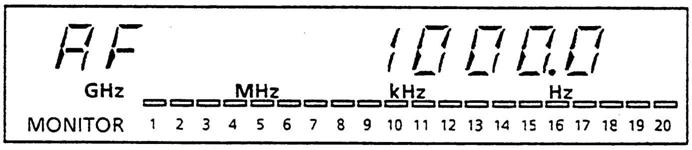


10 [msec]

Press [msec].
(The sweep time is set to 50 ms and the FREQUENCY display returns to the previous frequency setting.)

Step	Procedure
11 [SINGLE]	Press [SINGLE]. (The sweep starts in SINGLE mode. The [SINGLE] LED blinks.)  The sweep stops at −5 dBm and the [SINGLE] LED goes out.

Example 4: Set carrier frequency to 1 GHz and FM deviation to 3.5 kHz, then perform the AF AUTO mode sweep from AF 100 Hz to AF 100 kHz in LOG 1% and 10 ms sweep time.

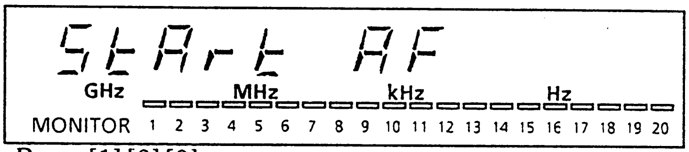
Step		Procedure
1	[FREQ] [1] [GHz/dBm]	Set to 1 GHz. 
2	[FM/ØM] [3] [•] [5] [kHz/mV]	Set FM deviation to 3.5 kHz. 
3	FM/ØM [INT] [EXT AC] [EXT DC FREQ CAL]	Press each key to light the [INT]LED only. (The FM modulation input mode is set only to the INT mode.)
4	[INT MOD FREQ]	Press [INT MOD FREQ] repeatedly until the [AF] LED is lit. (The internal modulation frequency is set to AF.) 
5	[AF]	Select AF frequency setting mode. (The [AF] LED is lit and the FREQUENCY display shows the current AF frequency.) 

Step		Procedure

Setting START AF frequency

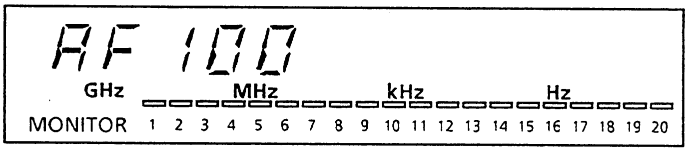
6 [START]

Select START AF frequency setting mode.
(The [START] LED is lit.)



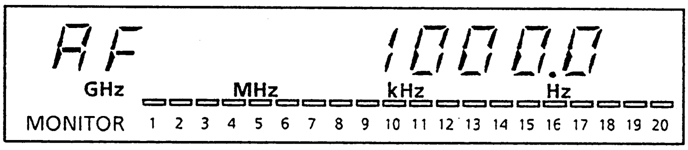
7 [1] [0] [0]

Press [1] [0] [0].



8 [Hz/µV]

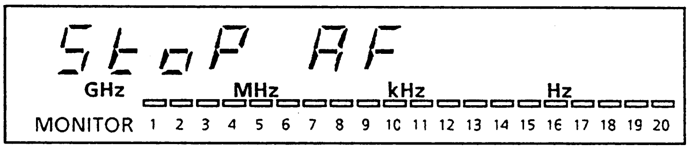
Press [Hz]. (The START AF frequency is set to 100 Hz and the FREQUENCY display returns to the current AF-frequency 1000 Hz display.)



Setting STOP AF frequency

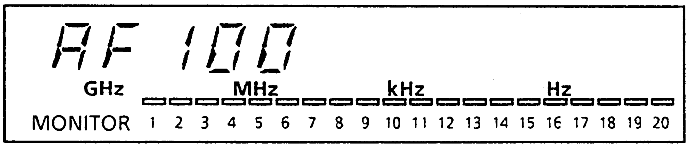
9 [STOP]

Select STOP AF frequency setting mode.



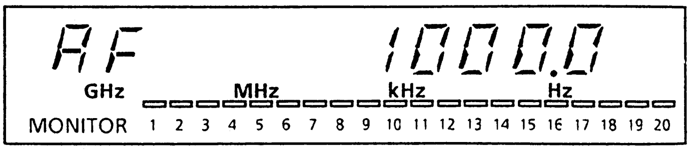
10 [1] [0] [0]

Press [1] [0] [0].



11 [kHz/mV]

Press [kHz]. (The STOP AF frequency is set to 100 kHz and the DISPLAY returns to the current Af frequency 1000 Hz display.)

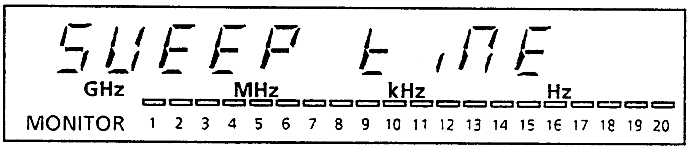


Step **Procedure**

Setting sweep time

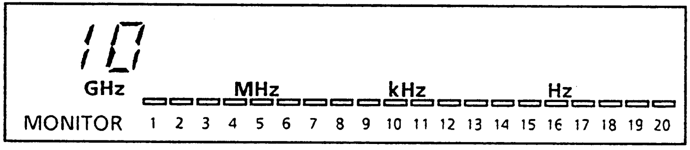
12 [TIME/STEP]

Select sweep time setting mode.



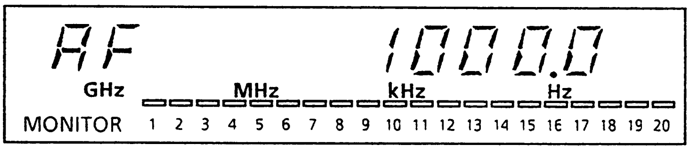
13 [1] [0]

Press [1] [0].



14 [msec]

Press [msec]. (The sweep time is set to 10 ms and the FREQUENCY display returns to the current AF frequency 1000 Hz display.)

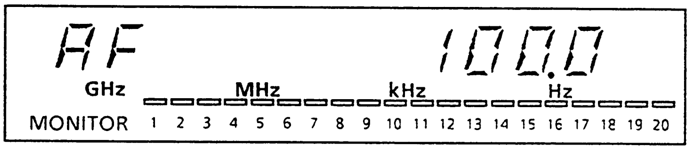


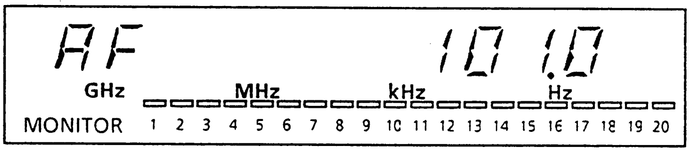
Setting LOG 1%

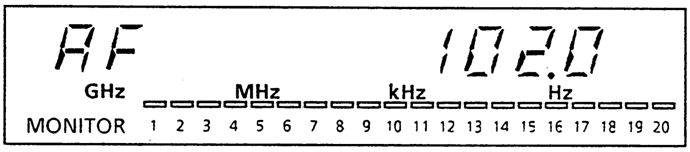
15 [LOG 1%]

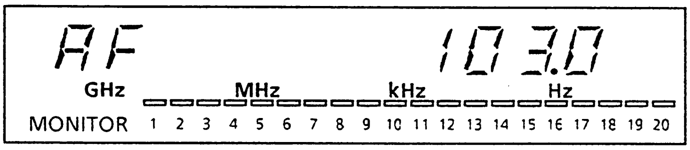
Set sweep pattern to LOG 1%. (The [LOG 1%]LED is lit.)

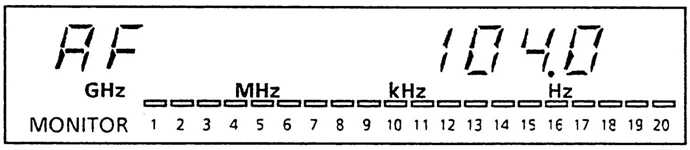
Step	Procedure
16 [AUTO]	Press [AUTO] (The sweep starts in AUTO mode. The [AUTO] LED blinks.)





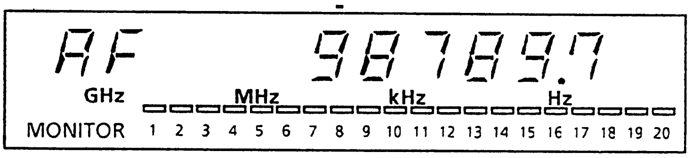


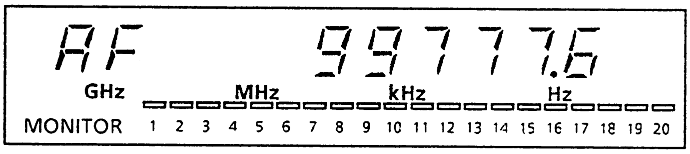


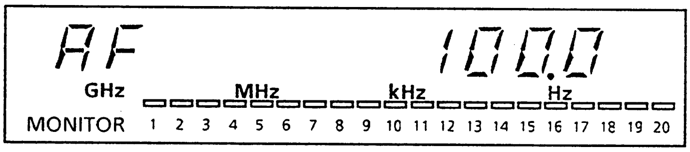


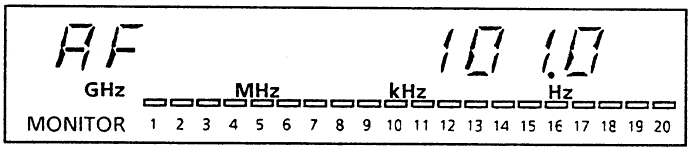
⋮

Step	Procedure
16 (con't)	⋮







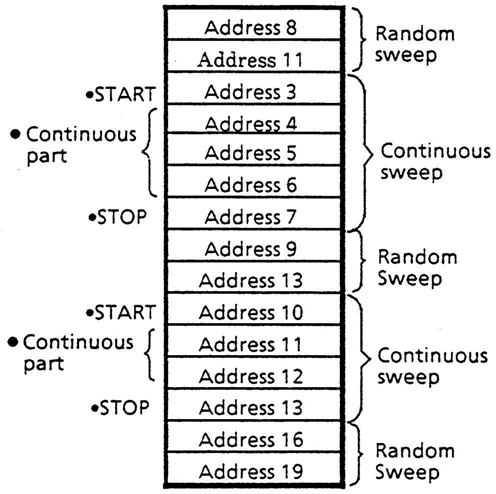


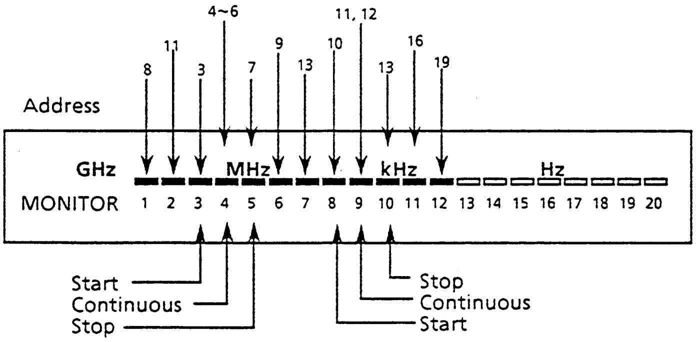
⋮

4.10.4 Setting FREQ memory and FUNCTION memory sweep

This is a sweep method in which the carrier frequencies and panel setting conditions stored in the FREQ memory and FUNCTION memory, respectively, are recalled at random, continuously, or in a combination there of.

Note: The maximum number of sweep steps for a FREQ or FUNCTION memory is 20.
To monitor the current number of the memory sweep step, the resolution-digit MONITOR LED is used as a step number MONITOR LED. When sweep is performed on the 15 memories shown in the figure, the number of the lit MONITOR LEDs is 12. This is described below. For a continuous sweep, irrespective of the number of sweep addresses, only three MONITOR LEDs are lit. (ie. one corresponding to start address, another indicating sweep, and another LED to signal STOP address.)





(1) Random-address sweep

This a method in which the FREQ or FUNCTION memory addresses are set in any chosen order and they are recalled in the same order.

After pressing MEMORY [FREQ] or [FUNCTION], set the addresses by pressing keys, as follows.

[MEMORY], numeric keys (memory address), [.], numeric keys (memory address), [.], ..., [.], numeric keys (memory address), POINT[HZ/μV]

(2) Continuous address sweep

This is a method in which continuous addresses of FREQ or FUNCTION memory are recalled sequentially.

After pressing MEMORY [FREQ] or [FUNCTION], set the addresses by pressing keys, as follows.

[MEMORY], numeric keys (start address), [.], [.], numeric keys (stop address), POINT[Hz/μV].

(Press [.] twice!)

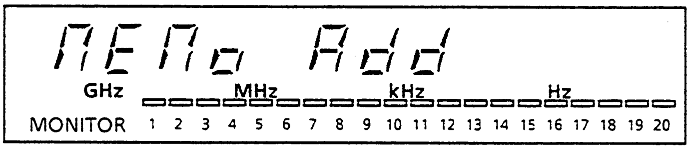
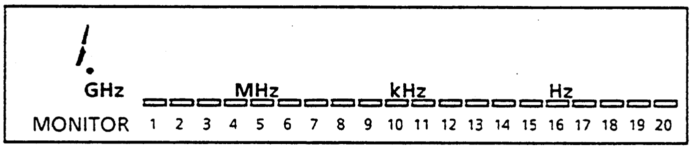
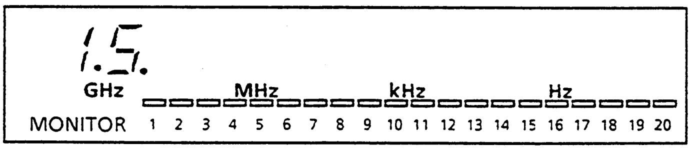
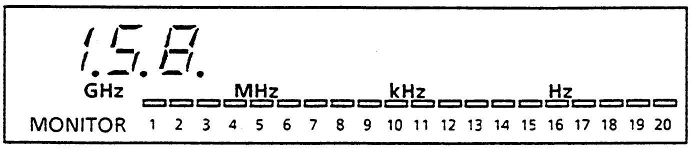
(3) Combining random and continuous address sweep

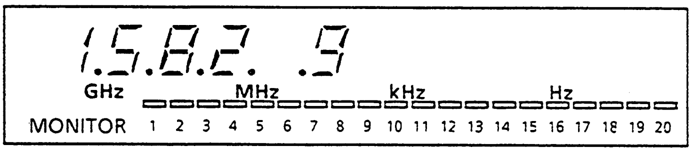
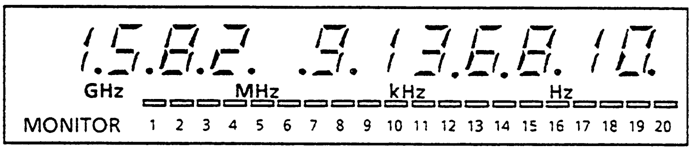
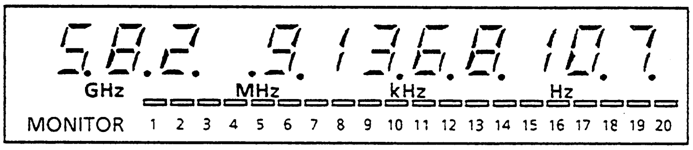
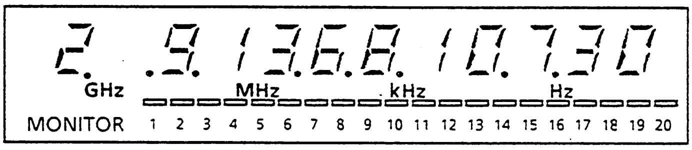
The continuous address sweep (underlined) can be incorporated into the random address sweep. Set the addresses by pressing keys, as follows.

[MEMORY], numeric keys (memory address), [.], numeric keys (start address), [.], [.], numeric keys (stop address), [.], numeric keys (memory address), [.], numeric keys (memory address), POINT[Hz/μV]

The input data is displayed left-justified on the FREQUENCY display. When the data reaches the right end of the display, the display scrolls to the left thereafter. The MONITOR LED is also lit to indicate which step is now being input. This MONITOR LED serves as a display which announces which step is now being swept during the sweeping.

As the keys are pressed, the FREQUENCY display contents are changed as shown below.

Key operation	FREQUENCY Display
[MEMORY]	
[1] [●]	
[5] [●]	
[8] [●]	

Key operation		FREQUENCY Display
[2] [•] [•] [9]		
[•] [1] [3] [•] [6] [•] [8] [•] [1] [0] [•]		
[7] [•]	Scrolling ←	
[3] [0] [POINT]	Scrolling ←	

(4) Setting sweep time (TIME/STEP)

(a) FREQ-memory sweep time

After pressing MEMORY [FREQ] and SWEEP PATTERN [MEMORY], press [TIME/STEP], numeric keys (sweep time), and unit key in this order to set sweep time.
The sweep time set here represents the time per one step.
The sweep time is common to all the sweep patterns.
The sweep time range is 100 μs to 600s and the resolution is 10 μs.

(b) FUNCTION-memory sweep time

Independent FUNCTION memory sweep times (set time) are input with panel settings before they are stored in the FUNCTION memory.

- Input set times for function memory addresses without sweep function, as follows.

  Press SWEEP PATTERN [MEMORY] and MEMORY [FUNCTION] and then press [TIME/STEP], numeric keys (set time), and unit key in this order.

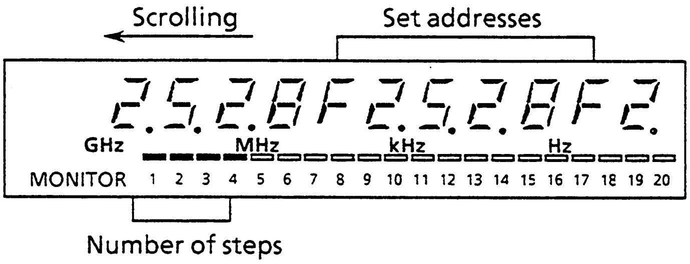
- When panel settings containing any sweep of FREQ, LEVEL, or AF sweep, the set times automatically become the sweep times automatically.

  The FUNCTION memory sweep performs a SINGLE mode sweep and proceeds to the next step address.

(5) Confirming a memory sweep address

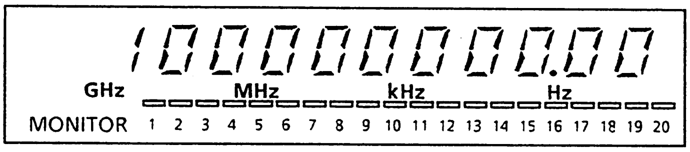
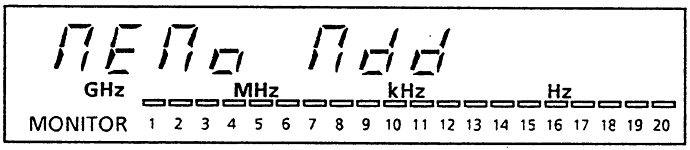
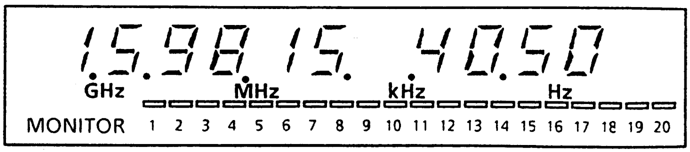
To confirm the address setting in the memory sweep, press and hold [MEMORY] when the MEMORY [FREQ] or [FUNCTION] LED is lit. Then, the set addresses placed between the letters "F" are displayed repeatedly on the FREQUENCY display (shifting from right to left) while [MEMORY] is pressed.

The MONITOR LED also displays the number of steps.



(6) Examples

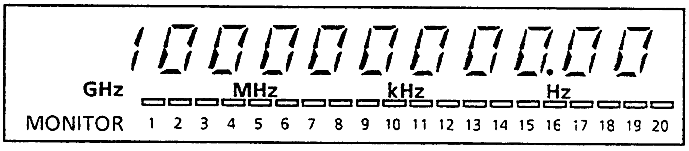
Example 1: Store 1 MHz, 2 MHz, 3 MHz, ... 100 MHz to address 1, 2, 3, ... 100, respectively, and perform a manual FREQ sweep in the 1, 5, 98, 15 to 40, and 50 address order.

Step	Procedure	
1	[FREQ] [1] [MHz/dBμ]	Setting 1 MHz
	[FREQ] [1] [STORE] (MEMORY section)	1 MHz→address 1
	[2] [MHz/dBμ]	Setting 2 MHz
	[3] [STORE]	2 MHz→address 2
	[3] [MHz/dBμ]	Setting 3 MHz
	[3] [STORE]	3MHz→address 3
	⋮	⋮
	[1] [0] [0] [MHz/dBμ]	Setting 100 MHz
	[1] [0] [0] [STORE]	100 MHz→address 100 
2	[MEMORY]	Select FREQ memory sweep address setting mode. (The SWEEP PATTERN [MEMORY] LED is lit.) 
3	[1] [●] [5] [●] [9] [8] [●] [1] [5] [●] [●] [4] [0] [●] [5] [0]	Input the FREQ memory sweep addresses. (The input data is input left-justified on the FREQUENCY display.) 

Step **Procedure**

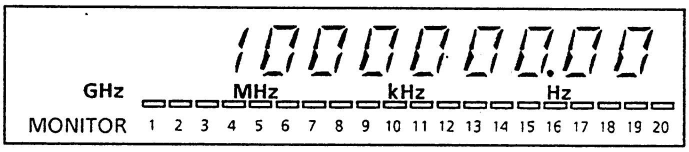
4 [POINT]

Press [POINT]. (The FREQ-memory sweep address is set and the FREQUENCY display returns to the previous 100 MHz display.)



5 [MANUAL MARKER]

Set MANUAL mode sweep. (The [MANUAL] LED is lit and the FREQ memory address contents which is input first are recalled.)



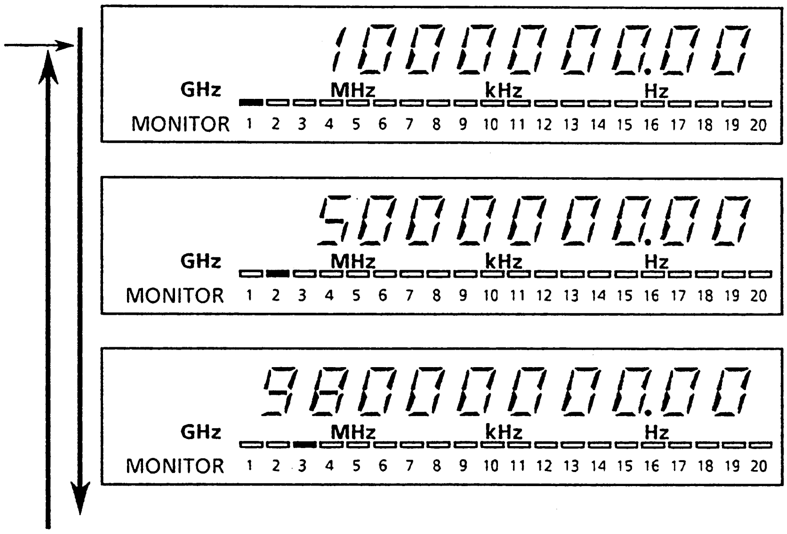
6 **ROTARY KNOB**
(up)

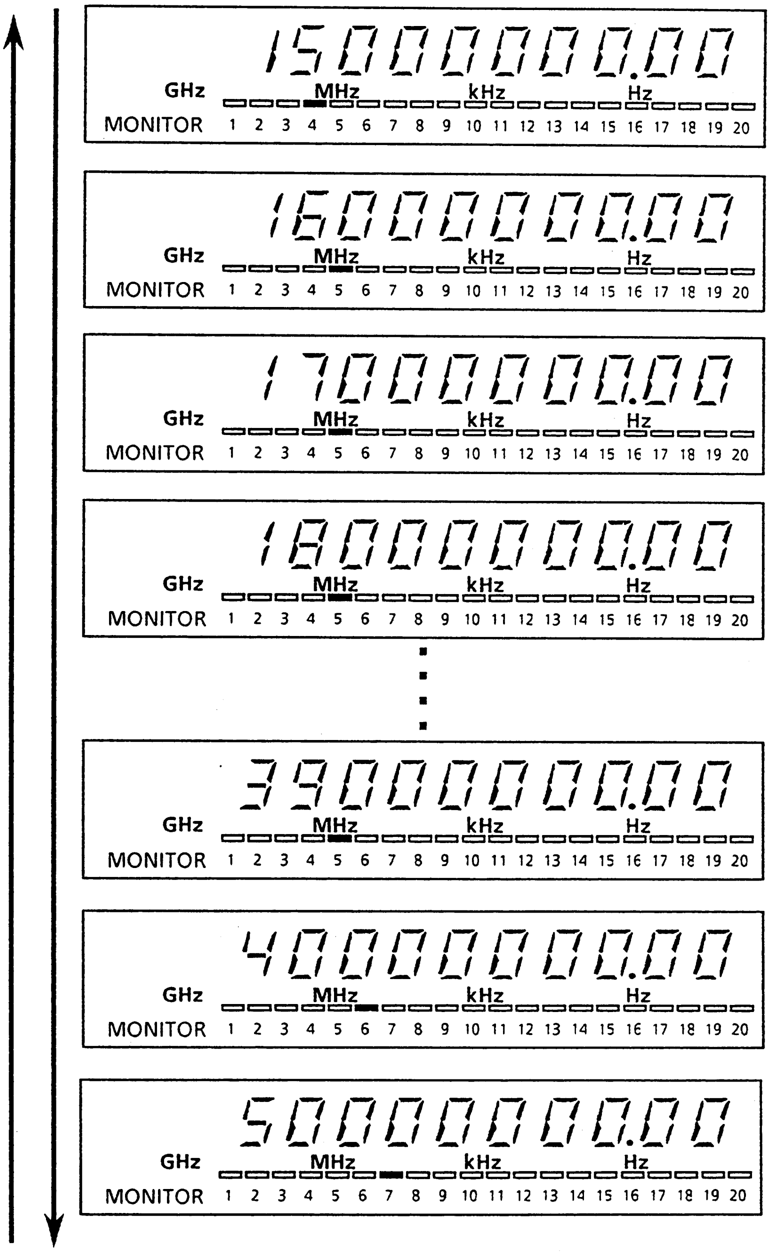
or

INCREMENT [⩓]

(Up direction)

Perform MANUAL sweep in a forward or backward direction of the address order by turning rotary knob or pressing INCREMENT [∨] or [∧].



Step		Procedure
6 (con't)	**ROTARY KNOB** (down) or **INCREMENT** [︾]	

Example 2: Repeat the following panel settings.

Address 1: 10-second settings of 455 kHz, 0 dBm, AM 30%, and INT MOD FREQ 1 kHz
Address 2: Settings of 455 kHz, 0 dBm, modulation OFF, SPAN 50 kHz, STEP 1 kHz, and TIME/STEP 20 ms sweep
Address 3: 20-second settings of 10.7 MHz, −10 dBm, FM 100 kHz, and INT MOD FREQ 1 kHz
Address 4: Settings of 10.7 MHz, −10 dBm, modulation OFF, SPAN 1 MHz, STEP 20 kHz, and TIME/STEP 50 ms sweep

Step		Procedure
1	[SPECIAL] [0] [0]	Initialization (For details, see paragraph 4.11.2.)
2	[FUNCTION]	Set FUNCTION memory mode. (The [FUNCTION] LED is lit.)
	Setting address-1 contents	
3	[4] [5] [5] [kHz/mV]	The header [FREQ] LED is lit.
4	[LEVEL] [0] [GHz/dBm]	
5	[AM] [3] [0] [%]	
6	[TIME/STEP] [1] [0] [sec]	
7	[1] [STORE]	

Step	Procedure	
	Setting address-2 contents	
8	[AM ON/OFF]	Set different contents from that of address 1.
9	[SPAN] [5] [0] [kHz/mV]	
10	[STEP SIZE] [1] [kHz/mV]	
11	[TIME/STEP] [2] [0] [msec]	
12	[AUTO]	
13	[2] [STORE]	
	Setting address-3 contents	
14	[SWEEP OFF]	
15	[1] [0] [•] [7] [MHz/dBμ]	The header [FREQ] LED is lit.
16	[LEVEL] [−] [1] [0] [GHz/dBm]	
17	[FM/ØM] [1] [0] [0] [kHz/mV]	
18	[TIME/STEP] [2] [0] [sec]	
19	[3] [STORE]	

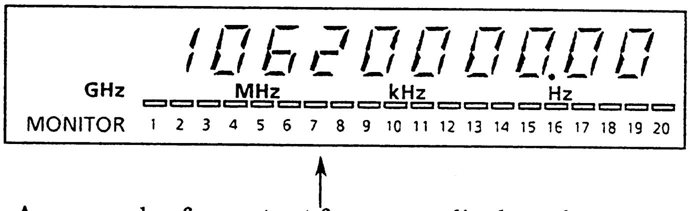
Step		Procedure
	Setting address-4 contents	
20	[FM/ØM ON/OFF]	Set different contents from that of address 3.
21	[SPAN] [1] [MHz/dBμ]	
22	[STEP SIZE] [2] [0] [kHz/mV]	
23	[TIME/STEP] [5] [0] [msec]	
24	[AUTO]	
25	[4] [STORE]	

Step		Procedure

Setting FUNCTION memory sweep address

26 [SWEEP OFF]

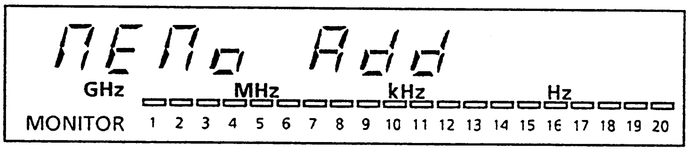
Stop sweeping.



An example of an output frequency display when sweep stops.

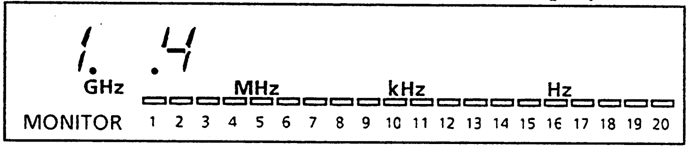
27 [MEMORY]

Select FUNCTION memory sweep address setting mode (The [MEMORY] LED is lit.)



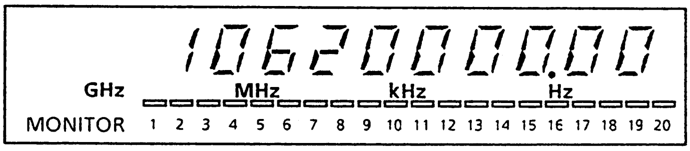
28 [1] [•] [•] [4]

Input FUNCTION memory sweep address. (The data is input left-justified on the FREQUENCY display.)



29 [POINT]

Press [POINT].
(The FUNCTION memory sweep address is set and the FREQUENCY display returns to the 10.62 MHz display at step 26.)



Starting FUNCTION memory sweep

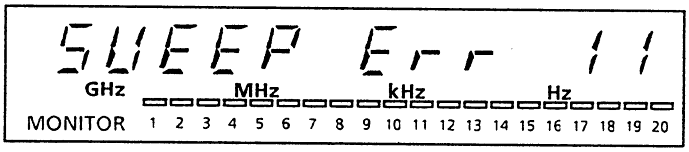
30 [AUTO]

Start sweeping in AUTO mode.
(The [AUTO] LED blinks.)

4.10.5 MARKER

A marker signal can be output from the MARKER connector on the rear panel by performing the following operation during sweeping in the AUTO or SINGLE mode.

- Press [SHIFT] and then [MANUAL MARKER] to turn on the marker function.
- Use the rotary knob or INCREMENT [\/] [/\] to set the marker point. The marker-point frequency for frequency sweep or the marker-point level for level sweep is displayed on the FREQUENCY or OUTPUT LEVEL display, respectively.
- When the actual sweep point and the marker-set point match, the positive pulse signal (TTL) is output from the MARKER connector on the rear panel.
- To disengage marker function, press [SHIFT], then press [MANUAL MARKER].
- The marker function cannot be turned on in the MANUAL mode. If an attempt is made to turn on the function, the [STATUS] LED blinks. At this time,when the [STATUS] is pressed, the following error message is displayed.



- When the marker function is turned on for the first time during sweeping, the marker point is set to the sweep start point. When the marker function which was turned off is turned on again, the previous marker is recovered.
- When the SWEEP PATTERN or SWEEP STEP parameter is changed during sweeping, the marker is set to the point closest to the marker point before change. If the closest point are two at the same distance, the marker is set to the lower point.

4.10.6 Presetting sweep

When sweep is not performed, the re-start sweep point can be set forcibly to the start or stop point in the currently-set sweep pattern.

(1) Presetting to start point

Press [SHIFT], then press [START].

(2) Presetting to stop point

Press [SHIFT], then press [STOP].

4.10.7 Output connectors related to sweep function

Sweep-function output connectors are explained below.

1. SWEEP OUTPUT on front panel

   Outputs a 0 to 10V stair case sawtooth waveform synchronized with sweeping.

2. SWEEP STATUS on rear panel

   Outputs sweep status signal (high level during sweeping).

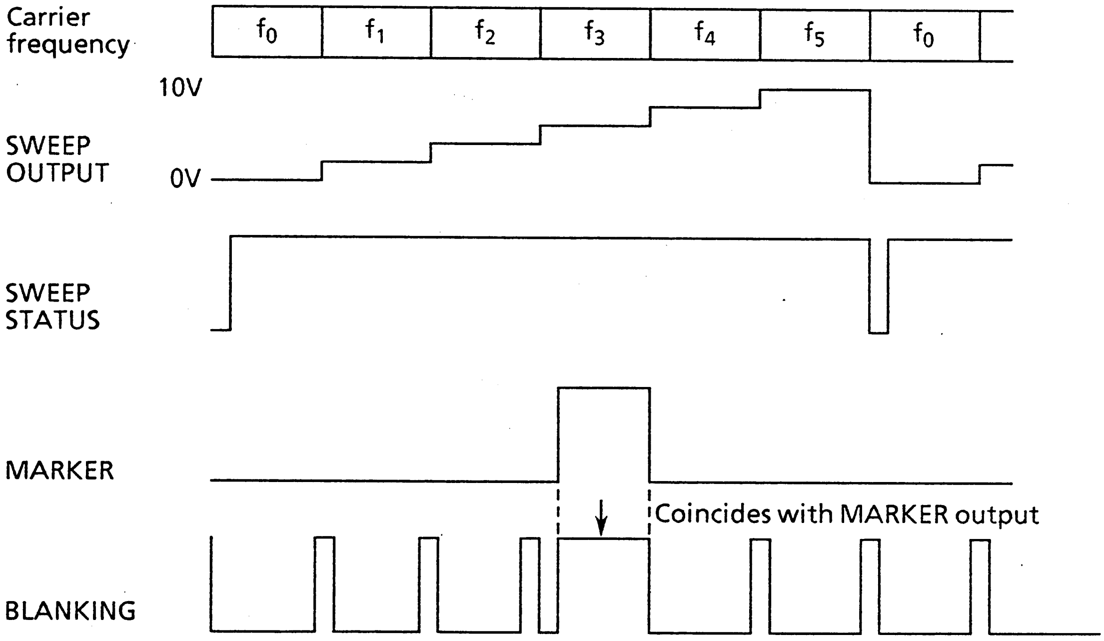
3. MARKER on rear panel

   Outputs a positive pulse when the current point coincides with the marker point at marker function ON.

4. BLANKING on rear panel

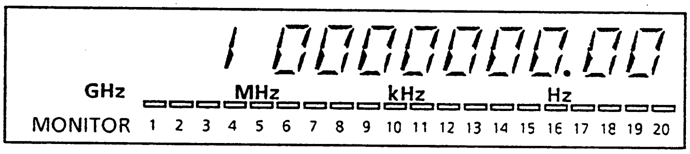
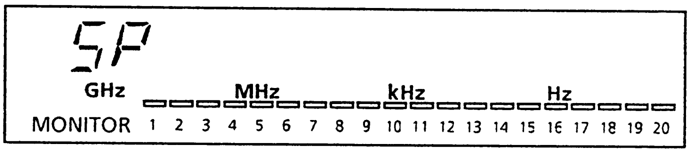
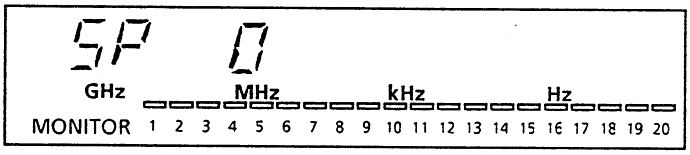
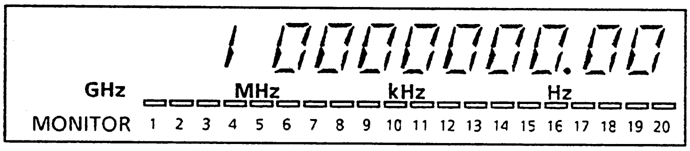
   Outputs a pulse when sweep steps. The pulse polarity is selected using SP43 for positive pulse and SP44 for negative pulse.

Output timing of these signals are shown below using an example of frequency AUTO sweep from f_0 to f_5 with STEP N = 6 and marker point at f_3.



4.11 Special Functions

Special function can be set by pressing [SPECIAL] and inputting two-digit codes (00 to 99). The special function codes are listed in the table on the following page.

Key operation	FREQUENCY display
	
[SPECIAL]	
[0]	
[1]	

When the second digit is pressed, the special function is also set.

Table 4-1 Special Functions (1/5)

Contents	Code
Initialization	00
Bell : Bell OFF	01
Bell : Bell ON *	02
Output level : Open-circuit voltage display (EMF) *	03
Output level : Terminated voltage display	04
Output level : Limiter OFF *	05
Output level : Limiter ON	06
Output level : Offset mode OFF *	07
Output level : Offset mode ON	08
Frequency : Offset mode OFF *	11
Frequency : Offset mode ON	12
FREQ memory : Protect OFF *	13
FREQ memory : Protect ON	14
FUNCTION memory : Protect OFF *	15
FUNCTION memory : Protect ON	16
FM OSC. : Automatic switching*	17
FM OSC. : Middle fixed	18
FM OSC. : Wide fixed	19
ØM OSC. : Automatic switching*	20
ØM OSC. : Middle fixed	21
ØM OSC. : Wide fixed	22
FM/ØM : Polarity normal *	23
FM/ØM : Polarity invert	24
FM/ØM : INT/EXT deviation fixed release*	25
FM/ØM : INT deviation fixed	26
FM/ØM : EXT deviation fixed	27

* denotes initial status

Table 4-1 Special Functions (2/5)

Contents	Code
INT MOD : Normal *	30
INT MOD : + DC applied	31
INT MOD : − DC applied	32
INT MOD : ± DC external control	33
MOD OUTPUT : Automatic switching*	35
MOD OUTPUT : INT fixed	36
MOD OUTPUT : AM EXT fixed	37
MOD OUTPUT : FM/∅M EXT fixed	38
Sweep blanking output : Positive logic*	43
Sweep blanking output : Negative logic	44
FUNCTION memory sweep : Sweep output pattern 1*	45
FUNCTION memory sweep : Sweep output pattern 2	46

* denotes initial status

Table 4-1 Special Functions (3/5)

Contents	Code
Output level limiter value header	51
Output level offset value header	52
Frequency offset value header	53
Trigger program: Setting	56
Trigger program: Clear	57
Trigger program: Start	58

Table 4-1 Special Functions (4/5)

Contents	Code
GP-IB : Talker data with header *	60
GP-IB : Talker data without header	61
GP-IB : Address setting	62
GP-IB : Address display	63
GP-IB : Only mode OFF	64
GP-IB : Frequency talk-only-mode ON	65
GP-IB : Output level talk-only-mode ON	66
GP-IB : Frequency/Output level talk-only-mode ON	67
GP-IB : Listen only mode ON	68
SRQ : ALL MASK *	70
SRQ : ERROR MASK OFF	71
SRQ : BUSY/READY MASK OFF	72
SRQ : MALFUNCTION MASK OFF	73
SRQ : SELF TEST MASK OFF	74
SRQ : SUSPENSION MASK OFF	75
SRQ : DATA ERROR MASK OFF	76
SRQ : TRIGGER PROGRAM END MASK OFF	77
SRQ : SWEEP END MASK OFF	78
SRQ : MARKER POSITION MASK OFF	79
SRQ : STRINGS END MASK OFF	80

* denotes initial status

Table 4-1 Special Functions (5/5)

Contents	Code
FREQ memory: Clear	81
FUNCTION memory: Clear	82
Option display	83
Output level correction : Normal *	86
Output level correction : (CAL data 1) (Option 07)	87
Output level correction : (CAL data 2) (Option 07)	88

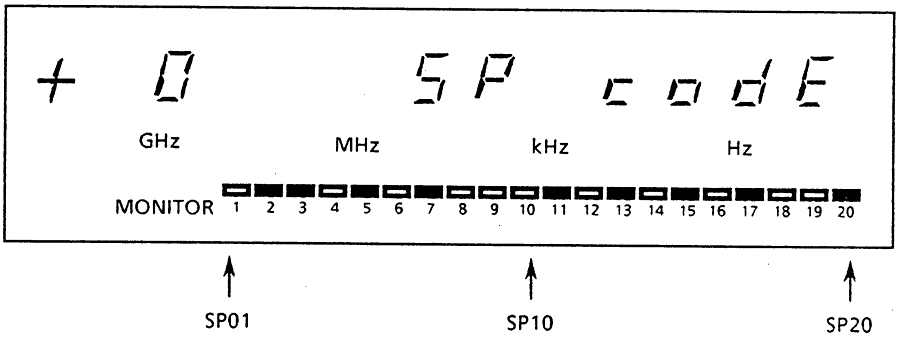
* denotes initial status

4.11.1 Special function status

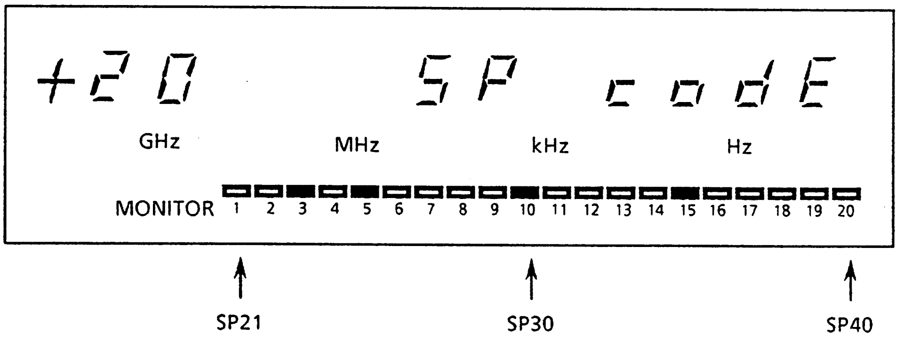
To check special function setting, press [SPECIAL], numeric key 1 to 5, and [STATUS] in this order. While [STATUS] is pressed and held, the set special function code is displayed on the MONITOR LED below the FREQUENCY display.

The following example shows initialized status codes of 02, 03, 05, 07, 11, 13, 15, 17, 20, 23, 25, 30, 35, 43, 45, 60, 70, and 86.

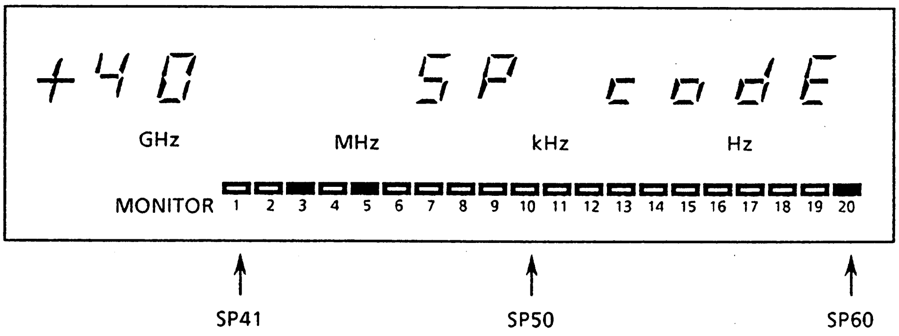
Press [SPECIAL] [**1**] [STATUS] to check SP01 to 20.



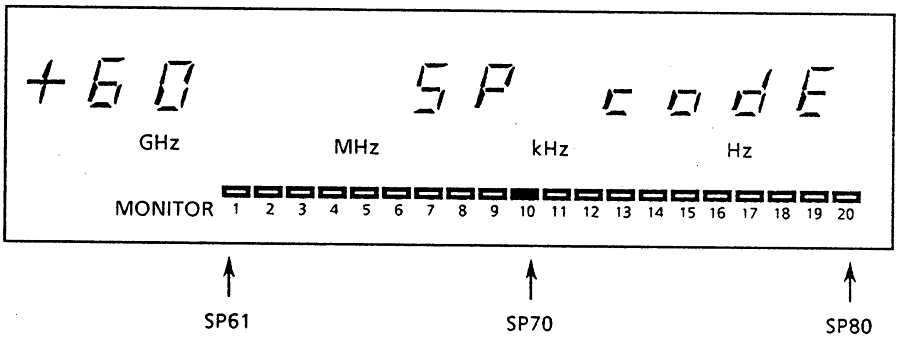
Press [SPECIAL] [**2**] [STATUS] to check SP21 to 40.



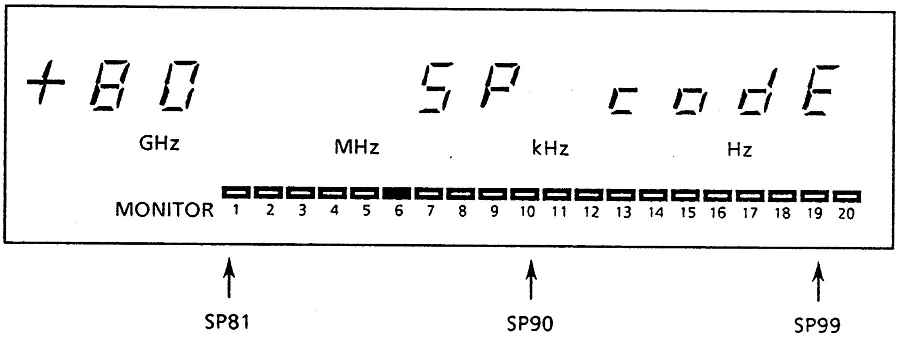
Press [SPECIAL] [**3**] [STATUS] to check SP41 to 60.



Press [SPECIAL] [**4**] [STATUS] to check SP61 to 80.



Press [SPECIAL] [**5**] [STATUS] to check SP81 to 99.



4.11.2 Initial setting (SP00)

To set the panel settings and operating system values to initial status, press [SPECIAL], [0], and [0] in this order.

Header :	FREQ
Rotary knob HOLD :	OFF
Carrier frequency :	10 MHz
Carrier frequency increment value :	1 MHz
Carrier frequency resolution :	10 kHz digit
RELATIVE FREQ :	OFF
Frequency offset value :	0 Hz
Output level :	0 dBm
Output level increment value :	1 dB
Output level resolution :	0.1 dB digit
CONTINUOUS mode :	OFF
RELATIVE LEVEL :	OFF
RF ON/OFF	ON
Output level offset value :	0 dB
Output level limiter value :	− 10 dBm
AF frequency :	1 kHz
AF frequency increment value :	100 Hz
AF frequency resolution :	100 Hz
FM/ØM :	FM
FM modulation :	OFF
FM frequency deviation :	3.5 kHz

FM frequency deviation resolution : Second digit
FM input mode : INT
FM INT MOD FREQ : 1 kHz

AM modulation : OFF
AM modulation factor : 30%
AM modulation factor resolution : 1 % digit
AM input mode : INT
AM INT MOD FREQ : 1 kHz

ØM modulation : OFF
ØM phase deviation : 1 rad
ØM phase deviation resolution : Second digit
ØM input mode : INT
ØM INT MOD FREQ : 1 kHz

MEMORY mode : FREQ memory

Sweep mode : OFF

Carrier frequency sweep pattern : START-STOP
Carrier frequency sweep step : LIN-STEP N
Start frequency : 1 MHz
Stop frequency : 100 MHz
Span frequency : 1 MHz
Number of frequency steps : 990
Frequency step size : 100 kHz

Output-level sweep pattern : START-STOP
Start level : −35 dBm
Stop level : −25 dBm
Span level : 10 dB

AF frequency sweep pattern :	START-STOP
AF frequency sweep step :	LIN-STEP N
Start AF frequency :	100 Hz
Stop AF frequency :	100 kHz
Span AF frequency :	1 kHz
Number of AF frequency steps :	999
AF frequency step size :	100 Hz
FREQ memory sweep :	(No data)
Sweep time :	5 ms / step
FUNCTION memory sweep :	(No data)
FUNCTION memory set time :	1 s / step
Special function :	See Table 4-1 of special function

4.11.3 Bell ON/OFF (SP02/01)

Special Function 02/01 give an alarm bell on/off.

1. [SPECIAL] [0] [1] Turns off the bell.
2. [SPECIAL] [0] [2] Turns on the bell.

4.11.4 Terminated and open-circuit voltage (EMF) display of output level (SP04/03)

Special Function 04 gives a terminated output voltage display by pressing [SPECIAL] [0] [4]. Special Function 03 gives an open-circuit (EMF) voltage display by pressing [SPECIAL] [0] [3].

Terminated voltage ↔ open-circuit (EMF) voltage conversion changes alone display without changing the actual output level. When the open-circuit (EMF) voltage is displayed, the "EMF" LED is lit on the display.

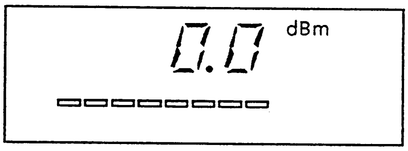
Even if SP03 or 04 is input when the unit is dBm, the display does not change. When the unit is dBμ, V, mV or μV, the display changes to the open-circuit (EMF) or terminated voltage display.

Example : Unit conversion to dBμ or mV at the output level of 0 dBm

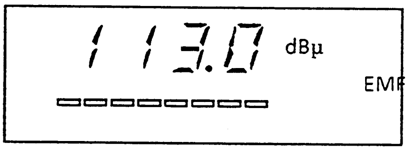
Step **Procedure**

dBm→dBμ conversion

1 [LEVEL] [0] [GHz/dBm]

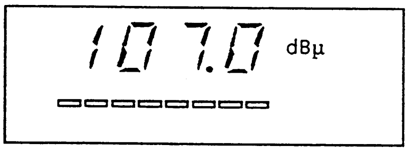


2 [MHz/dBμ]



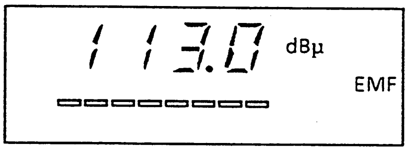
EMF→terminated voltage display

3 [SPECIAL] [0] [4]

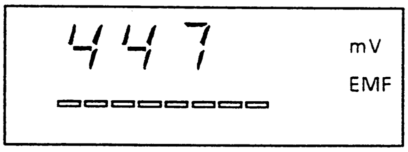


Terminated→EMF voltage display

4 [SPECIAL] [0] [3]

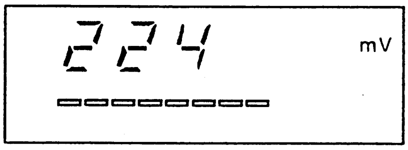


5 [kHz/mV]



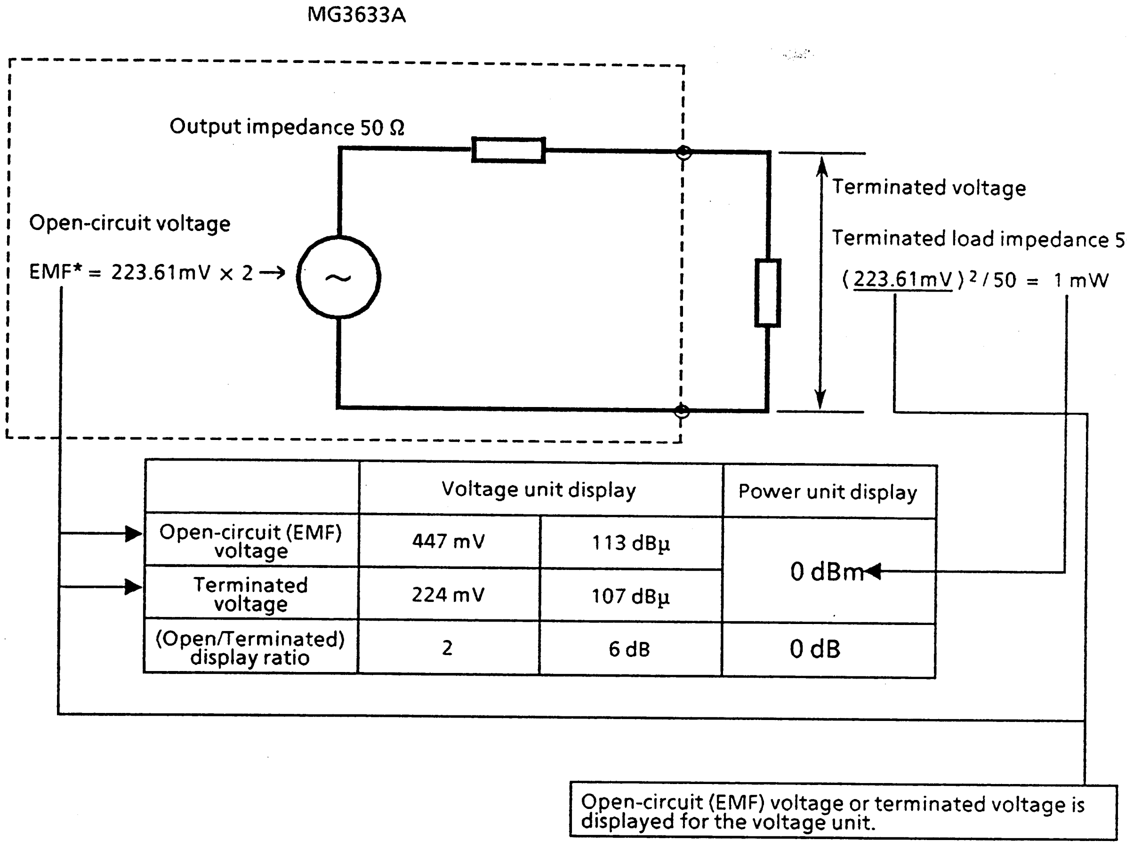
EMF→terminated voltage display

6 [SPECIAL] [0] [4]



- Relationship between open-circuit (EMF) voltage and terminated voltage

When 1 mW power is applied to an external 50Ω terminated load, the relationship between open-circuit (EMF) voltage and terminated voltage is as shown below:



	Voltage unit display		Power unit display
Open-circuit (EMF) voltage	447 mV	113 dBμ	0 dBm
Terminated voltage	224 mV	107 dBμ	
(Open/Terminated) display ratio	2	6 dB	0 dB

Open-circuit (EMF) voltage or terminated voltage is displayed for the voltage unit.

Note: When voltage conversion between EMF and terminated voltages is performed, conversion error may occur due to internal calculations based on dBm. However, actual output level is the same.

4.11.5 Output level limiter ON/OFF (SP06/05)

Special Function 06/05 limit the maximum value of output level.

1. [SPECIAL] [0] [6] Output level limiter ON
2. [SPECIAL] [0] [5] Output level limiter OFF

The upper limit value of the output level is set as follows :

[SPECIAL] [5] [1], numeric keys (upper limit value), unit key

- The range and resolution is the same as those for output level.
- When the output level limiter is turned on, the output level cannot be raised above the level set for the upper limit value. Thus, devices which are easily affected by excessive input are protected.
- If the output level (at the time the output level limiter is turned on) exceeds the upper limit value, the output is automatically adjusted to the upper limit value.
- The upper limit value can be set even while the output level limiter is turned off.

4.11.6 Output level offset mode ON/OFF (SP08/07)

Special Function 08/07 are ON/OFF controls for the output level offset mode.

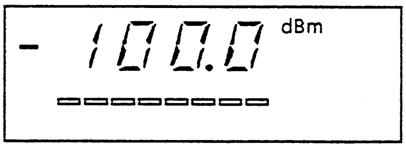
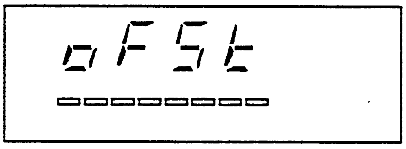
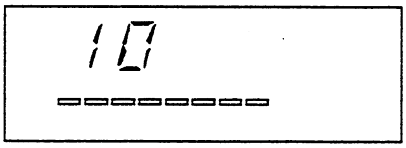
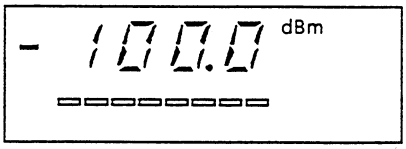
1. [SPECIAL] [0] [8] Turns on the output level offset mode.
2. [SPECIAL] [0] [7] Turns off the output level offset mode.

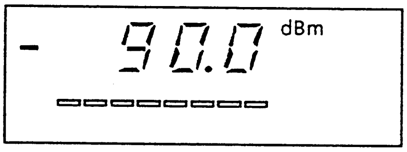
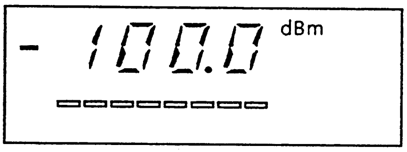
The output level offset value is set as follows :

[SPECIAL] [5] [2], numeric keys (offset value), [dB]

Offset value unit is dB only, the units V, mV or µV cannot be input as the offset value.

Example: Confirm the output level display when the offset value is set to +10 dB after the output level is set to −100 dBm.

Step		Procedure
1	[LEVEL] [−] [1] [0] [0] [GHz/dBm]	Set to −100 dBm. 
2	[SPECIAL] [5] [2]	Input the output level offset value header. 
3	[1] [0]	Input the +10 dB offset data. Check the input data displayed before pressing the unit key. 
4	[dB]	Press [dB]. (The offset value is set to +10 dB and the OUTPUT LEVEL display returns to the current output level display.) 

Step	Procedure
5 [SPECIAL] [0] [8]	Turn on the offset mode. (−100 dBm+10 dB= −90 dBm is displayed.) 
6 [SPECIAL] [0] [7]	Turn off the offset mode. 

Note: The offset value range is from −166 to 166 dB.
When the actual output level exceeds the output level range, errors may result.
The offset value can be set even while the offset mode is turned off.
When the units are V, mV, or µV, the offset is applied after the unit is automatically converted to dBµ.

4.11.7 Frequency offset mode ON/OFF (SP12/11)

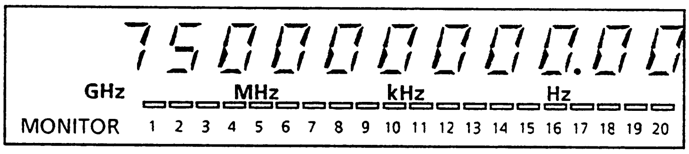
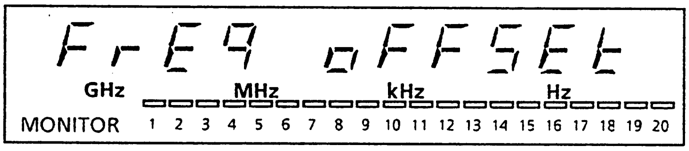
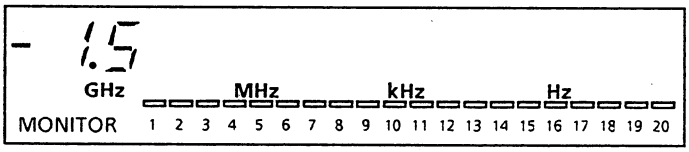
Special Function 12/11 give a carrier frequency offset mode ON/OF control.

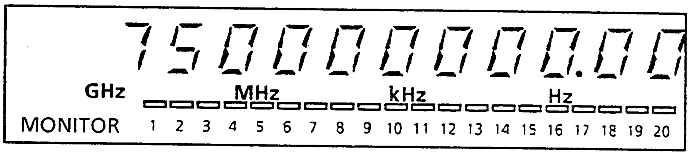
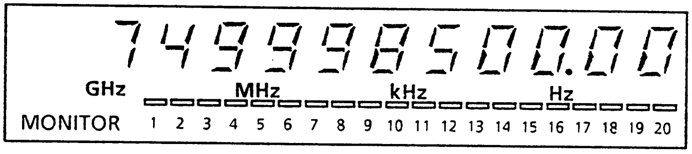
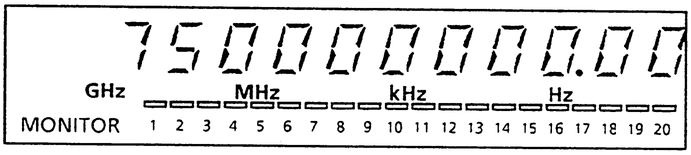
1. [SPECIAL] [1] [2] Turns on the frequency offset mode.
2. [SPECIAL] [1] [1] Turns off the frequency offset mode.

The frequency offset value is set as follows :

[SPECIAL] [5] [3], numeric keys (offset value), unit key

Example: Confirm the frequency display when the offset value is set to −1.5 kHz after the frequency is set to 750 MHz.

Step		Procedure
1	[FREQ] [7] [5] [0] [MHz/dBμ]	Set to 750 MHz. 
2	[SPECIAL] [5] [3]	Input frequency offset value header. 
3	[−] [1] [•] [5]	Input −1.5 kHz offset data. Check the input data displayed before pressing unit key. 

Step		Procedure
4	[kHz/mV]	Press [kHz]. (The offset value is set to – 1.5kHz and the FREQUENCY display returns to the current frequency.) 
5	[SPECIAL] [1] [2]	Turn on the offset mode. (750 MHz – 1.5 kHz = 749.9985 MHz displayed.) 
6	[SPECIAL] [1] [1]	Turn off the offset mode. 

Note: The offset value range is from – 2.7 GHz to 2.7 GHz.
When the actual frequency exceeds the frequency range, error may result.
The offset value can be set even while the offset mode is turned off.

4.11.8 FREQ-memory protect ON/OFF (SP14/13)

See paragraph 4.9.3.

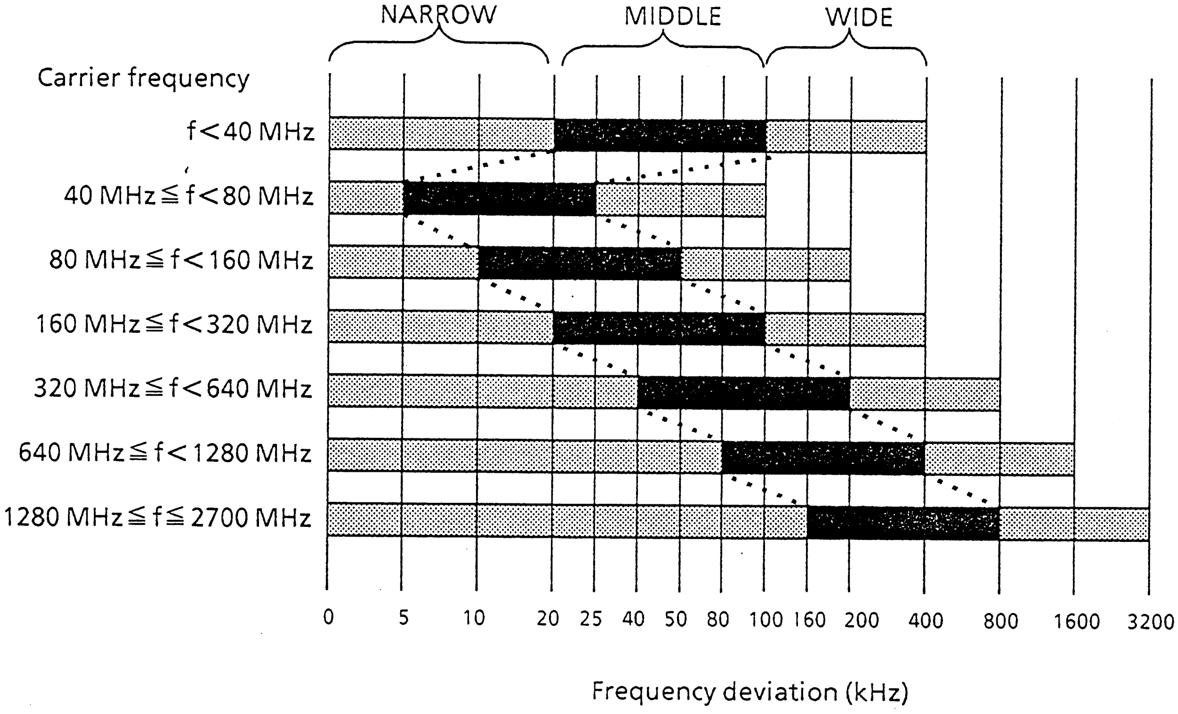
4.11.9 FUNCTION-memory protect ON/OFF (SP16/15)

See paragraph 4.9.3.

4.11.10 FM OSC : Automatic switching/MIDDLE fixed/WIDE fixed (SP17/18/19)

There are three types of FM modulation oscillators: NARROW, MIDDLE, and WIDE deviation devices.

Usually, automatic switching is performed as shown below according to the carrier frequency and frequency deviation.

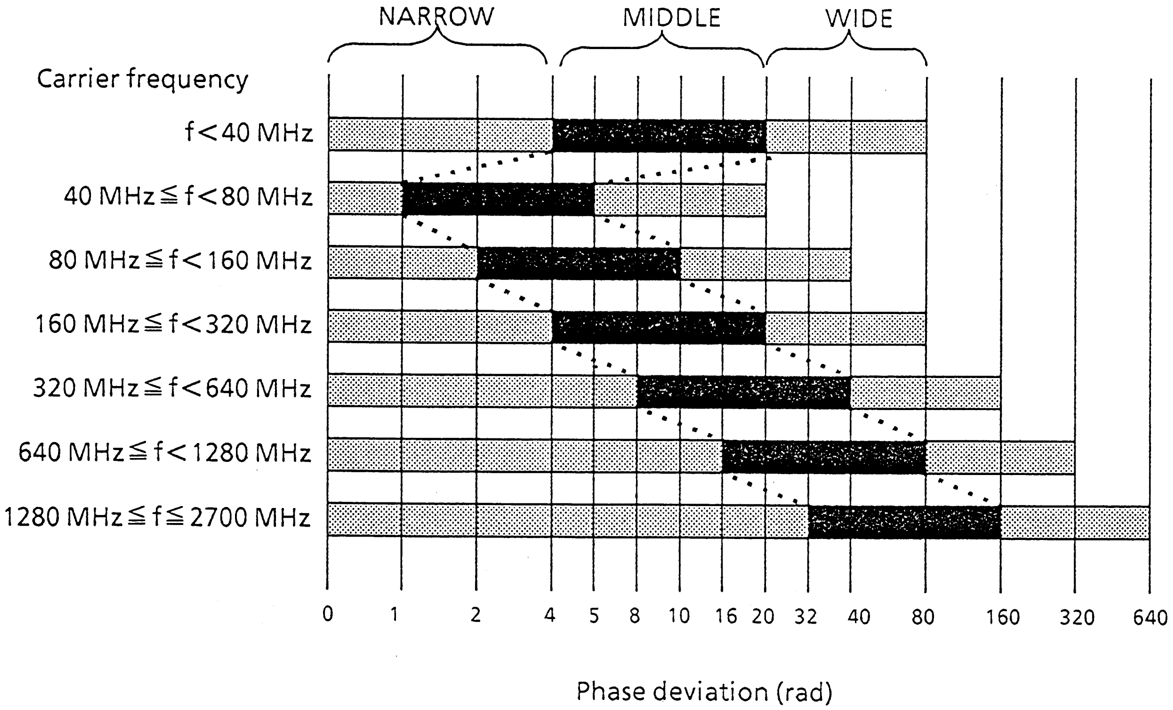


The three oscillators each have different modulation characteristics. Therefore, when changing the oscillator will affect measurement results, the oscillator to be used must be fixed using Special Function 18/19. In this case, the maximum frequency deviation is that of the fixed oscillator.

1. [SPECIAL] [1] [7] The FM oscillator is set to automatic switching.
2. [SPECIAL] [1] [8] The FM oscillator is fixed to the MIDDLE oscillator. Even if the frequency deviation is decreased, it is not switched to the NARROW oscillator. The maximum frequency deviation is 1/4 of the value obtained at the automatic switching.
3. [SPECIAL] [1] [9] The FM oscillator is fixed to the WIDE oscillator. Even if the frequency deviation is decreased, it is not switched to the NARROW or MIDDLE oscillator. The maximum frequency deviation is the same value obtained at automatic switching.

4.11.11 ØM OSC : Automatic switching/MIDDLE fixed/WIDE fixed (SP20/21/22)

There are three types of ØM modulation oscillators; NARROW, MIDDLE, and WIDE deviation devices. Usually, automatic switching is performed (as shown below) according to the carrier frequency and phase deviation.



The three oscillators each have different modulation characteristics. Therefore, when changing the oscillator will affect measurement results, the oscillator to be used must be fixed using Special Function 21/22. In this case, the maximum phase deviation is that of the fixed oscillator.

1. [SPECIAL] [2] [0] The ∅M oscillator is set to automatic switching.
2. [SPECIAL] [2] [1] The ∅M oscillator is fixed to the MIDDLE oscillator. Even if the phase deviation is decreased, it is not switched to the NARROW oscillator. The maximum phase deviation is 1/4 of the value obtained at the automatic switching.
3. [SPECIAL] [2] [2] The ∅M oscillator is fixed to the WIDE oscillator. Even if the phase deviation is decreased, it is not switched to the NARROW or MIDDLE oscillator. The maximum phase deviation is the same value obtained at the automatic switching.

4.11.12 FM/∅M : POLARITY NORMAL/INVERT (SP23/24)

1. [SPECIAL] [2] [3] Modulation is applied without inverting the polarity of the EXT FM/∅M input signal.
2. [SPECIAL] [2] [4] Modulation is applied with inverting the polarity of the EXT FM/∅M input signal.

4.11.13 FM/∅M : INT/EXT deviation fixed (SP25/26/27)

Special Function 25 (initial status) produces the same frequency or phase deviation for FM or ∅M internal and external simultaneous modulation.

Special Function 26/27 produce different frequency or phase deviation for FM or ∅M internal and external simultaneous modulation.

1. [SPECIAL] [2] [5]: Sets the same frequency or phase deviation for both internal and external deviations.
2. [SPECIAL] [2] [6], Numeric keys, unit key: Sets and fixes the internal frequency or phase deviation. After fixing internal deviation, set the external frequency or phase deviation which is displayed.
3. [SPECIAL] [2] [7], Numeric keys, unit key: Sets and fixes the external frequency or phase deviation. After fixing external deviation, set the internal frequency or phase deviation which is displayed.

Notes: *1.* Fixing the frequency or phase deviation which was set last is valid.

2. Either the internal or external deviation can be fixed.
When either internal or external FM/∅M deviation is fixed, the other not-fixed deviation is displayed. When the not-fixed deviation is off, MODULATION display indicates OFF.

3. When the internal or external deviation is fixed, the deviation which is not fixed has the same fixed decimal point display and digit setting as that for the fixed deviation. For example, when the internal deviation is fixed to 75 kHz, the external one is a maximum 99.9 kHz and the minimum resolution is 0.1 kHz.

4. INT/EXT deviation fixed status remains unchanged even when FM and ∅M is switched back and forth.
The deviation fixed when FM/∅M is switched is as follows:

- When the FM frequency deviation is at FM fix (Hz)

  ↓

  The ∅M phase deviation is fixed to ∅M fix (rad) = FM fix/5000.
- When the ∅M phase deviation is fixed at ∅M fix (rad)

  ↓

  The FM frequency deviation is fixed to FM fix (Hz) = ∅M fix × 5000.

Table 4-2 FM Variable Range at Fixed INT/EXT

Carrier frequency	Fixed frequency deviation (kHz)	Non-fixed frequency deviation/ setting resolution (kHz)
>40 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.1 to 20.0	0 to 20.0 / 0.1
	20.1 to 99.9	0 to 99.9 / 0.1
	100	0 to 100 / 1
	101 to 400	0 to 400 / 1
40 to <80 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 25.0	0 to 25.0 / 0.1
	25.1 to 99.9	0 to 99.9 / 0.1
	100	0 to 100 / 1
80 to <160 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.1 to 50.0	0 to 50.0 / 0.1
	50.1 to 99.9	0 to 99.9 / 0.1
	100 to 200	0 to 200 / 1
160 to <320 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.1 to 20.0	0 to 20.0 / 0.1
	20.1 to 99.9	0 to 99.9 / 0.1
	100	0 to 100 / 1
	101 to 400	0 to 400 / 1
320 to <640 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.1 to 20.0	0 to 20.0 / 0.1
	20.1 to 40.0	0 to 40.0 / 0.1
	40.1 to 99.9	0 to 99.9 / 0.1
	100 to 200	0 to 200 / 1
	201 to 800	0 to 800 / 1

Table 4-2 FM Variable Range at Fixed INT/EXT (Cont'd)

Carrier frequency	Fixed frequency deviation (kHz)	Non-fixed frequency deviation/ setting resolution (kHz)
640 to <1280 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.1 to 20.0	0 to 20.0 / 0.1
	20.1 to 40.0	0 to 40.0 / 0.1
	40.1 to 80.0	0 to 80.0 / 0.1
	80.1 to 99.9	0 to 99.9 / 0.1
	100 to 400	0 to 400 / 1
	401 to 999	0 to 999 / 1
	1000 to 1600	0 to 1600 / 10
≧1280 MHz	0.00 to 0.50	0 to 0.50 / 0.01
	0.51 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.1 to 20.0	0 to 20.0 / 0.1
	20.1 to 40.0	0 to 40.0 / 0.1
	40.1 to 80.0	0 to 80.0 / 0.1
	80.1 to 99.9	0 to 99.9 / 0.1
	100 to 160	0 to 160 / 1
	161 to 800	0 to 800 / 1
	801 to 999	0 to 999 / 1
	1000 to 3200	0 to 3200 / 10

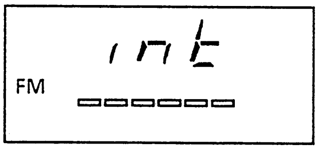
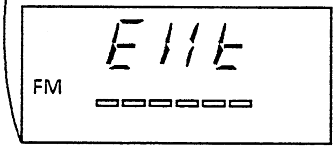
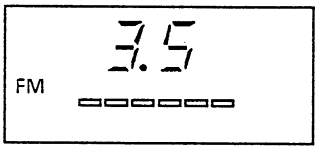
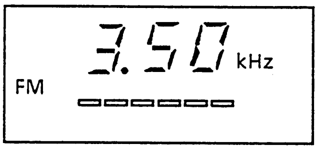
Table 4-3 ΦM Variable Range at Fixed INT/EXT

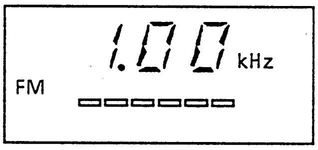
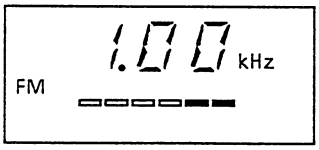
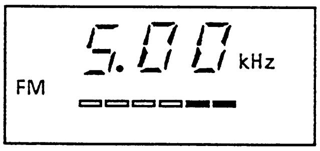
Carrier frequency	Fixed frequency deviation (kHz)	Non-fixed frequency deviation/ setting resolution (kHz)
>40 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 2.00	0 to 2.00 / 0.01
	2.01 to 4.00	0 to 4.00 / 0.01
	4.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 20.0	0 to 20.0 / 0.1
	20.1 to 80.0	0 to 80.0 / 0.1
40 to <80 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 5.00	0 to 5.00 / 0.01
	5.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 20.0	0 to 20.0 / 0.1
80 to <160 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 2.00	0 to 2.00 / 0.01
	2.01 to 9.99	0 to 9.99 / 0.01
	10.0	0 to 10.0 / 0.1
	10.0 to 40.0	0 to 40.0 / 0.1
160 to 320 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 2.00	0 to 2.00 / 0.01
	2.01 to 4.00	0 to 4.00 / 0.01
	4.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 20.0	0 to 20.0 / 0.1
	20.1 to 80.0	0 to 80.0 / 0.1
320 to <640 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 2.00	0 to 2.00 / 0.01
	2.01 to 4.00	0 to 4.00 / 0.01
	4.01 to 8.00	0 to 8.00 / 0.01
	8.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 40.0	0 to 40.0 / 0.1
	40.1 to 99.9	0 to 99.9 / 0.1
	100 to 160	0 to 160 / 1

Table 4-3 ΦM Variable Range at Fixed INT/EXT (Cont'd)

Carrier frequency	Fixed frequency deviation (kHz)	Non-fixed frequency deviation/ setting resolution (kHz)
640 to <1280 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 2.00	0 to 2.00 / 0.01
	2.01 to 4.00	0 to 4.00 / 0.01
	4.01 to 8.00	0 to 80.0 / 0.01
	8.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 16.0	0 to 16.0 / 0.1
	16.1 to 80.0	0 to 80.0 / 0.1
	80.1 to 99.9	0 to 99.9 / 0.1
	100 to 320	0 to 320 / 1
≧1280 MHz	0.00 to 0.10	0 to 0.10 / 0.01
	0.11 to 1.00	0 to 1.00 / 0.01
	1.01 to 2.00	0 to 2.00 / 0.01
	2.01 to 4.00	0 to 4.00 / 0.01
	4.01 to 8.00	0 to 8.00 / 0.01
	8.01 to 9.99	0 to 9.99 / 0.01
	10.0 to 16.0	0 to 16.0 / 0.1
	16.1 to 32.0	0 to 32.0 / 0.1
	32.1 to 99.9	0 to 99.9 / 0.1
	100 to 160	0 to 160 / 1
	161 to 640	0 to 640 / 1

Example: Fix the FM internal frequency deviation to 3.5 kHz and change the FM external (AC) requency deviation from 1 to 5 kHz at 0.01 kHz resolution.

Step		Procedure
1	FM/ØM [INT] [EXT AC] [EXT DC FREQ CAL]	Press each key to light both the [INT] and [EXT AC] LEDs. (FM modulation input mode is set to the INT and EXT AC simultaneous modulation mode.)
2	[SPECIAL] [2] [6]	Enters the internal deviation fixing mode.  (***Note:*** For external fixing mode )
3	[3] [•] [5]	Input data for internal frequency deviation fixing. 
4	[kHz/mV]	Press unit key. (The internal frequency deviation is fixed to 3.5 kHz, and the external frequency deviation is displayed.) 

Step		Procedure
5	[FM/ØM] [1] [kHz/mV]	Set FM deviation is set to 1 kHz.  At this time, the internal frequency deviation is 3.5 kHz, and the external frequency deviation is 1 kHz.
6	RESOLUTION [≫]	Press and hold RESOLUTION [>] until the resolution digit MONITOR LED lights at the rightmost digit. 
7	ROTARY KNOB	Turn the rotary knob clockwise until 5.00 kHz is obtained.  At this time the internal frequency deviation is 3.5 kHz, but the external frequency deviation is changed to 5 kHz.

4.11.14 INT MOD : NORMAL/ + DC applied/ – DC applied/ ± DC external control (SP30/31/32/33)

When the INT modulation input mode is selected during FM, AM, or ØM modulation, Special Functions 31/32 superimpose the DC voltage corresponding to the internal modulation sine wave signal ± peak value on the signal itself. This shifts the zero crossing value of the modulation signal to either the + or – values of the DC voltage. Special Function 33 permits selection of the voltage polarity by external TTL control signal, which allows you to determine whether the zero crossing value of the modulation signal will be shifted to the positive or negative DC value.

1. [SPECIAL] [3] [0] Sets the internal modulation sine wave signal to normal status (1 kHz, 400 Hz, or AF signal)

2. [SPECIAL] [3] [1] Superimposes the DC voltage corresponding to the sine wave + peak internal modulation signal on to the internal modulation signal.

   At FM : The carrier frequency shifts in the higher direction by the displayed frequency deviation amount.

   At AM : The output level increases by the displayed modulation factor (%) amount.

   $$\text{Increase in output level} = 20 \log_{10} \left(\frac{\text{AM mod.factor} + 100}{100} \right)$$

   At ØM : The phase of the carrier frequency leads by the displayed phase deviation amount.

3. [SPECIAL] [3] [2] Superimposes the DC voltage corresponding to the sine wave – peak internal modulation signal on to the internal modulation signal. The MODULATION display indicates a negative value.

   At FM : The carrier frequency shifts in the lower direction by the displayed frequency deviation amount.

   At AM : The output level decreases by the displayed modulation factor (%) amount.

   $$\text{Decrease in output level} = 20 \log_{10} \left(\frac{-\text{AM mod.factor} + 100}{100} \right)$$

   At ØM : The phase of the carrier frequency lags by the displayed phase deviation amount.

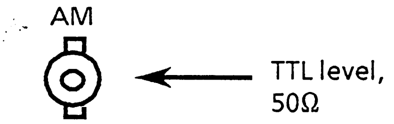
4. [SPECIAL] [3] [3] Switches the plus and minus peak voltages to be superimposed in synchronization with an external TTL control signal.

At FM : The binary FSK signal is obtained.

At AM : The PAM signal is obtained.

At ∅M : The binary PSK signal is obtained.

The external control signal is input on the TTL level from the AM INPUT of the MODULATION. At this time AM EXT DC and EXT AC cannot be set. (When EXT DC or EXT AC is on, it is forcibly turned off.)



H level : Superimposes + peak voltage

L level : Superimposes – peak voltage

When the external control signal is L level, the minus (–) mark lights on the MODULATION display.

4.11.15 MOD OUTPUT : Automatic switching/INT fixed/AM EXT fixed/FM·∅M EXT fixed (SP35/36/37/38)

The modulation signal output from the MOD OUTPUT connector is usually switched automatically according to the modulation setting status (SP35), but Special Functions 36/37/38 produce any desired modulation signal regardless of the modulation setting status.

1. [SPECIAL] [3] [5] Switches the modulation output automatically.
2. [SPECIAL] [3] [6] Outputs the internal modulation signal.
3. [SPECIAL] [3] [7] Outputs the AM external modulation signal.
4. [SPECIAL] [3] [8] Outputs the FM or ∅M external modulation signal.

4.11.16 Sweep blanking output : Positive /negative logic (SP43/44)

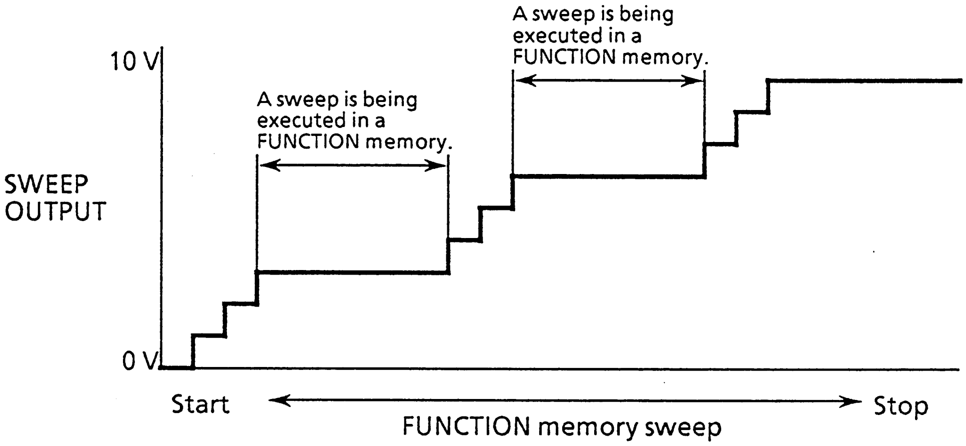
Special Functions 43/44 switch the BLANKING output logic on the rear panel.

1. [SPECIAL] [4] [3] Obtains positive logic
2. [SPECIAL] [4] [4] Obtains negative logic

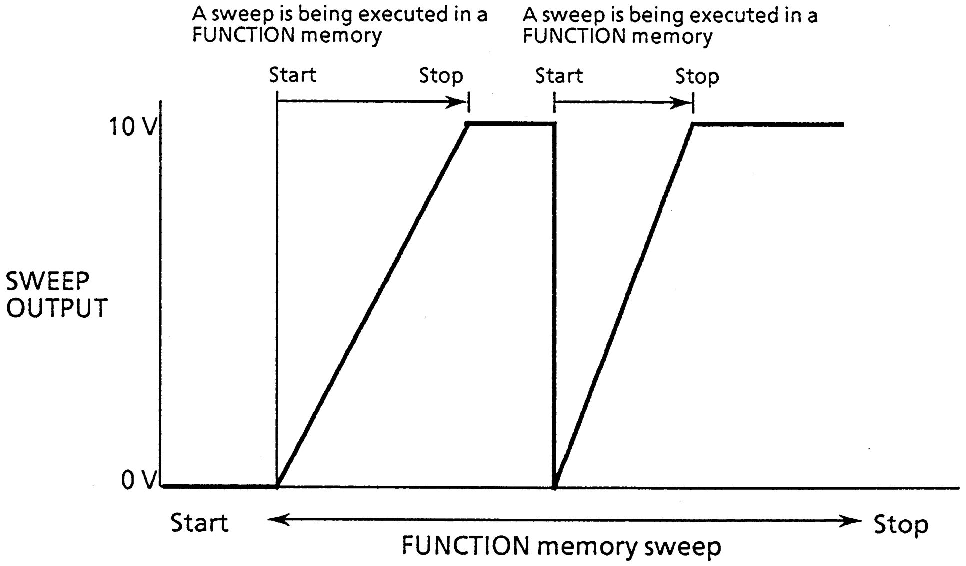
4.11.17 FUNCTION-memory sweep : sweep output pattern 1/pattern 2 (SP45/46)

Special Functions 45/46 select the SWEEP OUTPUT signal pattern when a sweep function is included in a FUNCTION memory to execute the FUNCTION memory sweep.

1. [SPECIAL] [4] [5] Outputs the SWEEP OUTPUT according to the FUNCTION memory sweep setting. SWEEP OUTPUT does not change while a sweep is being executed in a FUNCTION memory.



2. [SPECIAL] [4] [6] SWEEP OUTPUT occurs during a FUNCTION memory sweep.



4.11.18 Trigger (SP56/57/58)

Special functions 56/57/58 start the preset trigger program through the GP-IB or TRIGGER connector (on the rear panel) from an external device. The trigger pulse is TTL negative logic. The trigger program can be edited with panel key data except for the [LOCAL], [PANEL LOCK], [STATUS], [SPECIAL], [MANUAL], rotary knob, and POWER switch. Up to 99-step programs may be created.

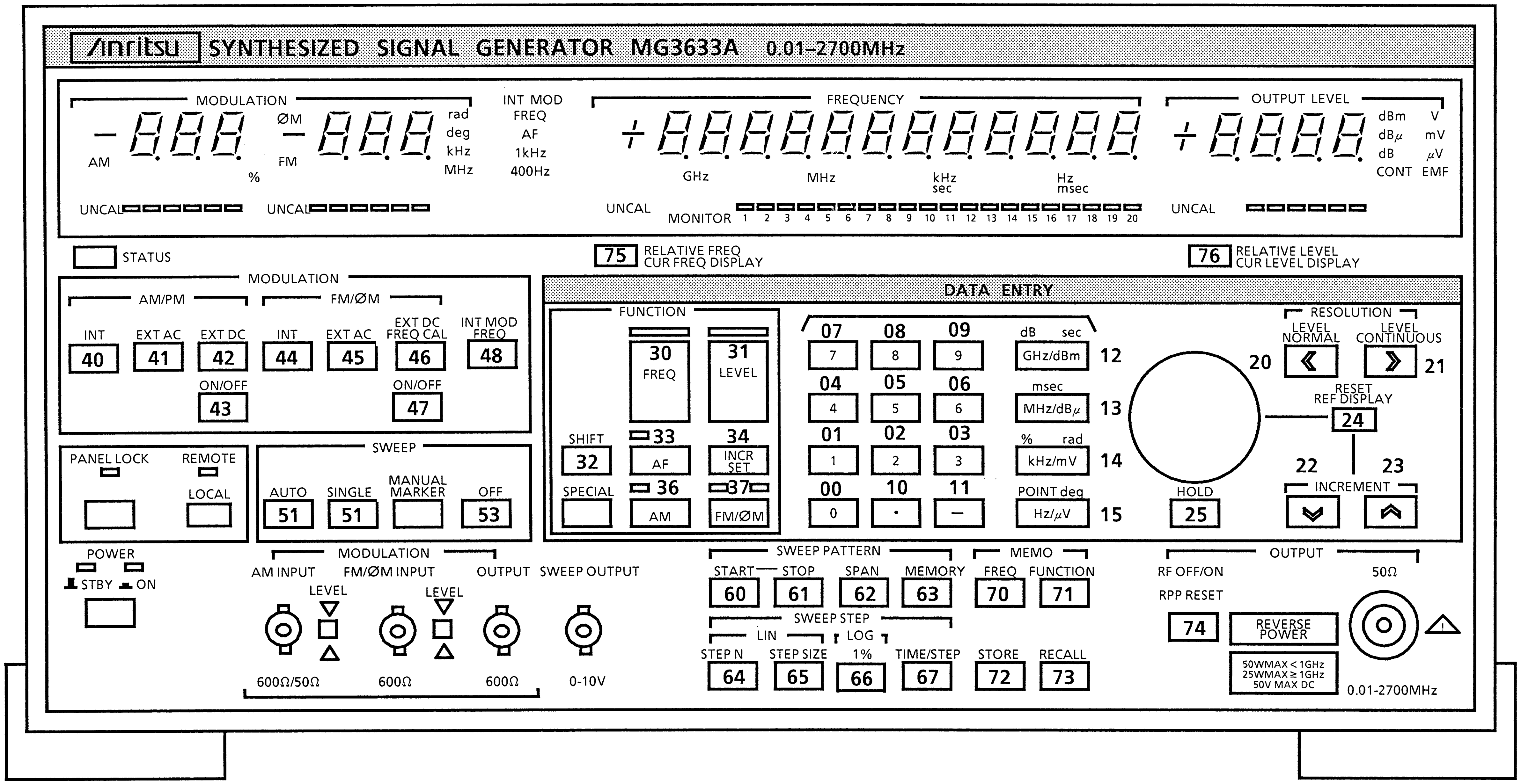
1. [SPECIAL] [**5**] [**6**] Sets trigger program editing status. Press [STATUS] to terminate program editing.
2. [SPECIAL] [**5**] [**7**] Erases the trigger program.
3. [SPECIAL] [**5**] [**8**] Starts the trigger program. (Used to check trigger program.)

Each time panel key data is entered while the trigger program is edited, address and key cords (corresponding to panel keys, shown on the next page) are automatically displayed on the FREQUENCY display.

Note: SWEEP [AUTO] has the same cord as that of [SINGLE]. Trigger program interprets [AUTO] as [SINGLE] to prevent the program from repeating sweep forever.

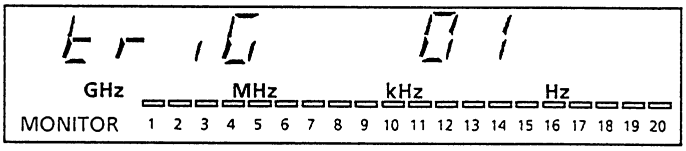
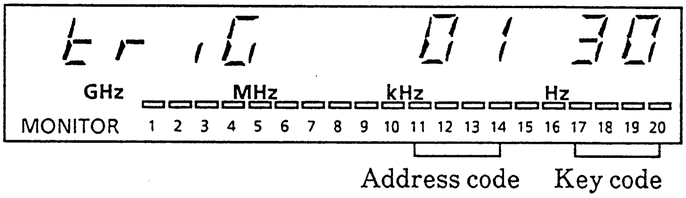
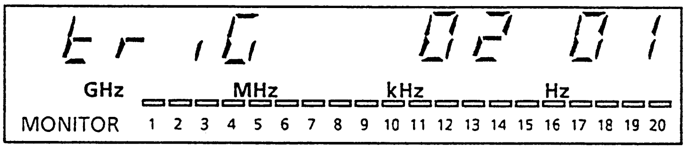
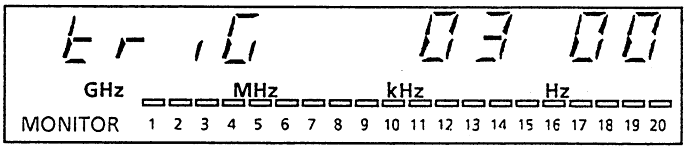
(Blank)

Table 4-2 Key Cords Corresponding to Panel Keys



(Blank)

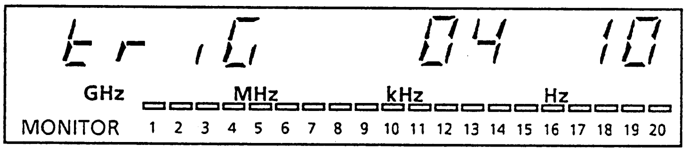
Example: Use trigger to start a single-mode sweep with a 10.7 MHz center frequency, 1 MHz span, 10kHz step size, and a 200 ms time/step.

Step		Procedure
1	[SPECIAL] [2] [0]	Set the mode for programming the trigger program. 
2	[FREQ]	Press [FREQ]. 
3	[1]	Press [1]. 
4	[0]	Press [0]. 

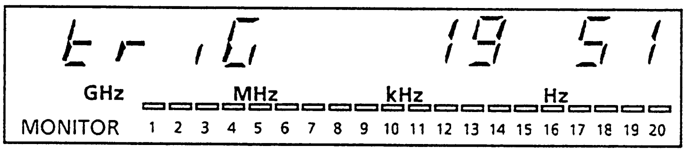
Step **Procedure**

5 [●] [7] [MHz/dBμ] [SPAN] [1]
[MHz/dBμ] [STEP SIZE] [1] [0] [kHz/mV]
[TIME/STEP] [2] [0] [0] [msec]
[SINGLE]

Press [·].



Press [SINGLE].

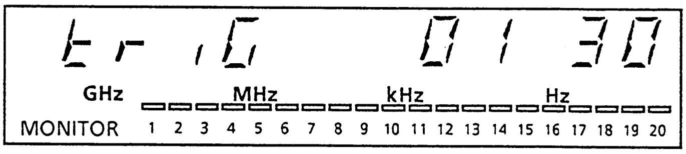


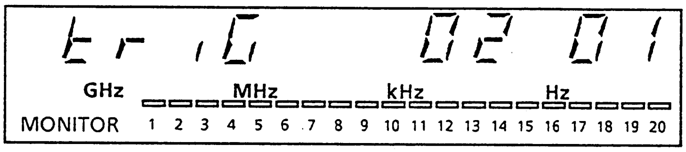
6 [STATUS] Terminates the mode for programming the trigger program.

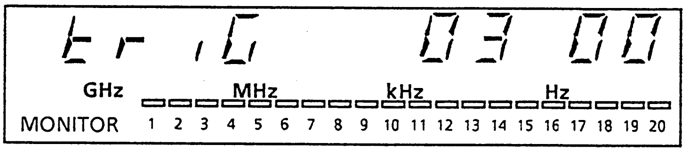
The contents of the trigger program can be checked with the following key operation.

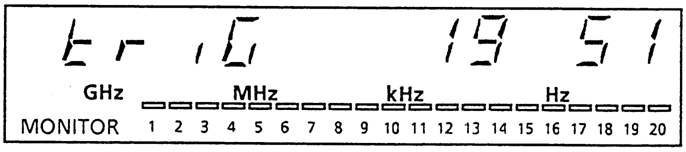
[SPECIAL] [5] [6] [STATUS]
↑
Press and hold.

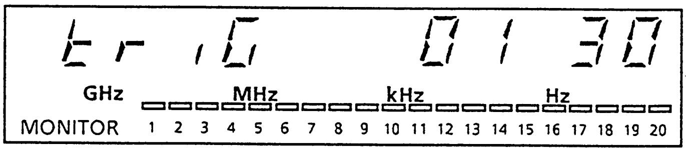
The key code is displayed sequentially from address code 01.

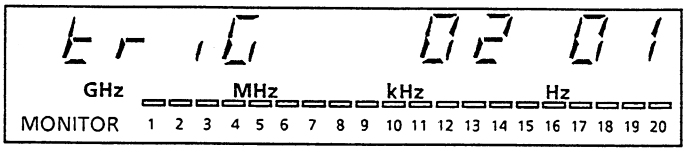












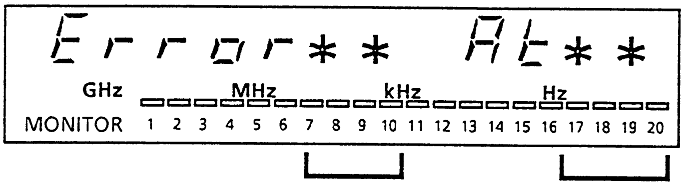
- When the trigger program is set again, clear the trigger data by pressing [SPECIAL] [5] and [7].
- When the key input follows [SPECIAL] [5] and [6] without clearing the data, the program can be edited following the address programmed up to then.
- The [HOLD] of the panel key data, when executed, means to halt the trigger.

  The trigger program halted with the [HOLD] position is resumed at the next trigger pulse.

- Key input from the panel is disabled during trigger program execution.

  However, trigger program execution can be halted by pressing [LOCAL].

- If an error occurs during trigger program execution, the trigger program is halted and the [STATUS] LED lights. When [STATUS] is pressed at this time, the following error message is displayed on the FREQUENCY display.



Status code

Address of trigger program where error occurred

- If there is no key input for approx. 30 seconds while the trigger program is edited, the trigger program is released and the MG3633A returns to normal operating status.

4.11.19 GP-IB : Talker data with/without header (SP60/61)

Special Functions 60/61 select if the data has header when the MG3633A becomes a talker.

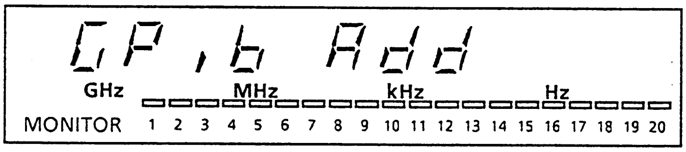
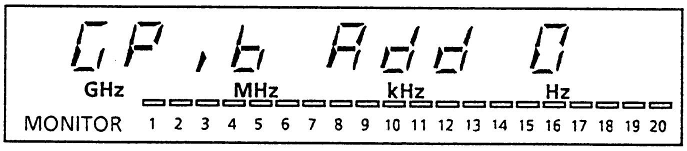
1. [SPECIAL] [6] [0] Gives data with header.
2. [SPECIAL] [6] [1] Gives data without header.

4.11.20 GP-IB : Address setting (SP62)

Special Function 62 sets a GP-IB address.

[SPECIAL] [6] [2] $\underbrace{[\ast]\ [\ast]}_{\text{GP-IB address}}$ Input a two-digit number after pressing [SPECIAL] [6] [2].

Example: Set GP-IB address to "07".

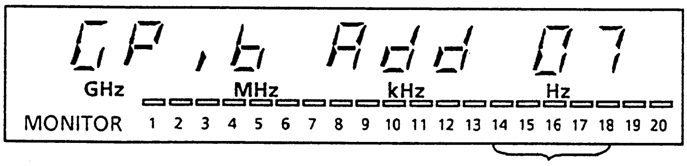
Step		Procedure
1	[SPECIAL] [6] [2]	
2	[0]	
3	[7]	The FREQUENCY display returns to the original display immediately after the second digit is input.

The GP-IB address setting range is 00 to 30. The GP-IB address is set to 03 at factory-shipment.

4.11.21 GP-IB : Address display (SP63)

Special Function 63 displays set GP-IB address.

[SPECIAL] [6] [3]
↑
Press and hold.



GP-IB address

4.11.22 GP-IB : ONLY mode (SP64 to 68)

Special Functions 65 to 68 allow the MG3633A to operate in ONLY mode. (See the separate GP-IB manual for the only-mode details.)

1. [SPECIAL] [6] [4] Turns off the ONLY mode.
2. [SPECIAL] [6] [5] Sets the frequency talk only mode.
3. [SPECIAL] [6] [6] Sets the output level talk only mode.
4. [SPECIAL] [6] [7] Sets both the frequency and output level talk only mode.
5. [SPECIAL] [6] [8] Sets the listen only mode.

4.11.23 SRQ MASK (SP70 to 80)

Special Functions 70 to 80 give SRQ mask functions.

1. [SPECIAL] [7] [0] Masks all SRQs.
2. [SPECIAL] [7] [1] Turns off error mask.
3. [SPECIAL] [7] [2] Turns off busy/ready mask.
4. [SPECIAL] [7] [3] Turns off malfunction mask.
5. [SPECIAL] [7] [4] Turns off self-test mask.
6. [SPECIAL] [7] [5] Turns off suspension-error mask.
7. [SPECIAL] [7] [6] Turns off data-error mask.
8. [SPECIAL] [7] [7] Turns off trigger-program-end.
9. [SPECIAL] [7] [8] Turns off sweep-end mask.
10. [SPECIAL] [7] [9] Turns off marker-position mask.
11. [SPECIAL] [8] [0] Turns off strings-end mask.

4.11.24 FREQ-memory clear (SP81)

See paragraph 4.9.4.

4.11.25 FUNCTION-memory clear (SP82)

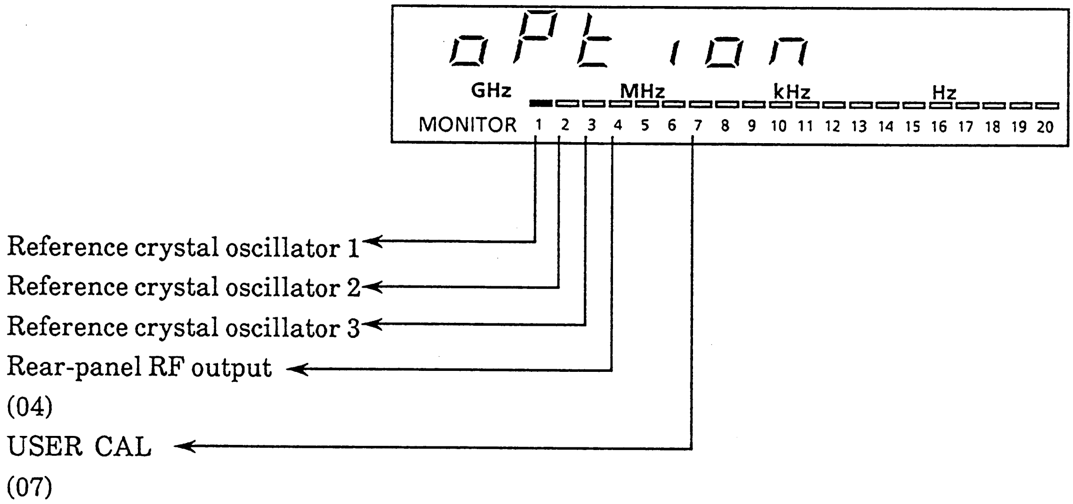
See paragraph 4.9.4.

4.11.26 Option display (SP83)

Special Function 83 produces the option setting display using the MONITOR LED of the FREQUENCY display.

[SPECIAL] [8] [3]

Press and hold.



The corresponding MONITOR LED is lit when an option is mounted.

4.11.27 Output level correction : Normal/CAL data 1 (option 07)/CAL data 2 (option 07) (SP86/87/88)

Special Functions 86/87/88 select the correction data of the output-level frequency characteristic.

1. [SPECIAL] [8] [6] Sets output level compensation to normal status to correct the output level at the OUTPUT connector on the front panel.
2. [SPECIAL] [8] [7] Corrects the output level with user CAL data 1.
3. [SPECIAL] [8] [8] Corrects the output level with user CAL data 2.

User-determined correction data can be written for the user CAL data 1 and 2 using a power meter and a GP-IB controller when option 07 is fitted. This is used to determine the output level at the cable end, etc. At factory-shipment, the data is written for user CAL data 1 and 2 so that the output level is maximum for all the frequency ranges.

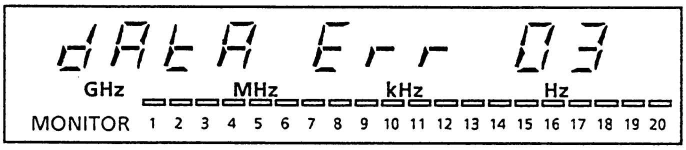
For writing user CAL data 1 and 2, refer to operation manual (Appendix C) for explanation of user CAL option.

4.12 STATUS

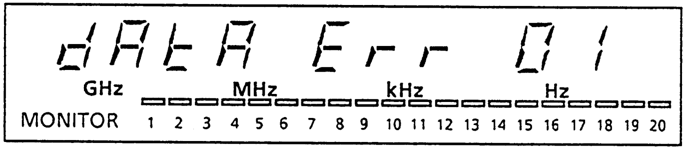
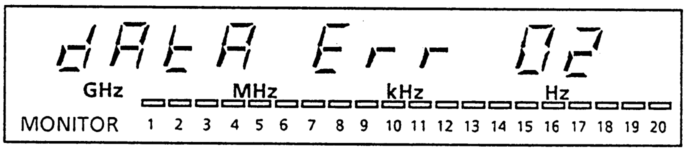
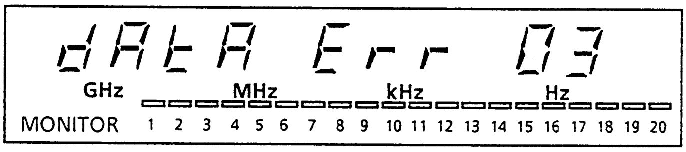
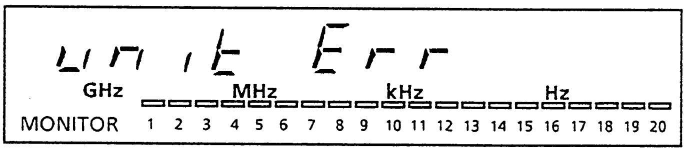
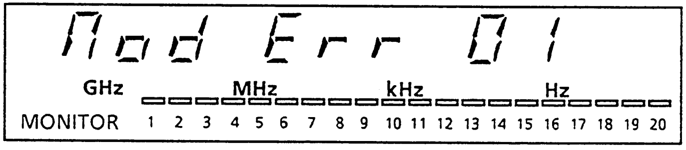
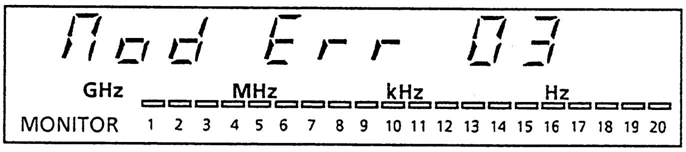
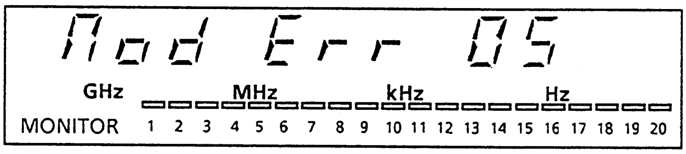
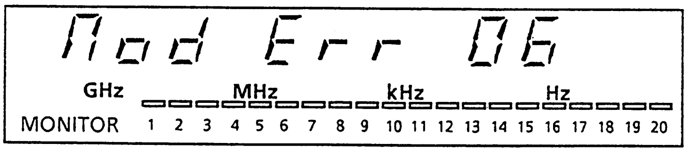
When an attempt is made to set a function item outside the prescribed range, the [STATUS] LED blinks.

If [STATUS] is pressed at this time, a status (error) message is shown on the FREQUENCY display while the key is pressed.

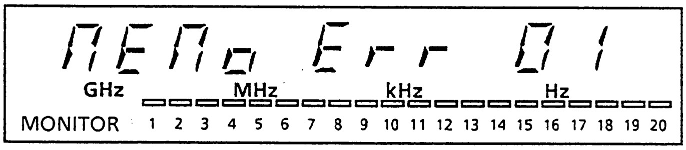
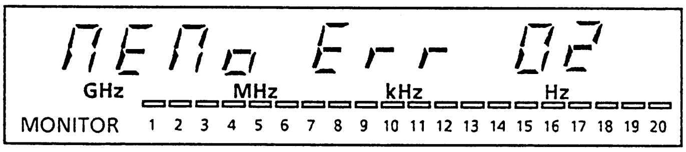
Status messages and codes are listed in the following table.



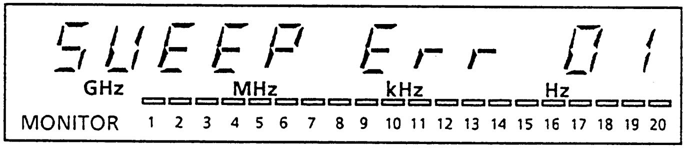
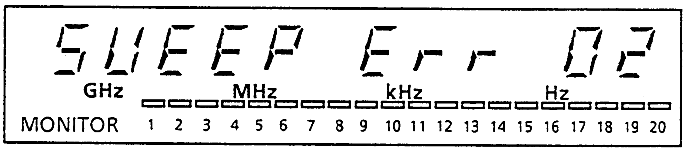
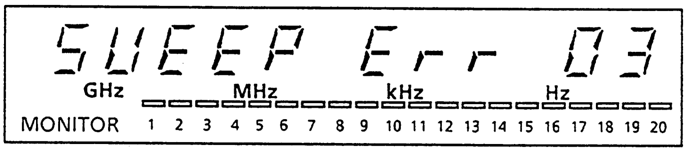
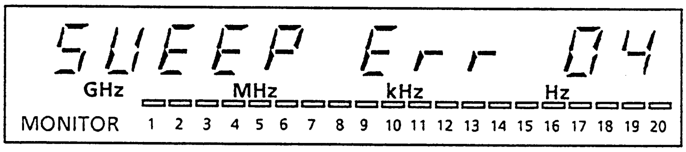
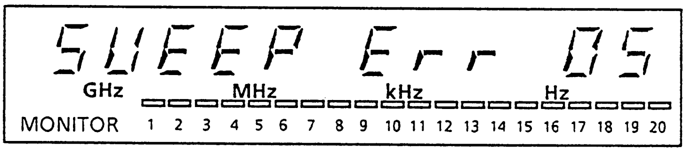
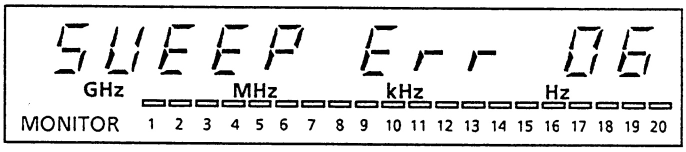
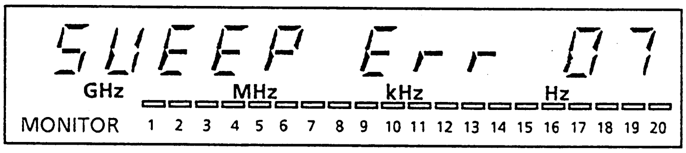
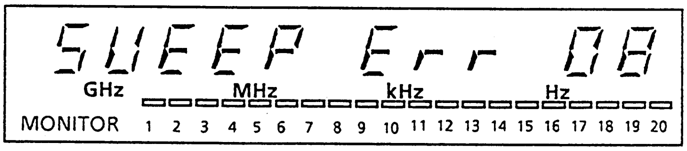
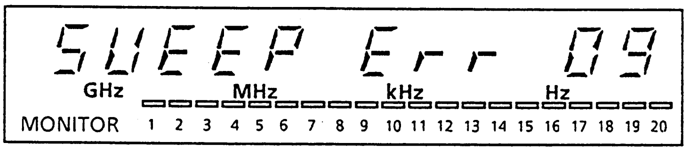
Status Messages and Codes (1/7)

Function	Contents	Message	Status code
ALL FUNCTION	Number of input data digits overflow		01
	Error input		02
	Data setting over-range		03
	Unit error		04
MODULATION	INT MOD FREQ selected in INT MOD OFF status		11
	AM EXT AC/DC selected at SP33		13
	Maximum frequency/phase deviation exceeded at SP26 and 27		15
	FREQ CAL performed at FM EXT DC OFF		16

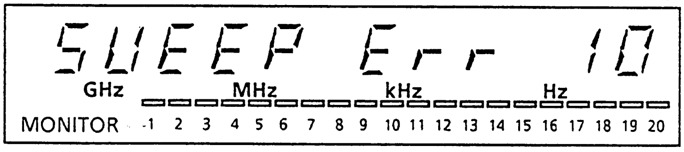
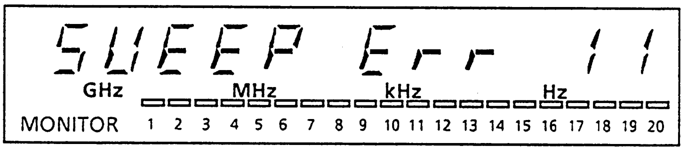
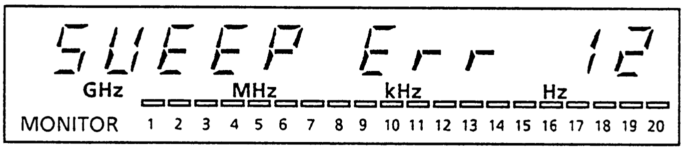
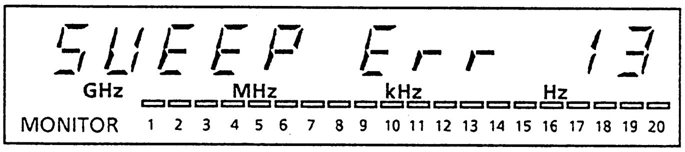
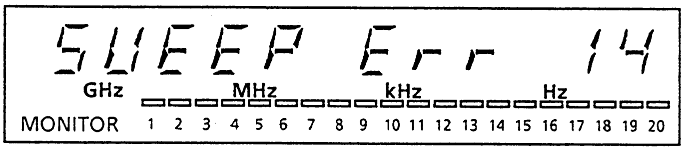
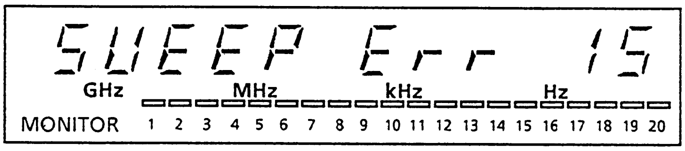
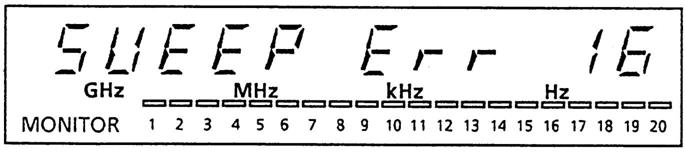
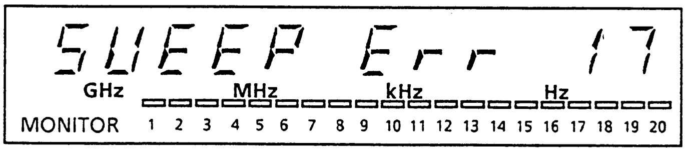
Status Messages and Codes (2/7)

Function	Contents	Message	Status code
MEMORY	Storing and clearing at memory-protect		21
	Error at memory recall		22

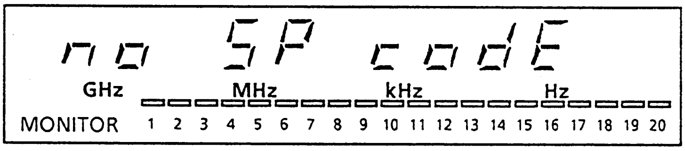
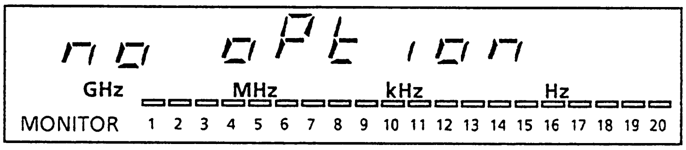
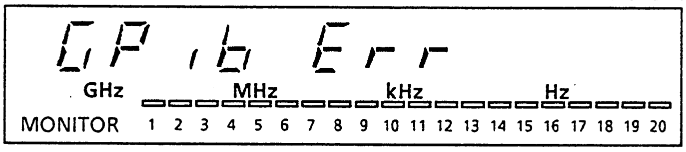
Status Messages and Codes (3/7)

Function	Contents	Message	Status code
SWEEP	START=STOP		31
	|STOP−START| <STEP SIZE		32
	SPAN <STEP SIZE		33
	$\text{CENTER}-\frac{\text{SPAN}}{2}$ <lower limit		34
	$\text{CENTER}+\frac{\text{SPAN}}{2}$ >upper limit		35
	LOG sweep START×1.01 >STOP		36
	Memory-sweep data format error		37
	Number of FREQ memory sweep steps overflow		38
	Number of FUNCTION-memory sweep steps overflow		39

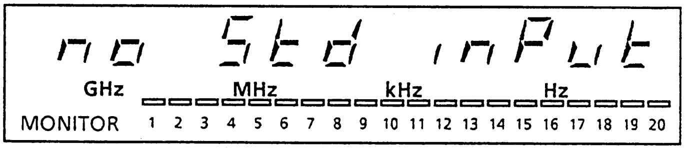
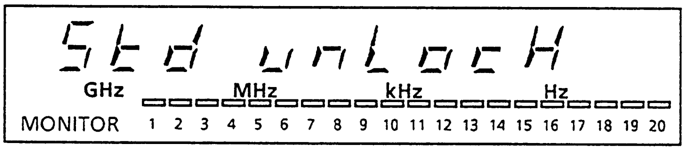
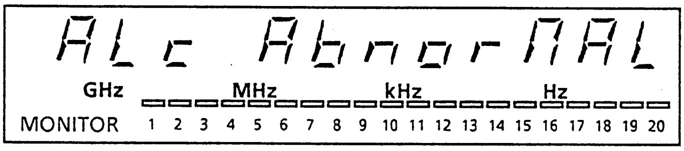
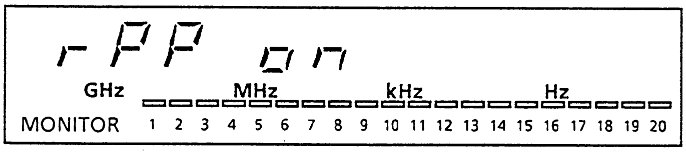
Status Messages and Codes (4/7)

Function	Contents	Message	Status code
SWEEP	Sweep step set in output-level sweep mode		40
	Marker on at manual sweep		41
	Sweep mode and sweep start set except for FREQ, OUTPUT LEVEL and AF		42
	LOG 1% set with CENTER-SPAN sweep		43
	$\frac{\lvert STOP-START \rvert}{N}$ <minimum resolution		44
	|STOP level-START level| >20 dB		45
	Without data for memory sweep		46
	LOG sweep over-range		47

Status Messages and Codes (5/7)

Function	Contents	Message	Status code
SPECIAL FUNCTION	Special function not registered		51
OPTION	Unavailable option set		56
GP-IB	Read error		61

Status Messages and Codes (6/7)

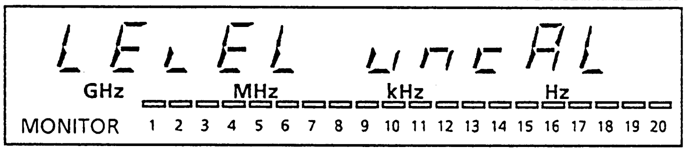
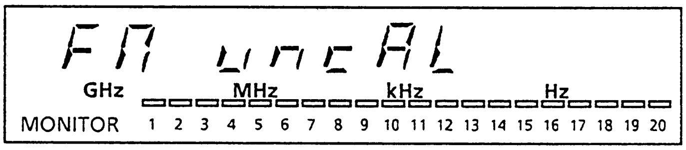
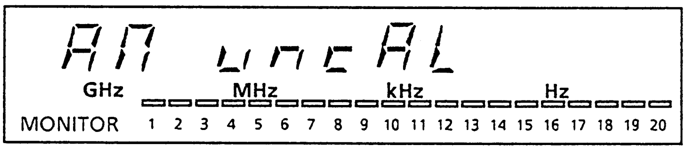
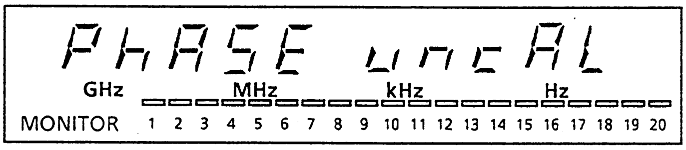
<table>
<tr><th>Function</th><th>Contents</th><th>Message</th><th>Status code</th></tr>
<tr><td>HARD WARE ERROR</td><td>No reference input signal</td><td>
</td><td>71</td></tr>
<tr><td></td><td>Reference signal unlock</td><td>
</td><td>72</td></tr>
<tr><td></td><td>Abnormal output level</td><td>
</td><td>73</td></tr>
<tr><td></td><td>RPP operation</td><td>
</td><td>74</td></tr>
</table>

If there are two or more hardware errors, they are displayed each time the [STATUS] is pressed in the order of the smaller error-code number first.

When status codes 71 and 72 occur, UNCAL in the FREQUENCY display is lit.

When the status codes 73 and 74 occur, UNCAL in the OUTPUT LEVEL display is lit.

Status Messages and Codes (7/7)

Function	Contents	Message	Status code
UNCAL	LEVEL		91
	FM		92
	AM		93
	ØM		94
		Status is always set during UNCAL. If another error occurs, that error has priority. If there are two or more UNCALs, they are displayed each time [STATUS] is pressed in the order: LEVEL, FM, ØM, and AM.	

4.12.1 Status messages related to all functions

When incompatible data input is attempted, the [STATUS] LED lights.

The new data is not set and the data remains as it was.

The [STATUS] LED is turned off by pressing [STATUS] or when any key other than data or unit keys is pressed.

(1) DATA ERROR 01 (status code 01)

When the number of data digits input is excessive, the [STATUS] LED lights.

- Items displayed on FREQUENCY display
  Carrier frequency: 13 or more digits (except ± sign)
  AF: 10 or more digits
- Item displayed on OUTPUT LEVEL display
  Output level: 5 or more digits (excluding ± sign)
- Items displayed on MODULATION display
  Modulation factor and deviation: 4 or more digits

(2) DATA ERROR 02 (status code 02)

An error occurs and the [STATUS] LED lights when the input data is as follows:

- When [–] is pressed other then before numeric data input
- When [•] is pressed two or more times during data input
- When [–] is pressed during AM, FM, and ØM modulation factor setting

(3) DATA ERROR 03 (status code 03)

When an input value exceeds the data setting range shown on the next page, the [STATUS] LED lights when the units key is pressed. The [STATUS] LED also lights when the range is exceeded when turning the rotary knob or [INCREMENT] keys.

Data Setting Ranges (1/2)

Item		Setting range		Condition	Remarks
		Lower limit	Upper limit		
Frequency	Carrier frequency	0 Hz	2.7 GHz		
	Incremental frequency	0.01 Hz	2.7GHz		
Output level	Output level	−143 dBm	+23 dBm		The upper limit becomes the output level limit at SP06.
		−30 dBμ	+136 dBμ		
		0.032 μV	6.32 V		
		−36 dBμ	+130 dBμ	In SP04	
		0.016 μV	3.16 V		
	Incremental output level	0.1 dB	166 dB		
AF frequency	AF frequency	0.1 Hz	100 kHz		
	AF incremental frequency	0.1 Hz	99.999 9 kHz		
Modulation	FM frequency deviation	0 Hz	3.2 MHz		
	AM modulation factor	0 %	100 %		
	ØM phase deviation	0 rad 0 deg	640 rad 999 deg		
Memory	FREQUENCY memory address	0	999		
	FUNCTION memory address	0	99		
Frequency sweep	START/STOP frequency	0 Hz	2.7 GHz		
	SPAN frequency	0.02 Hz	2.7 GHz		
	Number of frequency STEPs	1	2700 000 000 00		
	Frequency STEP SIZE	0.01 Hz	2.7 GHz		
	Frequency sweep time	0.1 ms	600 s		
Output level sweep	START / STOP level	−143 dBm	+23 dBm		The upper limit becomes the output level limit at SP06.
		−30 dBμ	+136 dBm		
		0.032 μV	6.32 V		
		−36 dBμ	+130 dBμ	In SP04	
		0.016 μV	3.16 V		
	SPAN level	0.2 dB	20 dB		
	Output level sweep time	0.1 ms	600 s		

Data Setting Ranges (2/2)

Item		Setting range		Conditions	Remarks
		Lower limit	Upper limit		
AF frequency sweep	START/STOP AF frequency	0.1 Hz	100 kHz		
	SPAN AF frequency	0.2 Hz	99.999 9 kHz		
	Number of AF frequency points	1	999 999		
	AF frequency STEP SIZE	0.1 Hz	99.999 9 kHz		
	AF frequency sweep time	0.1 ms	600 s		
Special function	Carrier frequency offset	−2.7 GHz	2.7 GHz		
	Output level offset	−166 dB	166 dB		
	Output level limit	−143 dBm −30 dBμ 0.032 μV −36 dBμ 0.016 μV	+23 dBm +136 dBμ 6.32 V +130 dBμ 3.16 V	} In SP04	
	GP-IB address	00	30		

(4) UNIT ERROR (status code 04)

The [STATUS] LED lights in the following cases.

1. When a key other than the suitable unit key is pressed during or after the numerical data is input

   The unit keys suitable for each setting item are listed.

Setting item	Unit key			
	dB sec	msec	% rad	POINT deg
	GHz/dB	MHz/dBμ	kHz/mV	Hz/μV
Carrier frequency	○	○	○	○
Incremental frequency	○	○	○	○
Output level	○	○	○	○
Incremental output level	○	×	×	×
AF frequency	○	○	○	○
Incremental AF frequency	○	○	○	○
FM frequency deviation	×	○	○	○
AM modulation factor	×	×	○	×
ØM phase deviation	×	×	○	○
START/STOP frequency	○	○	○	○
SPAN frequency	○	○	○	○
Frequency STEP SIZE	○	○	○	○
START/STOP level	○	○	○	○
SPAN level	○	×	×	×
START/STOP AF frequency	○	○	○	○
SPAN AF frequency	○	○	○	○
AF frequency STEP SIZE	○	○	○	○
Number of sweep points	×	×	×	○
Sweep time	○	○	×	×
Carrier frequency offset	○	○	○	○
Output level offset	○	×	×	×
Output level limit	○	○	○	○
Output level at offset mode	○	×	×	×

○ : Suitable
× : Unsuitable

2. When trying to convert a 17.5 rad or more phase deviation to “deg” display in ØM modulation mode.

4.12.2 UNCAL

When a setting is made for values in a range where performance cannot be guaranteed, the [STATUS] LED lights.

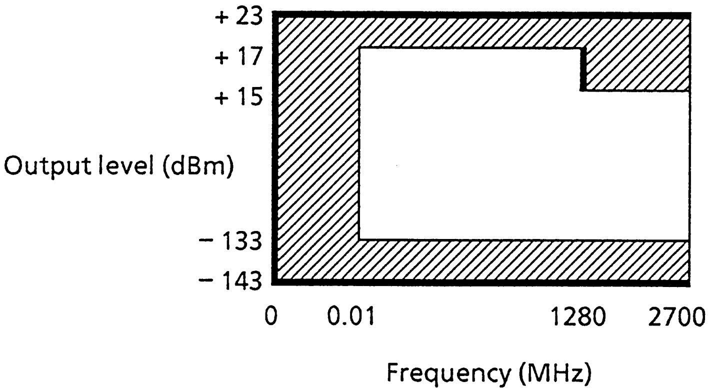
In each UNCAL area shown below, the oblique line extent and the border line of the area marked with the thick solid line are UNCAL areas.

The blank space and the border line of the area marked with the fine solid line are not UNCAL areas.

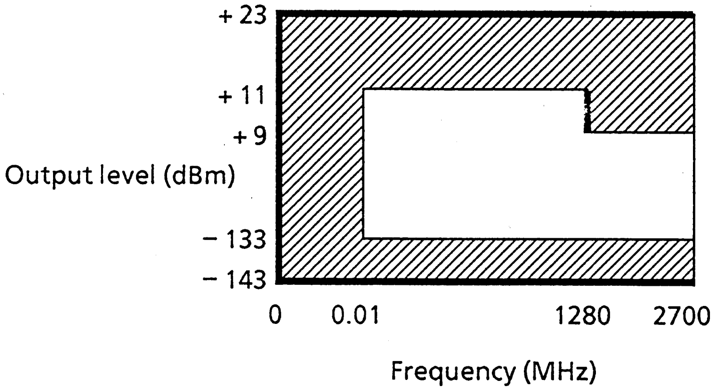
When an UNCAL conditions exists, the UNCAL LED is lit.

(1) UNCAL area for output level (status code 91)

(a) At CW, FM, and ∅M



(b) At AM

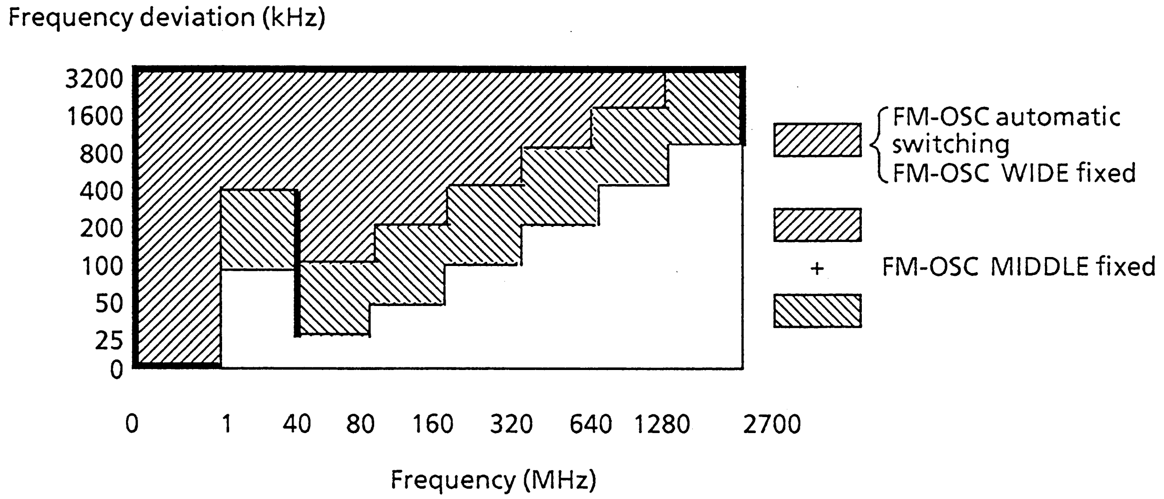


Note: When LEVEL UNCAL is lit, one of the following two status messages appears.

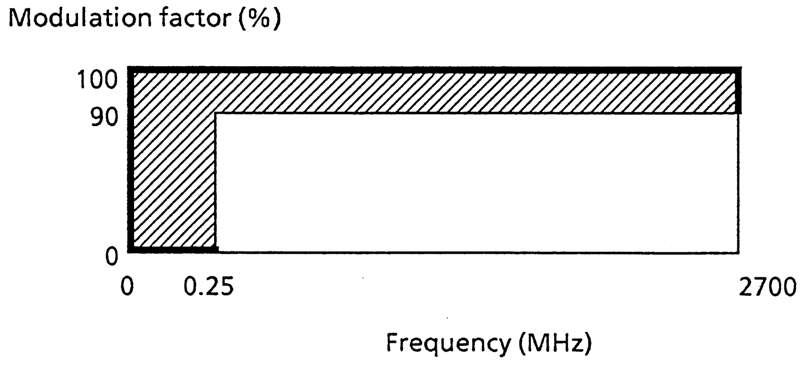
LEVEL uncAL : Level accuracy is not guaranteed. However, level approximate to the indicated value is output.

ALc AbnormAL : Amplifier output ability is exceeded, and the actual output level is less than the indicated value. During this status, output level cannot be increased any more.

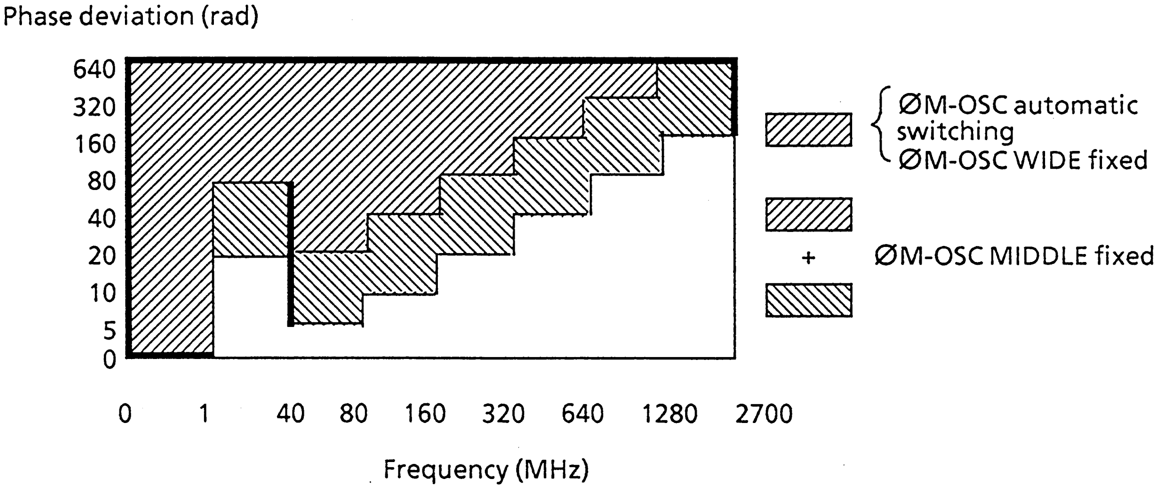
(2) UNCAL area for FM frequency deviation (status code 92)



(3) UNCAL area for AM modulation factor (status code 93)



(4) UNCAL area for ∅M phase deviation (status code 94)



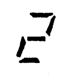
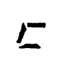
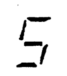
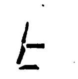
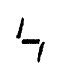
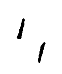
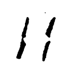
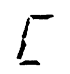
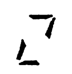
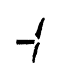
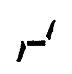
4.13 Panel Lock

All the key and rotary knob inputs except the POWER switch, [LOCAL], and [PANEL LOCK] are disabled.When the [PANEL LOCK] is pressed, the LED lights and panel lock is engaged. When it is pressed again, the LED goes off and the panel lock status is disengaged.

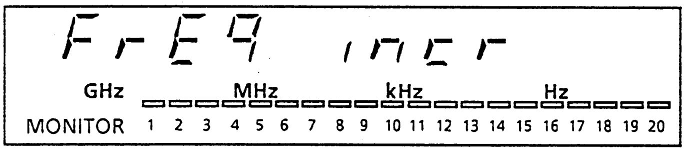
4.14 Message Display by 7-Segment Display

Since the MG3633A displays various messages using a 7-segment displays, the message may sometimes be undecipherable.

The following table is a list of definitions for messages generated in the 7-segment displays.

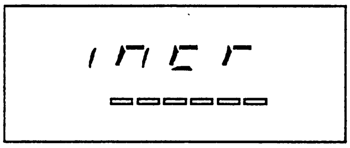
Actual character	7 Segments	Actual character	7 Segments	Actual character	7 Segments	Actual character	7 Segments
0		@		P		SPACE	
1		A		Q		!	
2		B		R		”	
3		C		S		#	
4		D		T		$	
5		E		U		%	
6		F		V		&	
7		G		W		'	
8		H		X		(	
9		I		Y		)	
:		J		Z		*	
;		K		[		+	
<		L		\		,	
=		M		]		—	
>		N		⌒		.	
?		O		_		/	

At data input related to carrier frequency

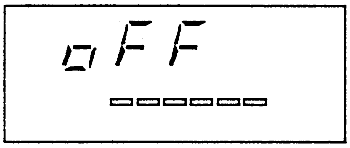


FREQ INCR	Frequency increment

At data input related to output level

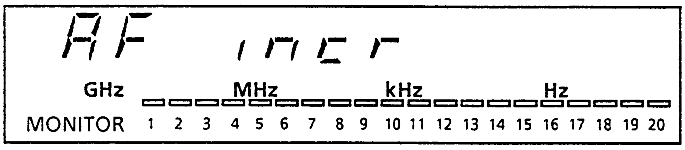


INCR	Output level increment



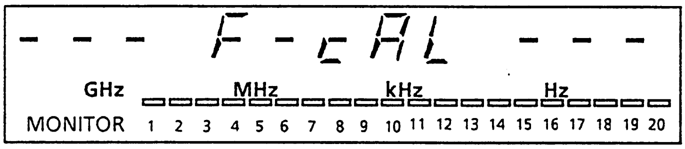
OFF	At RF OFF

At data input related to AF frequency



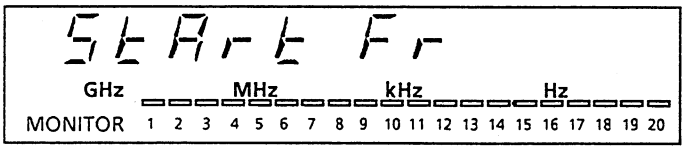
AF INCR	AF-frequency increment

At modulation input

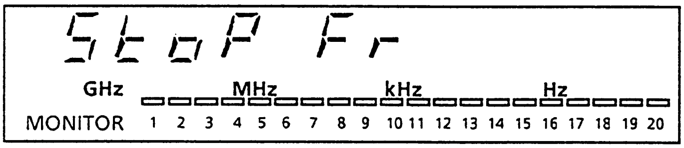


F-CAL	During EXT DC FM frequency calibration

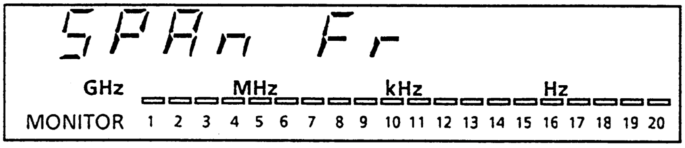
At data input related to sweep



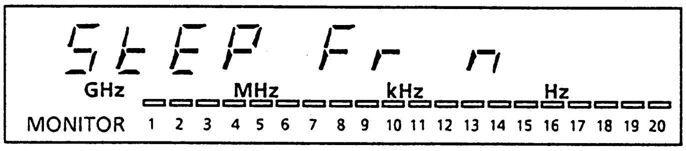
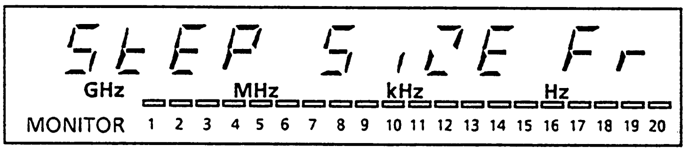
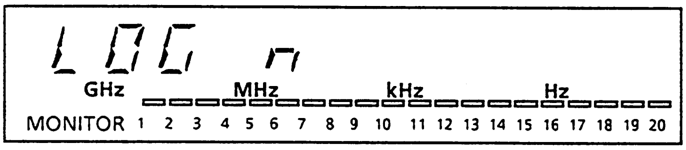
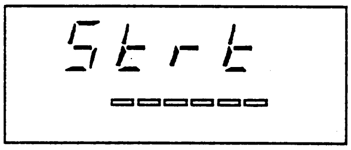
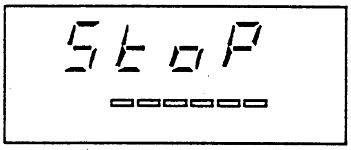
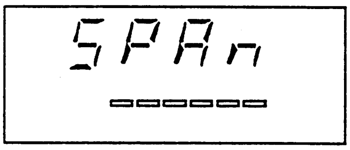
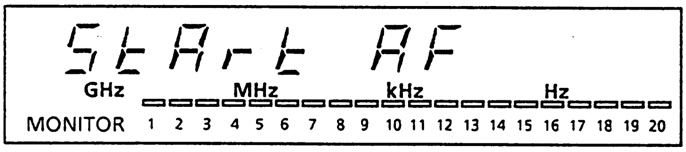
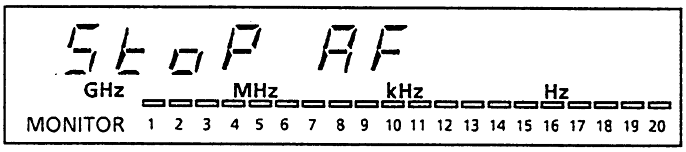
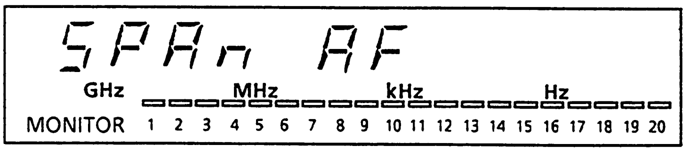
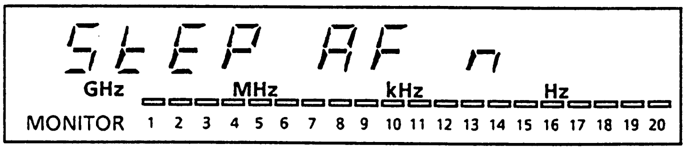
START FR	START frequency

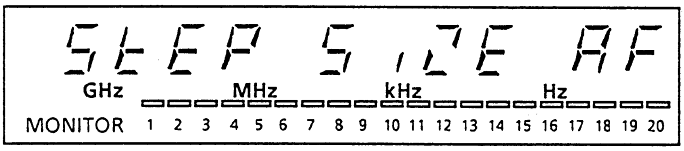
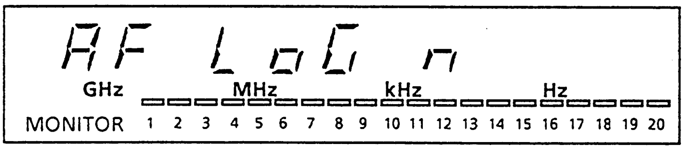
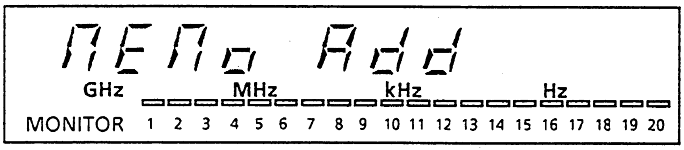
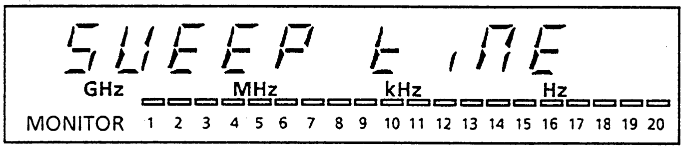
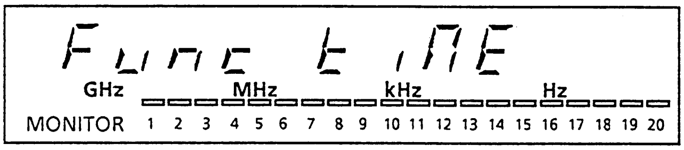


STOP FR	STOP frequency



SPAN FR	SPAN frequency

	STEP FR N	Number of frequency STEPs
	STEP SIZE FR	Frequency STEP SIZE
	LOG N	Number of LOG sweep steps (only for checking)
	STRT	START level
	STOP	STOP level
	SPAN	SPAN level
	START AF	START AF frequency
	STOP AF	STOP AF frequency
	SPAN AF	SPAN AF frequency
	STEP AF N	Number of AF frequency STEPS

	STEP SIZE AF	AF frequency STEP SIZE
	AF LOG N	Number of AF frequency LOG sweep steps (only for checking)
	MEMO ADD	Memory address
	SWEEP TIME	Sweep time
	FUNC TIME	FUNCTION-memory set time

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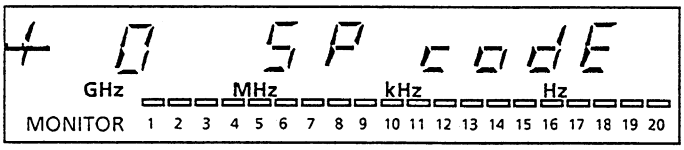
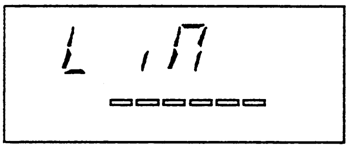
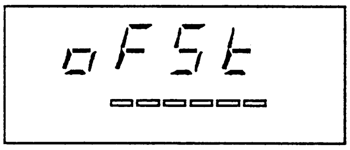
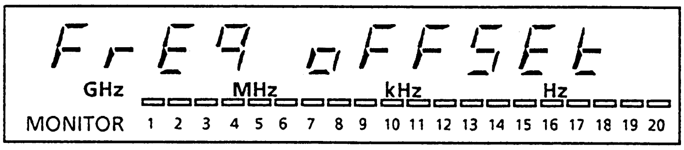
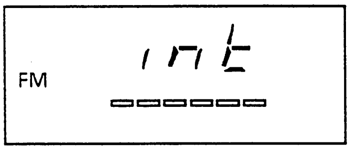
	+0 SP CODE	See paragraph 4.11.1
	LIM	Output level limit
	OFST	Output level offset
	FREQ OFFSET	Frequency offset



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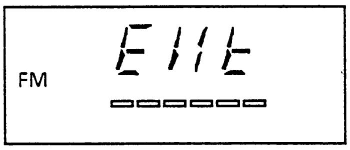

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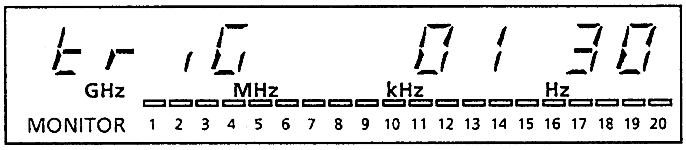

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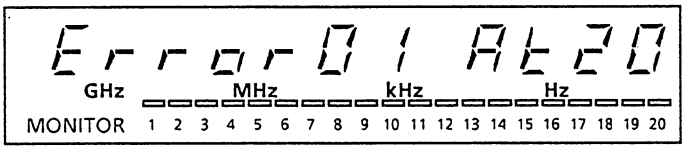

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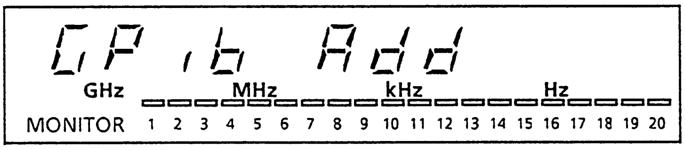

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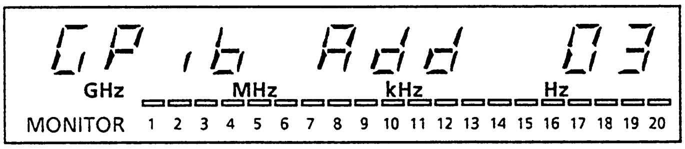

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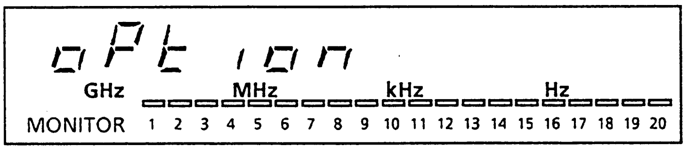
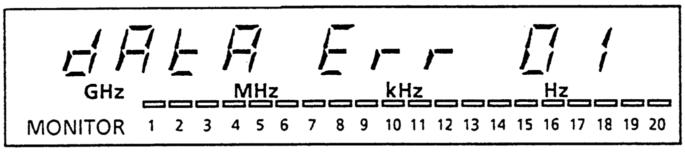


OPTION See paragraph 4.11.26

Related to status



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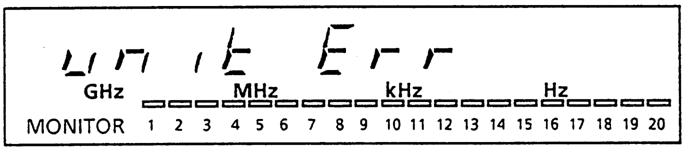

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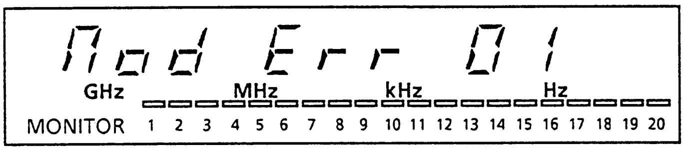

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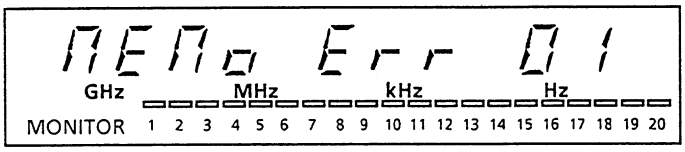

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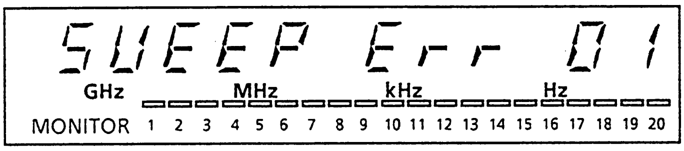

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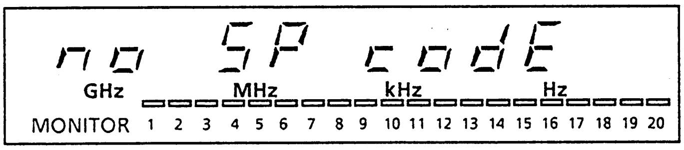

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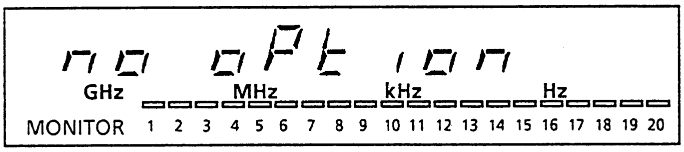

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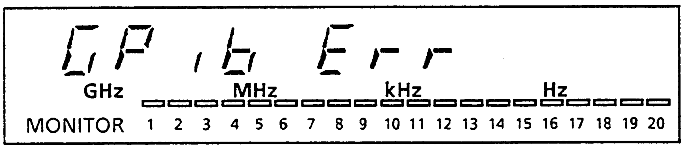
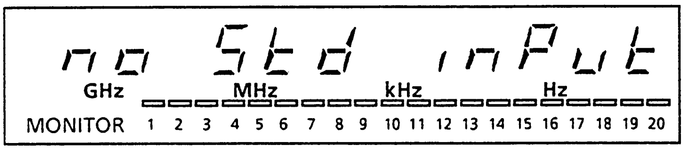


GPIB ERR



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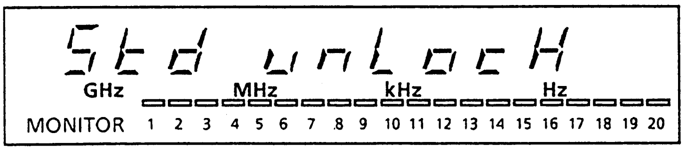

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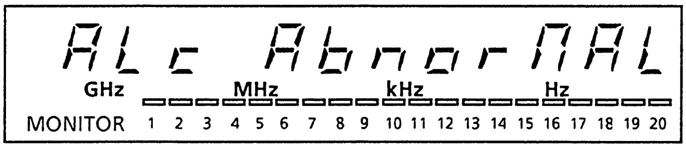

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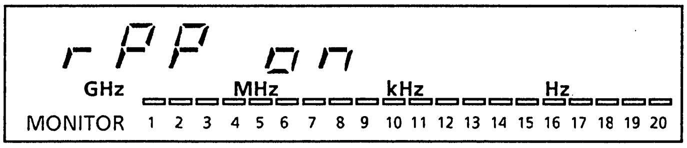

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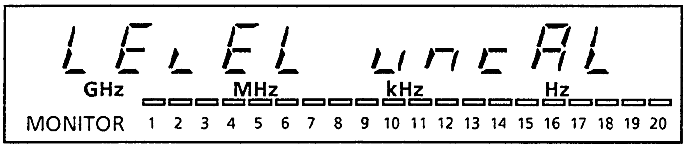

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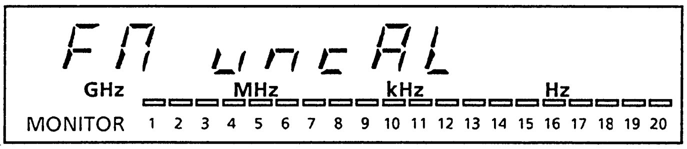
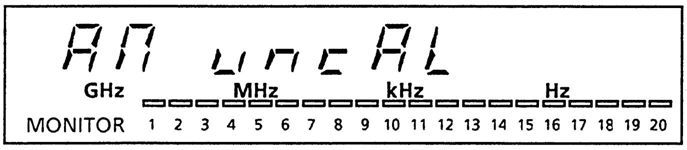
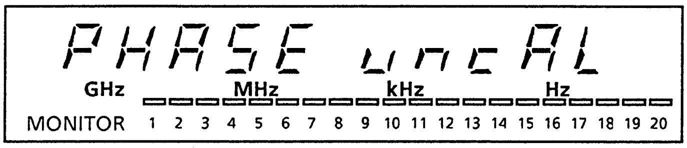


FM UNCAL



AM UNCAL



PHASE UNCAL

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SECTION 5
MEASUREMENT

In this section it is explained - through the use of typical measurement situations - how receiver sensitivity and selectivity can be evaluated using the MG3633A Synthesized Signal Generator (SG).

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SECTION 5
MEASUREMENT

For all the procedures described in this section, the MG3633A is assumed to be in an initial powered-up setting (SP00).

5.1 Measuring Sensitivity

The sensitivity of a receiver is the minimum signal input level required to obtain the rated signal output. At this time, the signal level, noise level, and signal distortion of the receiver output are handled as follows:

(1) AM receiver

Sensitivity is defined as the minimum standard modulated carrier voltage required to obtain the rated signal output at the specified S/N ratio.

For example, the minimum 60%-modulated carrier input voltage required to obtain a 50 mW signal output with a 20 dB S/N, is 10 µV.

(2) FM receiver

Sensitivity is defined as the minimum standard deviated carrier voltage required to obtain the rated output at the specified S/N ratio and distortion (SINAD) (for example, −12 dB SINAD for the 400 MHz band). In addition, another measure of sensitivity is the minimum carrier voltage required to suppress receiver noise output by 20 dB when no signal is being received. This is called the 20 dB noise quieting (NQ) sensitivity.

This paragraph explains how to measure the 20 dB NQ sensitivity and 12 dB SINAD sensitivity.

5.1.1 Measuring 20 dB NQ sensitivity

The 20 dB noise quieting (NQ) sensitivity is the minimum carrier input voltage required to suppress the receiver noise output by 20 dB when no signal is being input. Obtain the noise output before suppression by using the volume controller of the low-frequency amplification stage of the receiver so that the rated signal output can be obtained.

(1) Setup

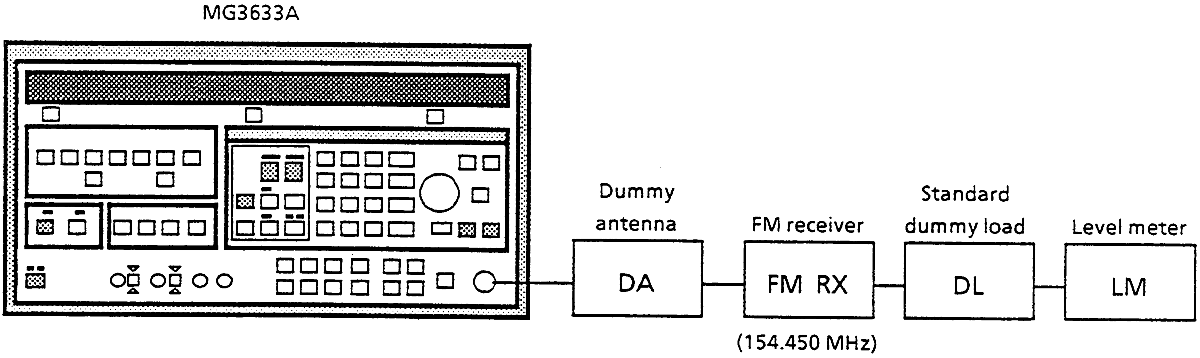


Fig. 5-1 20 dB NQ Sensitivity Measurement

(2) Measurement procedures

Step	Procedure
1	Set the MG3633A to 154.45 MHz as shown below.
2	Set the frequency deviation of the MG3633A to 70% of the specified maximum frequency deviation. If the specified maximum frequency deviation is 5 kHz, for example, set the frequency deviation of the SG to 3.5 kHz. Also, set the internal modulation frequency to 1 kHz.
3	Set the MG3633A output to an adequate level (30 dBμ or more), then supply the signal to the receiver.
4	Tune the receiver to 154.45 MHz (so that level meter (LM) deflection is maximum). Adjust the volume controller of the low-frequency amplification stage of the receiver so that the rated output can be obtained from the receiver according to the LM indication.
5	Turn the MG3633A output OFF. Also, turn the squelch of the receiver OFF.
6	Use LM to measure the noise output of the receiver, and set the meter indication to 0 dB.

Step	Procedure
7	Set MG3633A modulation to OFF. Set MG3633A output to ON.
8	Operate the INCREMENT [∧] [∨] and rotary knob in the MG3633A to adjust output level so that the LM indicates −20 dB. The value read on the OUTPUT LEVEL display of the MG3633A is the 20 dB NQ sensitivity.

5.1.2 Measuring 12 dB SINAD sensitivity

SINAD sensitivity is defined as the maximum SG output level at which the distortion does not exceed a specified standard (In Japan it is −12 dB for the 400 MHz band). The SINAD is determined by reducing SG output from a maximum level - while measuring distortion - until the demodulated receiver output of the standard modulation signal meets the distortion specification.

(1) Setup

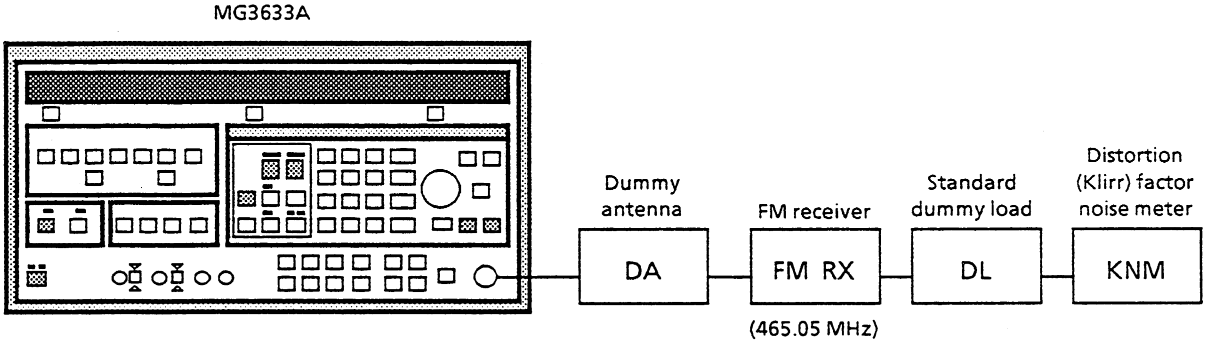


Fig. 5-2 12 dB SINAD Sensitivity Measurement

(2) Measurement procedures

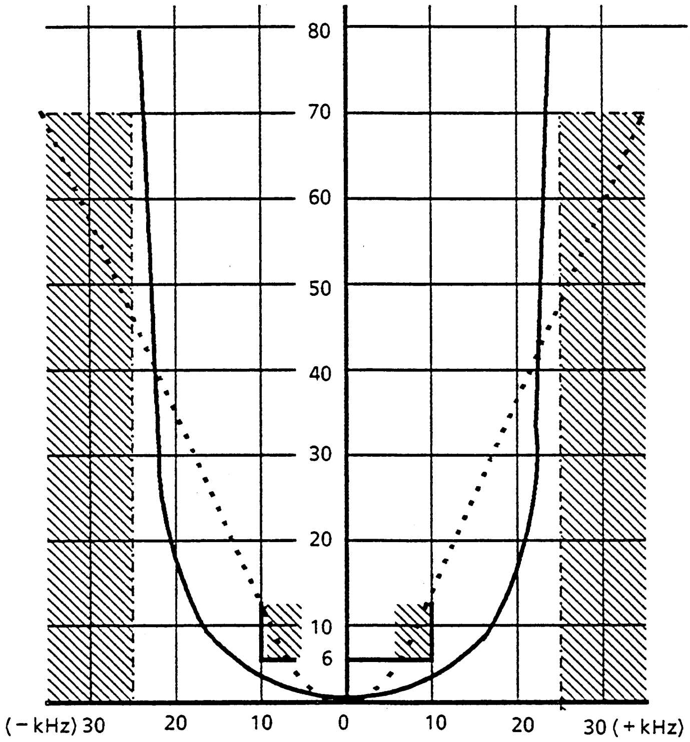
Step	Procedure
1	Set the MG3633A to 465.05 MHz as shown below.
2	Set the MG3633A to 70% of the specified maximum frequency deviation. If the specified maximum frequency deviation is 5 kHz, for example, set the MG3633A to 3.5 kHz. Also, set the internal modulation frequency to 1 kHz.

Step	Procedure
3	Set the MG3633A output to an adequate level (30 dBμ or more), then supply it to the receiver.
4	Turn receiver squelch OFF, then tune the receiver to receive a frequency of 465.05 MHz (so that KNM deflection is maximized). Adjust receiver volume controller of the low frequency amplification stage so that the rated receiver output can be obtained according to the KNM indication.
5	Operate the INCREMENT [∧] [∨] and rotary knob of the MG3633A to adjust output level so that the SINAD indication value of the KNM is −12 dB. The value read on the OUTPUT LEVEL display of the MG3633A is the 12 dB SINAD sensitivity.

5.2 Measuring One-Signal Selectivity

One-signal selectivity measurements are performed when both the desired and undesired signals are weak and when the receiver will operate in the linear range of the amplifier. When the SG signal is inputting to the receiver, selectivity is measured as the voltage ratio (desired/undesired) necessary to produce equivalent receiver outputs when the SG signal is alternated between desired and undesired signals. In this selectivity measurement, the pass band-width, attenuation, and spurious response are measured.

5.2.1 Using 20 dB NQ method to measure FM receiver selectivity



The figure on the left shows the selectivity characteristics of the 146 to 162 MHz band single-channel receiver. The specifications are as follows:

- Pass bandwidth:
  The width of 6 dB selectivity is 20 kHz (± 10 kHz) or more.
- Attenuation:
  The width of 70 dB selectivity is 50 kHz (± 25 kHz) or less.

Therefore, using the 20 dB NQ method, these selectivity are measured as follows:

- Pass bandwidth:
  Obtained from the frequency width obtained by increasing the SG output level to 6 dB higher than the 20 dB NQ sensitivity, and adjusting the SG frequency so that the receiver output will be the same as the 20 dB NQ level again.
- Attenuation:
  Obtained in the same way as above except for increasing the SG output level by 70 dB instead of 6 dB.

* Curve must not overlap the shaded region. Solid-line curve is acceptable, the dashed-line curve is unacceptable.

(1) Setup

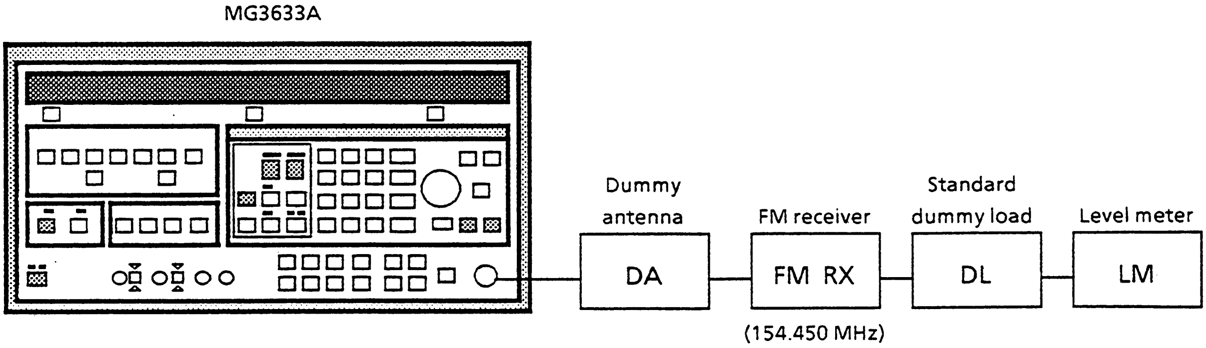


Fig. 5-3 Using 20 dB NQ Method to Measure Selectivity

(2) Measurement procedures 1 -- Pass bandwidth

Step	Procedure
1	Set the frequency and output level of the MG3633A, and FM RX in the same way as in 20 dB NQ sensitivity measurement (see paragraph 5.1.1).
2	Set the MG3633A to the relative level mode; set the output level resolution to 1 dB.
3	Turn the rotary knob clockwise to increase the output level of the MG3633A to 6 dB higher than the 20 dB NQ sensitivity.
4	Set the MG3633A output frequency resolution to 1 kHz.
5	Turn the rotary knob counterclockwise to lower the frequency and obtain a value where the 20 dB NQ level is indicated on the LM again.
6	Set the MG3633A to the relative frequency mode.
7	Turn the rotary knob clockwise to increase the frequency and obtain the frequency where the 20 dB NQ level is indicated on the LM again. The value on the MG3633A FREQUENCY display is the pass bandwidth.

(3) Measurement procedures 2 -- Attenuation

Step	Procedure
1	Set the frequency and output level of the MG3633A, and FM RX in the same way as in the 20 dB NQ sensitivity measurement (see paragraph 5.1.1).
2	Set the MG3633A to relative level mode; set output level resolution to 10 dB.
3	Turn the rotary knob clockwise to increase the output level of the MG3633A to 70 dB higher than the 20 dB NQ sensitivity.
4	Set the MG3633A output frequency resolution to 1 kHz.
5	Turn the rotary knob counterclockwise to lower the frequency and obtain the frequency where the 20 dB NQ level is indicated on the LM again.
6	Set the MG3633A to the relative frequency mode.
7	Turn the rotary knob clockwise to increase the frequency and obtain the frequency where the 20 dB NQ level is indicated on the LM again. The value on the MG3633A FREQUENCY display is the 70 dB attenuation bandwidth.

5.2.2 Measuring spurious response

Spurious sensitivity is low when there is a large difference between receiver output derived from source signals of a desired modulated signal compared with that from an undesired modulated signal source of spurious frequency. To measure the spurious response, adjust SG spurious frequency output so that both receiver outputs are equivalent. The difference between the SG spurious and desired output levels is the spurious sensitivity.

Assuming the desired signal frequency to be f_d, receiver IF frequency to be f_i, and receiver local frequency to be f_L, the spurious frequency f_s is:

- Image frequency interference

  $f_s = f_L \pm f_i = f_d \pm 2f_i$

- Harmonic interference:

  $f_s = f_L \pm f_i/2, \quad f_s = nf_d \pm f_i/2$

  When a signal is received that causes the frequency difference from the receiver local frequency to be $f_i/2$, the second harmonic of $f_i/2$ component becomes the IF frequency and interference occurs.

- Local frequency harmonic interference:

  $f_s = nf_L \pm f_i$

An example for $f_d = 154.450$ MHz, $f_s = f_d + 2f_i$, and $f_i = 10.7$ MHz is given here.

(1) Setup

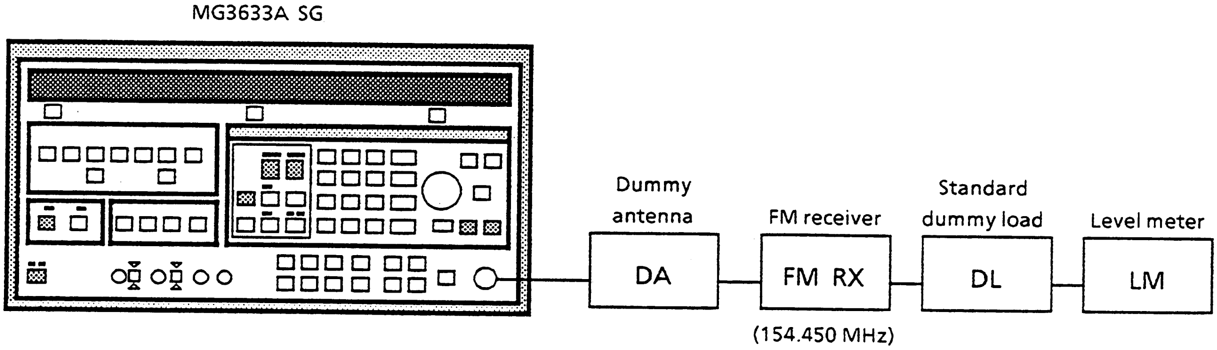


Fig. 5-4 Spurious Sensitivity Measurement

(2) Measurement procedures

Step	Procedure
1	Set the MG3633A to the desired frequency $f_d = 154.45$ MHz.
2	Set the frequency deviation of the MG3633A to 70% of the specified maximum frequency deviation. If the specified maximum frequency deviation is 5 kHz, for example, set the frequency deviation of the MG3633A to 3.5 kHz. Also, set the internal modulation frequency to 1 kHz.
3	Set the output level of the MG3633A high enough (usually, to −83 dBm or more), then input it to the receiver.
4	Tune the receiver to receive the 154.45 MHz signal (so LM deflection is maximum). Adjust the volume control for low frequency amplification (at the first stage, if possible) so that the rated output level can be obtained from the receiver according to the LM indication.
5	Set the MG3633A to the relative frequency mode.
6	Input spurious frequency ($f_s = f_d + 2f_i$) signal from the MG3633A to the receiver while keeping the receiver setting condition and the MG3633A modulation frequency and frequency deviation as is. For changing the MG3633A frequency to the spurious frequency, set $2 \times f_i = 2 \times 10.7$ MHz in the relative frequency mode, as follows.
7	Set the MG3633A to the relative level mode.
8	Set the MG3633A output level resolution to 1 dB.
9	Operate the INCREMENT [∨] [∧] and rotary knob of the MG3633A to adjust the output level so that the LM indicates the same value as the rated output in step 4. The value on the MG3633A OUTPUT LEVEL display is the spurious sensitivity.

5.3 Measuring Two-Signal Selectivity

In the one-signal selectivity measurements, the input signal level must be changed from around 0 dBμ up to around 100 dBμ to measure selectivity using a fixed output level receiver.

Because of the necessary large changes in SG output level, it is difficult for receiver amplifiers to produce a linear response over the entire range. Usually, amplifiers response is linear over an range of 20 or 30 dB. For a larger changes, however, sensitivity for high-level input diminishes due to saturation of the amplifier, among other factors, which causes errors in the measurement values.

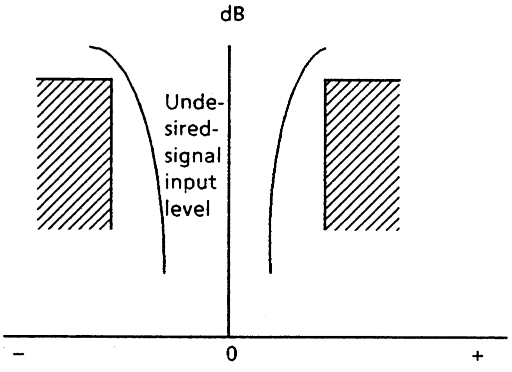
Two-signal selectivity (or effective selectivity) measurement is more suited to actual receiver conditions. This selectivity can indicate the interference separation capability of the receiver. That is, it indicates the maximum allowable input level of the undesired signal for suppressing the interference signal in the receiver output down to a fixed value while still maintaining reception of the desired signal. The following items are included.

1. Blocking effect
2. Cross-modulation characteristics
3. Inter-modulation characteristics

Items 1 and 2 above are explained in this section.

5.3.1 Measuring blocking effect of FM receiver

The blocking effect is characterized by the relationship of frequency separation (Δf) between desired and undesired non-modulated input signals on the same receiver output noise. Below, a graph shows the typical relationship between Δf and the input level for the undesired signal when the receiver output level is kept constant and the desired signal input is maintained at 6 dB higher than the 20 dB NQ sensitivity level. As is expected, as Δf becomes small, the level of the undesired signal input must be drastically reduced to maintain the same receiver output noise level.



Undesired-signal frequency

The following example is a measurement where the desired signal is 154.450 MHz and the undesired signal is ±40 kHz × n apart from the desired signal.

(1) Setup

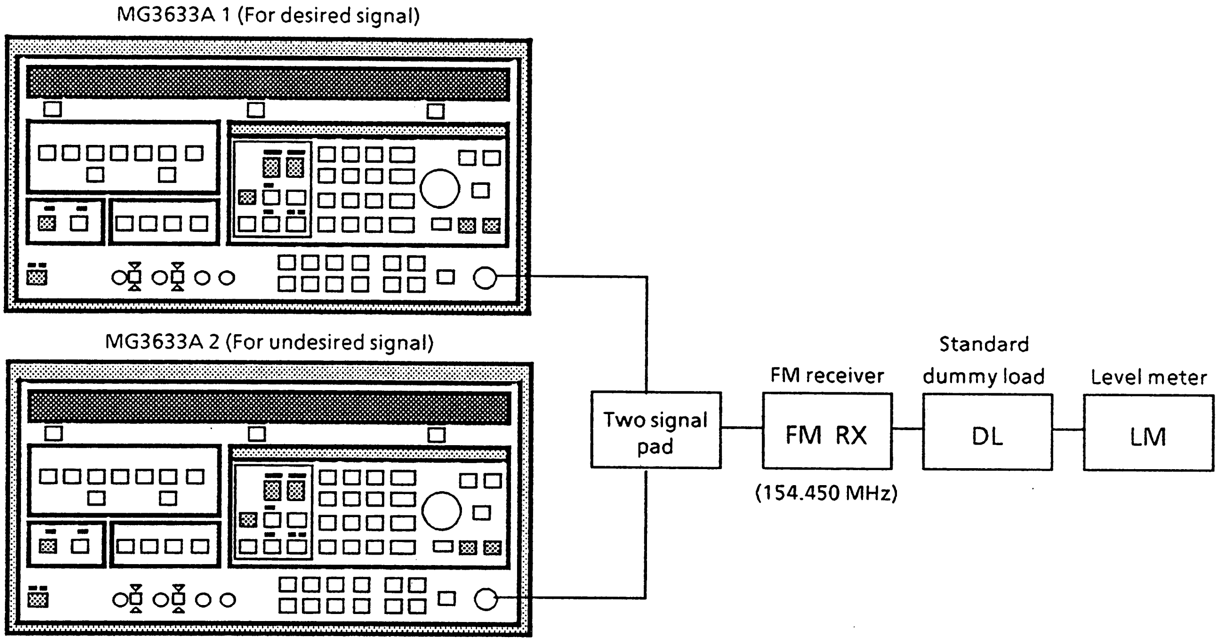


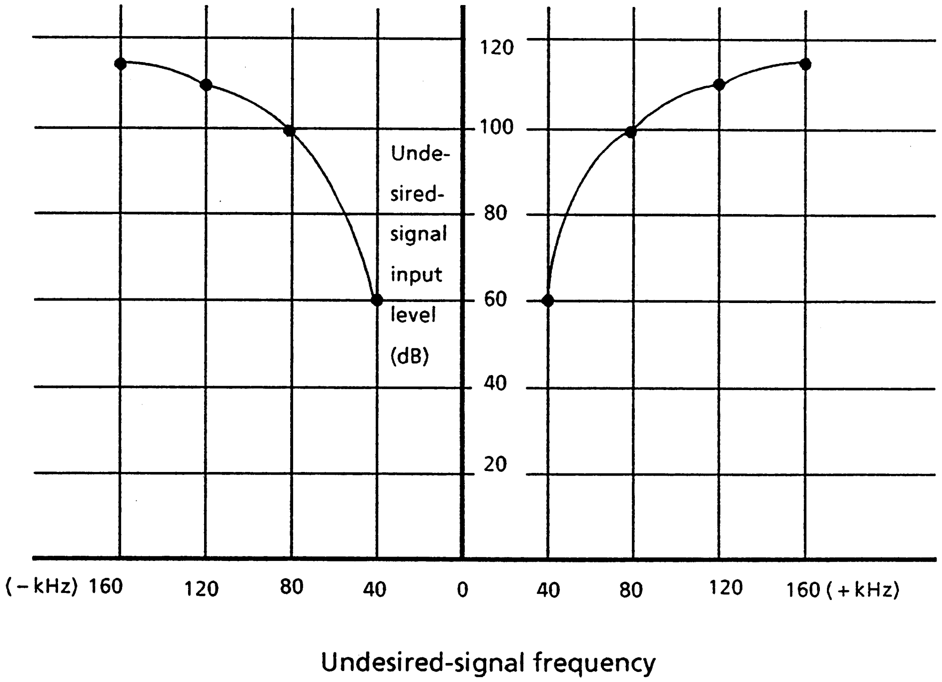
Fig. 5-5 Two-signal Selectivity Measurement

(2) Measurement procedures

Step	Procedure
1	Set the MG3633A-2 output to OFF.
2	Set the frequency and output level of the MG3633A-1, and FM RX in the same way as in 20 dB NQ sensitivity (see paragraph 5.1.1). Assume the noise level to be V_N dB at this time.
3	Set the MG3633A-1 output to OFF. Set the frequency and output level of the MG3633A-2, and FM RX in the same way as in 20 dB NQ sensitivity. (the noise level is V_N dB at this time.)
4	Set the MG3633A-2 output to OFF and the MG3633A-1 output to ON again.
5	Set the MG3633A-1 to the relative level mode. Set the output level resolution to 1 dB.
6	Turn the rotary knob of the MG3633A-1 clockwise to increase the output level by 6 dB higher than the 20 dB NQ sensitivity.
7	Hold the MG3633A-1 in the status of step 6. Set the MG3633A-2 output to ON and set it to the relative frequency mode.
8	Set the MG3633A-2 to the relative level mode and set the output level resolution to 1 dB.

Step	Procedure
9	Set the increment frequency ΔF of the MG3633A-2 to 40 kHz.
10	Adjust the rotary knob of the MG3633A-2 to increase the output level so that the noise output of the receiver is V_N dB in step 2, each time the INCREMENT [⩓] is pressed. At this time, the value indicated by the OUTPUT LEVEL display of MG3633A-2 is the undesired signal input level (dB) separated by ΔF × n from the desired signal.
11	Reset MG3633A-2 to the desired signal frequency of 154.450 MHz. (The same frequency as in steps 2 and 3.) Also, reset the MG3633A-2 output level to the level at the time when the relative level mode was set in step 8.
12	Adjust the rotary knob of the MG3633A-2 to increase the output level so that the noise output level of the receiver is V_N dB in step 2, each time the INCREMENT [⩔] is pressed. At this time, the value indicated by the OUTPUT LEVEL display of MG3633A-2 is the undesired signal input level (dB) separated by −ΔF × n from the desired signal.

From steps 10 and 12, the following blocking characteristics are obtained.



5.3.2 Measuring cross-modulation characteristics

Cross-modulation is evaluated in terms of the effect of an undesired modulated signal on the receiver output with a separate non-modulated desired signal. When the undesired and desired signals are close in frequency, demodulated signal appears at the receiver output. The cross-modulation is indicated by the undesired modulated input level when the receiver output level is a level lower than the rated output level by a specified amount. The rated output is obtained when a modulated signal is output free of interference.

When a relatively high-level modulated undesired signal is received with an non-modulated desired signal, non-linear operation of the receiver results in modulation of the desired signal, a phenomena known as cross modulation.

(1) Setup

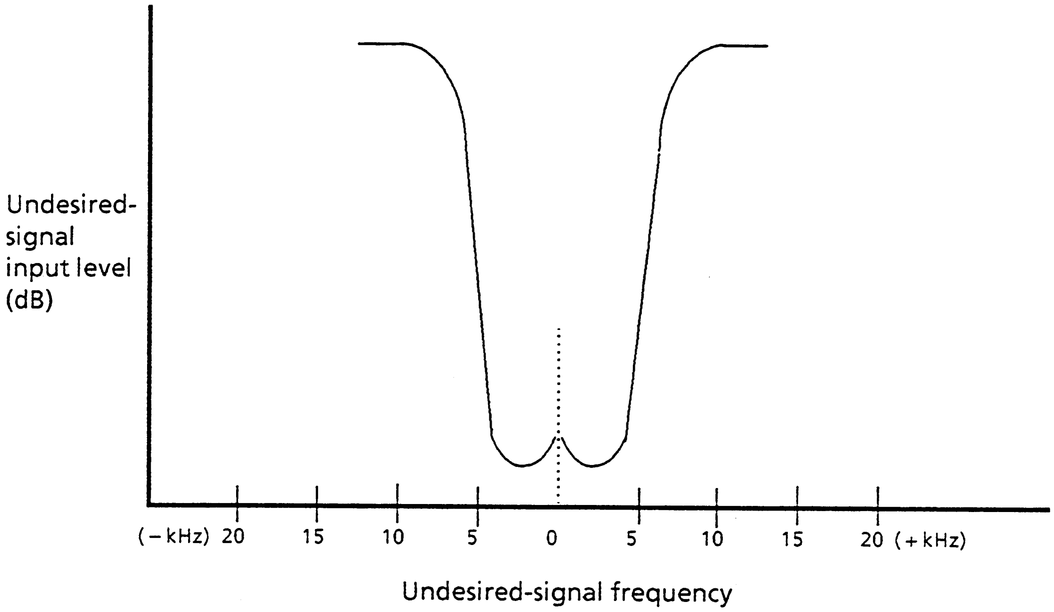
Figure 5-5 in paragraph 5.3.1 shows the required setup. Measuring AM signal is explained.

In the measurement procedure below, it is assumed that the desired signal is 1500 kHz and that the undesired signal is ±5 kHz×n apart from the desired signal.

(2) Measurement procedures

Step	Procedure
1	Set the MG3633A-2 output (for undesired signal) to OFF.
2	Set the MG3633A-1 frequency (for the desired signal) to 1500 kHz.
3	Set the AM modulation factor of the MG3633A-1 to 30% and the internal modulation frequency to 400 Hz.
4	Tune the receiver to 1500 kHz (so LM deflection is maximum). Set the AGC of the receiver to OFF and adjust the receiver to optimum status.
5	Operate the INCREMENT [∨] [∧] and rotary knob of the MG3633A-1 to adjust output level so that the LM indicates the rated signal output.
6	Assume the value of the MG3633A-1 OUTPUT LEVEL display in step 5 to be E_1 dBμ.
7	Set the MG3633A-1 modulation to OFF. Set the MG3633A-2 output to ON.
8	Set the MG3633A-2 to 1500 kHz.

Step	Procedure
9	Set the MG3633A-2 output level so that it is the same as the MG3633A-1 output level (E1 dBμ) in step 6.
10	Set the modulation factor and modulation frequency of the MG3633A-2 to 30% and 400 Hz, respectively, in the same way as for the MG3633A-1 in step 3.
11	Operate the rotary knob of the MG3633A-2 to adjust output level so that the receiver output is 20 dB less than the rated signal output in step 5 (this is the cross-modulation characteristic when the undesired signal frequency is the same as the desired signal frequency). Assume the output level of the MG3633A-2 at that time is E_2 dBμ. Assume the level 20 dB (1/10) less than the rated output is V_S dB.
12	Set the MG3633A-2 to the relative frequency and relative level modes, and set the output level resolution to 1 dB.
13	Set increment step frequency ΔF of the MG3633A-2 to 5 kHz.
14	Adjust the rotary knob of the MG3633A-2 to increase the output level so that the noise output level of the receiver is V_S dB in step 11, each time the INCREMENT [∧] is pressed. At this time, the value indicated by the OUTPUT LEVEL display of MG3633A-2 is the undesired-signal input level (dB) at $\Delta F \times n$ apart from the desired signal.
15	Reset the MG3633A-2 frequency to the desired-signal frequency 1500 kHz. Also, reset the MG3633A-2 output level to the level at the time when the relative level mode was set in step 12.

Step	Procedure
16	Adjust the rotary knob of the MG3633A-2 to increase the output level so that the noise output level of the receiver is V_S dB in step 11, each time INCREMENT [∨] is pressed. At this time, the value indicated by the OUTPUT LEVEL display of MG3633A-2 is the undesired-signal input level (dB) at $-\Delta F \times n$ apart from the desired signal. From steps 14 and 16, the following selectivity characteristic for cross-modulation are obtained. 

SECTION 6
PERFORMANCE TESTS

This section describes MG3633A Synthesized Signal Generator performance tests.

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SECTION 6

PERFORMANCE TESTS

6.1 Introduction

The procedures contained in paragraph 6.3.1 through 6.3.5 can be used to carry out: performance inspections upon receiving the MG3633A; routine maintenance inspections; and performance tests after repair or adjustment. Since checks are performed on the unit during normal system operation, no internal adjustments are necessary. Test important operating systems regularly as a method of preventive maintenance.

Note: The MG3633A warmup time can be as long as 24 hours, depending on the test item. For some test items, warm-up the instrument for at least 30 minutes and test the performance after the MG3633A has stabilized.

The warmup time of the test equipment must also be considered before making any measurements. For the highest measurement accuracy, in addition to the above, tests must be made at room temperature, the AC line voltage must be stable, and noise, vibration, dust and humidity must not be a problem.

6.2 Equipment Required for Performance Tests

Table 6-1 lists the equipment required for performance test.

Table 6-1 Equipment Required for Performance Test

Test item	Test equipment	Required performance*	Recommended model (Anritsu)	Reference paragraph
Output frequency	Frequency counter	10 kHz to 2.7 GHz	MF1603A	6.3.1
Output-level frequency characteristic	Power meter	100 kHz to 3 GHz −30 dBm to +20 dBm	ML4803A MA4601A (Sensor)	6.3.2
Output level accuracy	Level and attenuation calibrator	100 kHz to 1.3 GHz −20 dBμ to +130 dBμ	ME642A	6.3.3
	Pre-amplifier	100 kHz to 1200 MHz	MH648A	
FM frequency deviation	Modulation analyzer	150 kHz to 2.7 GHz	MS616B	6.3.4
AM modulation factor	Modulation analyzer	150 kHz to 2.7 GHz	MS616B	6.3.5
Modulation distortion	Distortion meter	20 Hz to 100 kHz		6.3.4, 6.3.5

* Only part of the performance that covers the test item measurement range is listed.

6.3 Performance Test

This paragraph describes performance test procedures for:

1. Output frequency
2. Output-level frequency characteristics
3. Output-level accuracy
4. FM deviation and FM distortion
5. AM modulation factor and AM distortion

6.3.1 Output frequency

This tests if the set frequency is being output normally.

(1) Test specifications

• Frequency range	10 kHz to 2700 MHz
• Setting resolution	0.01 Hz

(2) Test equipment

- Frequency counter

(3) Setup

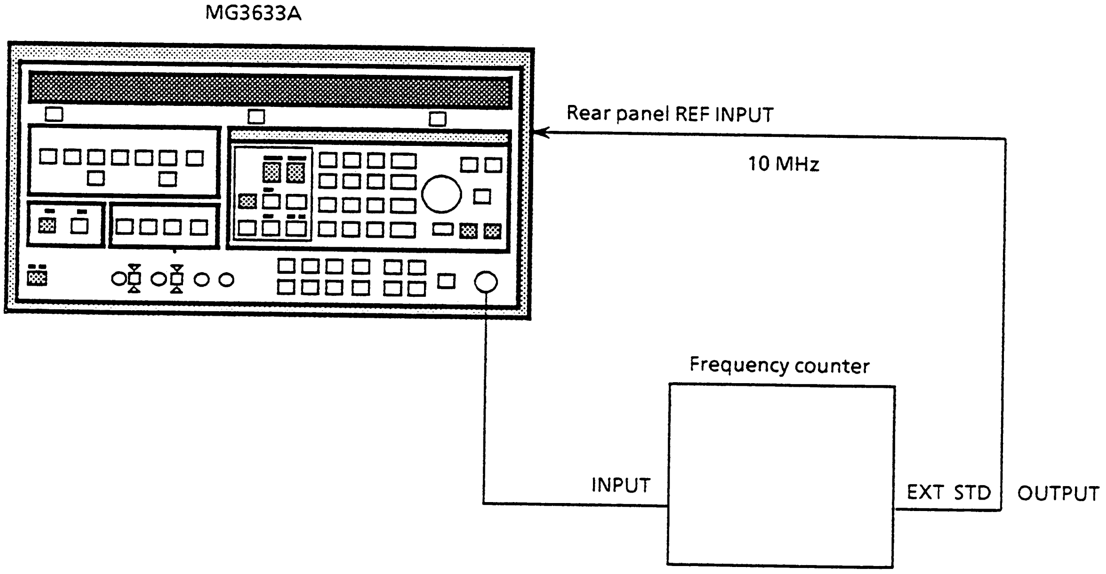

Fig. 6-3 Output Frequency

(4) Test procedure

Step	Procedure
1	Connect the standard frequency output (10 MHz) of the frequency counter to the external standard input (REF INPUT) of the MG3633A.
2	Connect the MG3633A output to the frequency counter input as shown in Fig. 6-3.
3	Set the MG3633A output level to +7 dBm.
4	Set the MG3633A to any frequency.
5	Check that the frequency counter reading is the same as the set value.
6	Change the frequency and repeat the test.

(5) Test precautions

The counter reading may include a ±1 count error.

6.3.2 Output-level frequency characteristic

(1) Test specifications

$\leqq \pm 0.5$ dB referred to 0 dBm ($<$1280 MHz)

$\leqq \pm 1$ dB referred to 0 dBm ($\geqq$1280 MHz)

(2) Test equipment

- Power meter: 10 kHz to 2700 MHz

(3) Setup

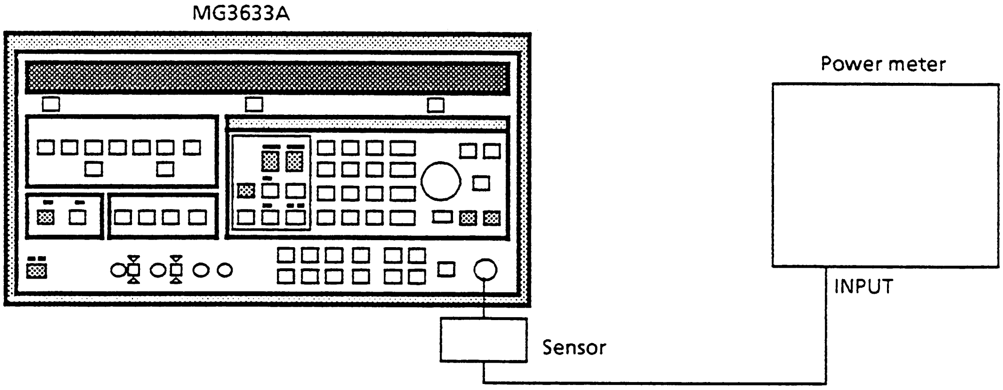

Fig. 6-4 Output-Level Frequency Characteristic

(4) Test procedure

Step	Procedure
1	Turn off the MG3633A output level and zero-adjust the power meter.
2	Set the MG3633A output level to 0 dBm.
3	Set the MG3633A to the frequency to be measured (for example, the table below).

Frequency	10 kHz	100 kHz	1 MHz	10 MHz	100 MHz	200 MHz	500 MHz	1000 MHz	1500 MHz	2000 MHz	2500 MHz	2700 MHz
Level deviation												

Step	Procedure
4	Set the calibration factor of the power meter sensor and read the output level.
5	Repeat steps 3 and 4.

(5) Test precautions

The MG3633A output-level frequency characteristic is specified at the OUTPUT connector on the SP86 (NORMAL correction). Therefore, when making measurements, connect the power sensor directly to the OUTPUT connector.

6.3.3 Output-level accuracy

(1) Test specifications

Frequency Output level	10 kHz to < 1280 MHz	≧ 1280 MHz
+17.1 to +23 dBm	–	–
±15.1 to +17 dBm	±1 dB	–
−122.9 to +15 dBm	±1 dB	±2 dB
−132.9 to −123 dBm	±3 dB	±4 dB
−143 to −133 dBm	–	–

(2) Test equipment

- Level and attenuation calibrator
  10 kHz to 2700 MHz
- Preamplifier
  10 kHz to 2700 MHz, gain 30 dB

(3) Setup

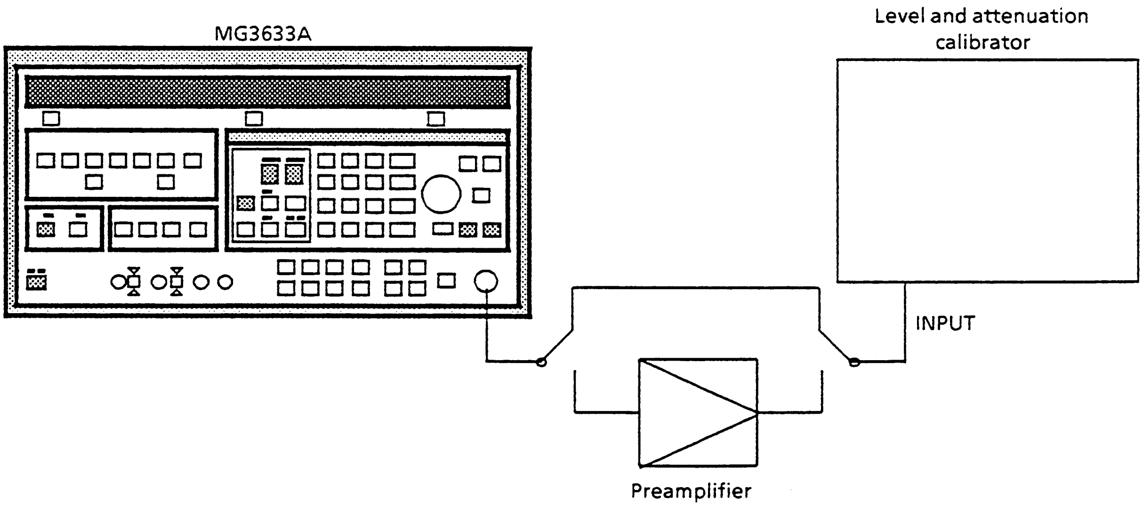

Fig. 6-5 Output-Level Accuracy

(4) Test procedure

Step	Procedure
1	Set the MG3633A to the measurement frequency and set the output level to +13 dBm.
2	Set a level and attenuation calibrator to the same frequency as the MG3633A and set the meter indication to 0 with the ATT and fine-adjustment control.
3	Attenuate the MG3633A output level in accordance with the table below. At the same time, change ATT of the calibrator by the same amount and read the deviation of the calibrator meter indication at that time.
4	Repeat Step 3 until the MG3633A output level reaches −113 dBm.
5	Next, insert a preamplifier between the MG3633A and calibrator to increase the input level to the calibrator for easy testing.
6	Set the meter indication to the same value as before the preamplifier was inserted, with the calibrator ATT and fine-adjustment control.
7	Attenuate the MG3633A output level again down to −133 dBm. At the same time, change the calibrator ATT by the same amount and read the deviation of the calibrator meter indication at that time.

(5) Test precautions

For frequencies that the calibrator cannot measure, use a mixer and local signal generator to convert to measurable ones.

MG3633A set frequency / MG3633A set output level (dBm)	100 kHz	1350 MHz	2700 MHz
+13			
+7			
+6			
+5			
+4			
+3			
+2			
+1			
0			
−1			
−2			
−3			
−13			
−23			
−33			
−43			
−53			
−63			
−73			
−83			
−93			
−103			
−113			
−123			
−133			

6.3.4 FM deviation and FM distortion

(1) Test specifications

Range:	0 to 400 kHz (1 MHz $\leqq f_c < 40$ MHz) 0 to 100 kHz (40 MHz $\leqq f_c < 80$ MHz) 0 to 200 kHz (80 MHz $\leqq f_c < 160$ MHz) 0 to 400 kHz (160 MHz $\leqq f_c < 320$ MHz) 0 to 800 kHz (320 MHz $\leqq f_c < 640$ MHz) 0 to 1.6 MHz (640 MHz $\leqq f_c < 1280$ MHz) 0 to 3.2 MHz (1280 MHz $\leqq f_c$)
Resolution:	10 Hz (0 to 9.99 kHz deviation) 100 Hz (10 to 99.9 kHz deviation) 1 kHz (100 to 999 kHz deviation) 10 kHz (1 to 3.2 MHz deviation)
Accuracy:	± (5% of indicated value +20 Hz) (Internal 1 kHz)
Distortion:	$\leqq$1% (Internal 1 kHz, 3.5 kHz deviation)

(2) Test equipment

- Modulation analyzer
- Distortion meter

(3) Setup

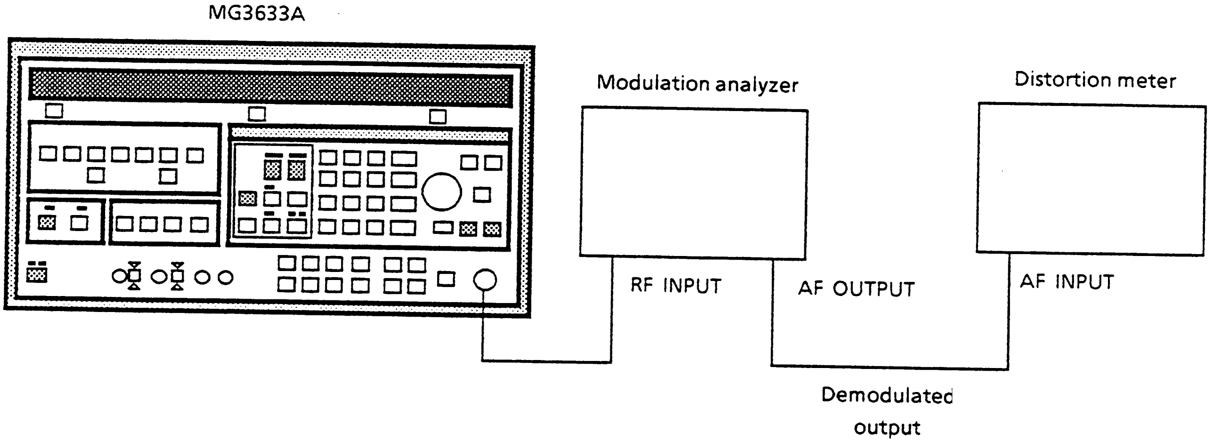

Fig. 6-6 FM Deviation and FM Distortion

(4) Test procedure

Step	Procedure
	FM deviation accuracy
1	Set the MG3633A output level to +7 dBm.
2	Set the MG3633A frequency to the measurement frequency.
3	Turn on the MG3633A FM. (If AM and ΦM are on, turn them off.) Set FM INT and modulation frequency to 1 kHz.
4	Set the MG3633A FM frequency deviation.
5	Read the modulation analyzer indication to test the FM frequency deviation.
6	Change the MG3633A FM frequency deviation and repeat the test.
	FM distortion
7	Set the MG3633A FM frequency deviation to 3.5 kHz.
8	Test the modulation-analyzer demodulated-output distortion with the distortion meter.

(5) Test precautions

- Test FM deviation at the modulation-analyzer for a 0.3 to 3 kHz demodulation-bandwidth.
- If a modulation analyzer with a large residual FM is used, when the FM deviation is small, distortion measurement will be adversely affected. Therefore, use a modulation analyzer with a small residual FM.

6.3.5 AM modulation factor and AM distortion

(1) Test specifications

- Range: 0% to 100%
- Accuracy: ± (5% of indicated value +2%)
  (at≧250 kHz, ≦ +7 dBm, 0 to 90% and internal 1 kHz)
- Distortion: ≦1% (at ≧1 MHz, < +7 dBm, internal 1 kHz, 30%)
  ≦3% (at ≧1 MHz, < +7 dBm, internal 1 kHz, 80%)
  ≦3% (at 250 kHz ≦fc<1 MHz < +7 dBm, internal 1 kHz, 30%)
  ≦10% (at 250 kHz ≦fc<1 MHz < +7 dBm, internal 1 kHz, 80%)

(2) Test equipment

- Modulation analyzer
- Distortion meter

(3) Setup

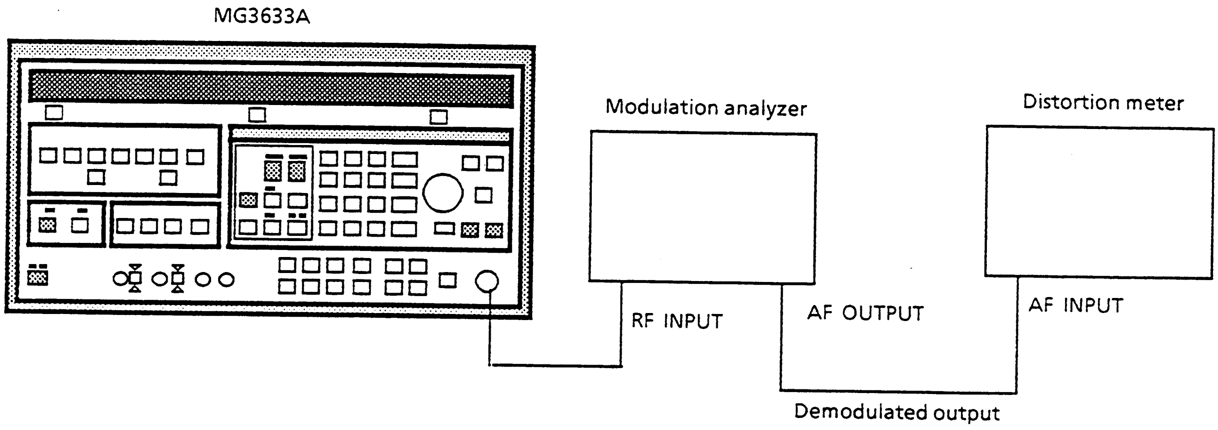

Fig. 6-7 AM Modulation Factor and AM Distortion

(4) Test procedure

Step	Procedure
	<u>AM modulation-factor accuracy</u>
1	Set the MG3633A output level to +7 dBm.
2	Set the MG3633A frequency to the test frequency.
3	Turn on the MG3633A AM mode. (If FM and ΦM are on, turn them off.) Set AM INT and modulation frequency to 1 kHz.
4	Set the MG3633A AM modulation factor.
5	Read the modulation-analyzer indication to test the AM modulation factor.
6	Change the MG3633A AM modulation factor and repeat the test.
	<u>AM Modulation-factor distortion</u>
7	Set the MG3633A AM modulation factor to 30% and 80%.
8	Test the modulation-analyzer demodulated-output distortion with the distortion meter.

(5) Test precautions

For AM modulation-factor accuracy test, set the modulation-analyzer demodulation bandwidth to 0.3 to 3 kHz, and for AM distortion measurement, set the demodulation bandwidth to 0.3 to 15 kHz or 0.3 to 20 kHz.

6.4 Service

When the instrument is damaged or does not operate normally, contact the sales agent or ANRITSU for repair.

When requesting repair, please specify the following:

(a) Instrument name and the serial No. on the rear panel

(b) Trouble symptoms

(c) Name and office of person(s) to be contacted during or after repair

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SECTION 7
CALIBRATION

This section describes the MG3633A Synthesized Signal Generator calibration.

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SECTION 7
CALIBRATION

7.1 Calibration

The MG3633A internal reference oscillator frequency must be calibrated periodically about once or twice a year.

If an item does not satisfy the specifications at calibration, contact the ANRITSU service department.

7.2 Equipment Required for Calibration

Table 8-1 lists the calibration equipment.

Table 7-1 Equipment Required for Calibration

Test item	Test equipment	Required performance*	Recommended model (Anritsu)
Reference oscillator frequency accuracy	Oscilloscope	50 MHz, external trigger possible	———
	Frequency counter	10 kHz to 2.7 GHz	MF1603A
	Frequency standard	10 MHz, $\approx 1 \times 10^{-10}$/day	———

* Only part of the performance that covers the test item measurement range is listed.

7.3 Calibration

The MG3633A internal reference oscillator frequency is calibrated.

The calibrated specifications are as follows.

Reference oscillator	Frequency	Aging rate	Temperature characteristics
Standard type	10 MHz	2×10^{-8}/day	$\pm 5 \times 10^{-8}$ (0° to 50°C)
Option 01	10 MHz	5×10^{-9}/day	$\pm 5 \times 10^{-8}$ (0° to 50°C)
Option 02	10 MHz	2×10^{-9}/day	$\pm 1.5 \times 10^{-8}$ (0° to 50°C)
Option 03	10 MHz	5×10^{-10}/day	$\pm 5 \times 10^{-9}$ (0° to 50°C)

7.3.1 Reference oscillator frequency calibration using frequency standard

This paragraph describes calibration when options 01 to 03 are installed.

Since the MG3633A 10 MHz reference oscillator stability is $\pm 2 \times 10^{-8}$/day or less, a standard signal generator, which either receives a standard signal or receives a color television subcarrier (signal locked to a rubidium atomic standard) and generates a signal locked to this signal, is used as the frequency standard.

(1) Setup

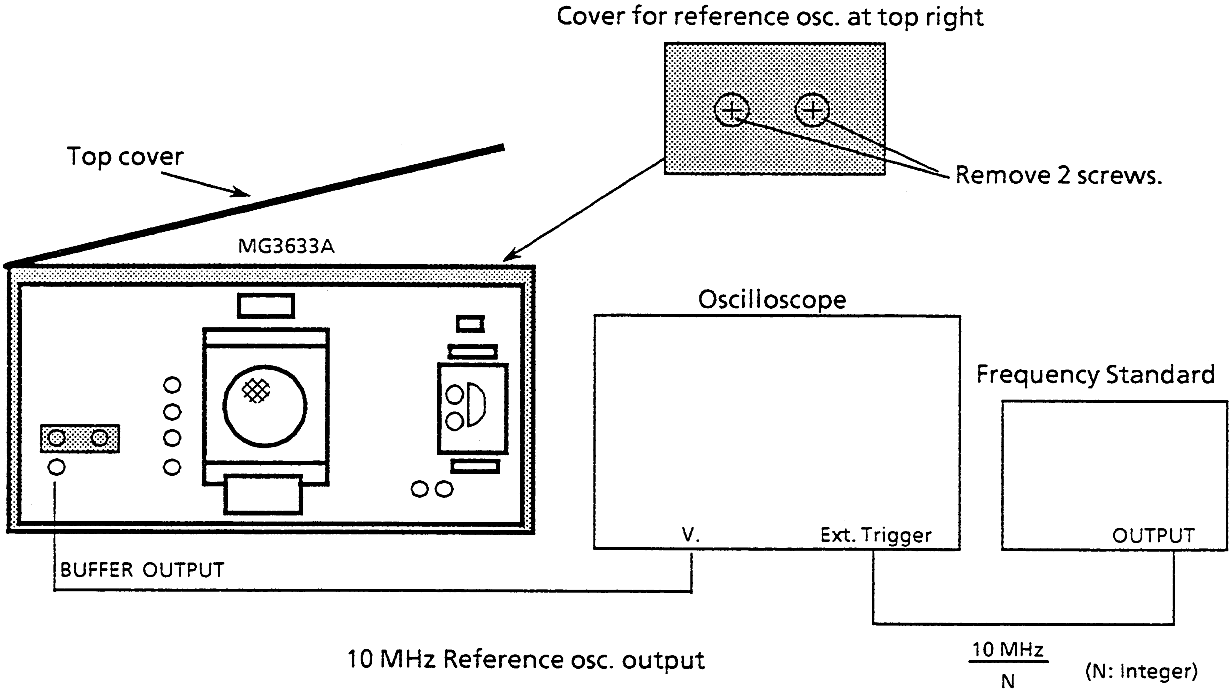

Fig. 7-1 Reference Oscillator Frequency Calibration using Frequency Standard

(2) Procedure

Step	Procedure
1	Set up the equipment an shown in Fig. 7-1 in a room at 23° ±5°C.
2	To warm-up the MG3633A reference oscillator, set the POWER switch to STBY and leave the MG3633A in that state for 24 hours.
3	After 24 hours, set the MG3633A POWER switch to ON.
4	Apply the standard frequency signal to the oscilloscope external trigger input. Also, apply the 10 MHz reference output signal from the BUFFER OUTPUT connector on the MG3633A rear panel to the oscilloscope vertical axis X.
5	Adjust the oscilloscope so that the input waveform can be observed. When the input waveform on the oscilloscope moves to the right or left and is not synchronized, the reference oscillator frequency does not match the standard frequency.
6	Adjust the potentiometer inside the reference oscillator calibration-hole under the MG3633A top cover shown in Fig. 7-1 so that the input waveform on the oscilloscope does not move to the left or right.

7.3.2 Reference oscillator frequency accuracy calibration using counter

This paragraph describes calibration when Options 01 to 03 are not installed: that is, for the standard instrument.

(1) Setup

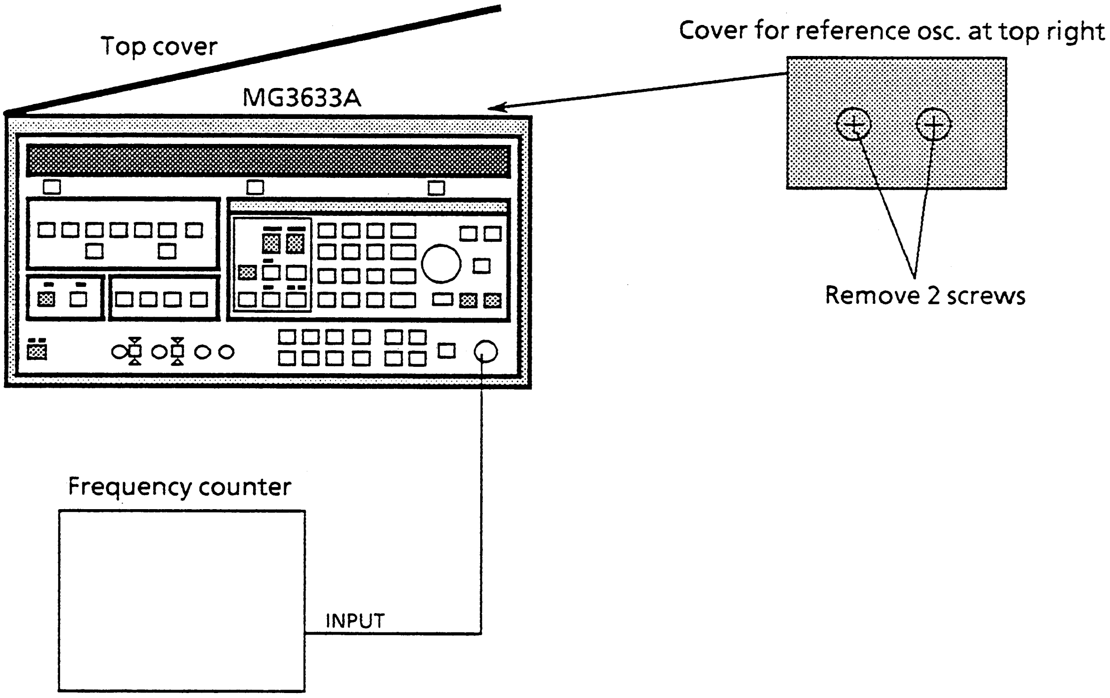

Fig. 7-2 Reference Oscillator Frequency Calibration Using Frequency Counter

(2) Procedure

Step	Procedure
1	Setup the equipment as shown in Fig. 7-2.
2	Set the MG3633A frequency to 1000 MHz.
3	Set the frequency counter resolution to 10 Hz or less.
4	While reading the frequency with the frequency counter, adjust the potentiometer under the MG3633A top cover shown in Fig. 7-2 with a screwdriver so that the frequency counter reads 1000 MHz.

SECTION 8
STORAGE AND TRANSPORTATION

This section describes daily maintenance, storage, and transportation of the MG3633A.

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SECTION 8

STORAGE AND TRANSPORTATION

8.1 Daily Servicing and Preventive Maintenance

To prevent degradation of the performance of the MG3633A, the MG3633A should be operated correctly under the specified conditions. Calibration and performance tests should also be performed routinely.

The regular servicing method and interval are shown in Table 8-1.

Table 8-1 Regular Servicing

	Period	Method
Soiling	● Before long-term storage ● When used in dusty locations ● When noticeable dust and dirt have accumulated inside cabinet	Wipe with damp cloth and soapy water or cleaning solvent* (DAIFLON)
Dust		Open cabinet and blow out dust with compressed air
Lubrication	None	
Loose screws	When detected	Retighten with recommended tool

* Do not use acetone or benzene; the paint finish may be damaged.

8.2 Storage Precautions

This paragraph describes the precautions to take when storing the MG3633A for a long time.

8.2.1 Precautions before storage

1. Wipe any dust and fingermarks off the cabinet.
2. Check the performance as described in SECTION 6 to confirm that the MG3633A operates normally.
3. The maximum and minimum storage temperature range is 60° to -20°C. The maximum humidity is 90%.

8.2.2 Recommended storage conditions

In addition to meeting the conditions listed in paragraph 8.2.1, the MG3633A should preferably be stored where:

1. Temperature is 0° to 30°C
2. Humidity is 40% to 80%
3. Temperature and humidity are stable

Before using the MG3633A after storage, check the performance as described in SECTION 6.

8.3 Repacking and Transportation

When transporting the MG3633A over long distances, observe the precautions described blow.

8.3.1 Repacking

Use the original packing materials. If the original packing materials were thrown away or destroyed, repack the MG3633A as follows:

1. Install the protective covers (B0020) over the front and rear panels.
2. Wrap the MG3633A in plastic or similar material.
3. Obtain a cardboard, wood, or aluminum box 10 to 15 cm larger than the MG3633A on all sides.
4. Put the MG3633A in the center of the box and fill the surrounding space with shock absorbent material.
5. Secure the box with twine, tape, or bands.

Note: It is easy to repack the MG3633A if the original packing materials are saved.

8.3.2 Transportation

Transport the MG3633A under the storage conditions recommended in paragraph 8.2.2.

APPENDIX A
PANEL LAYOUT

The front and rear panels are shown in Figs. A-1 and A-2 respectively. The numbers of the keys, connectors, and displays correspond to those described in this manual.

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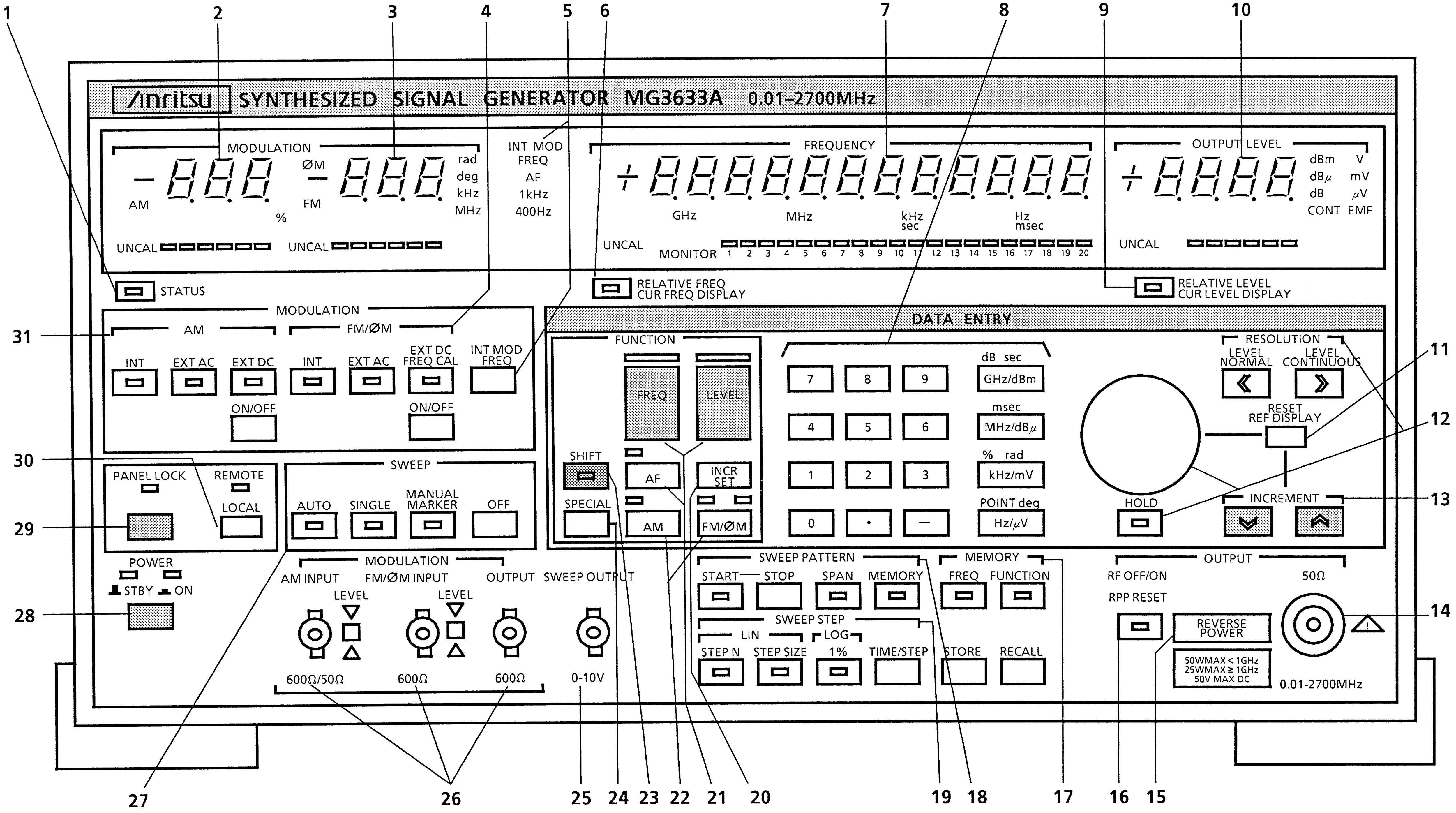

Fig. A-1 Front Panel

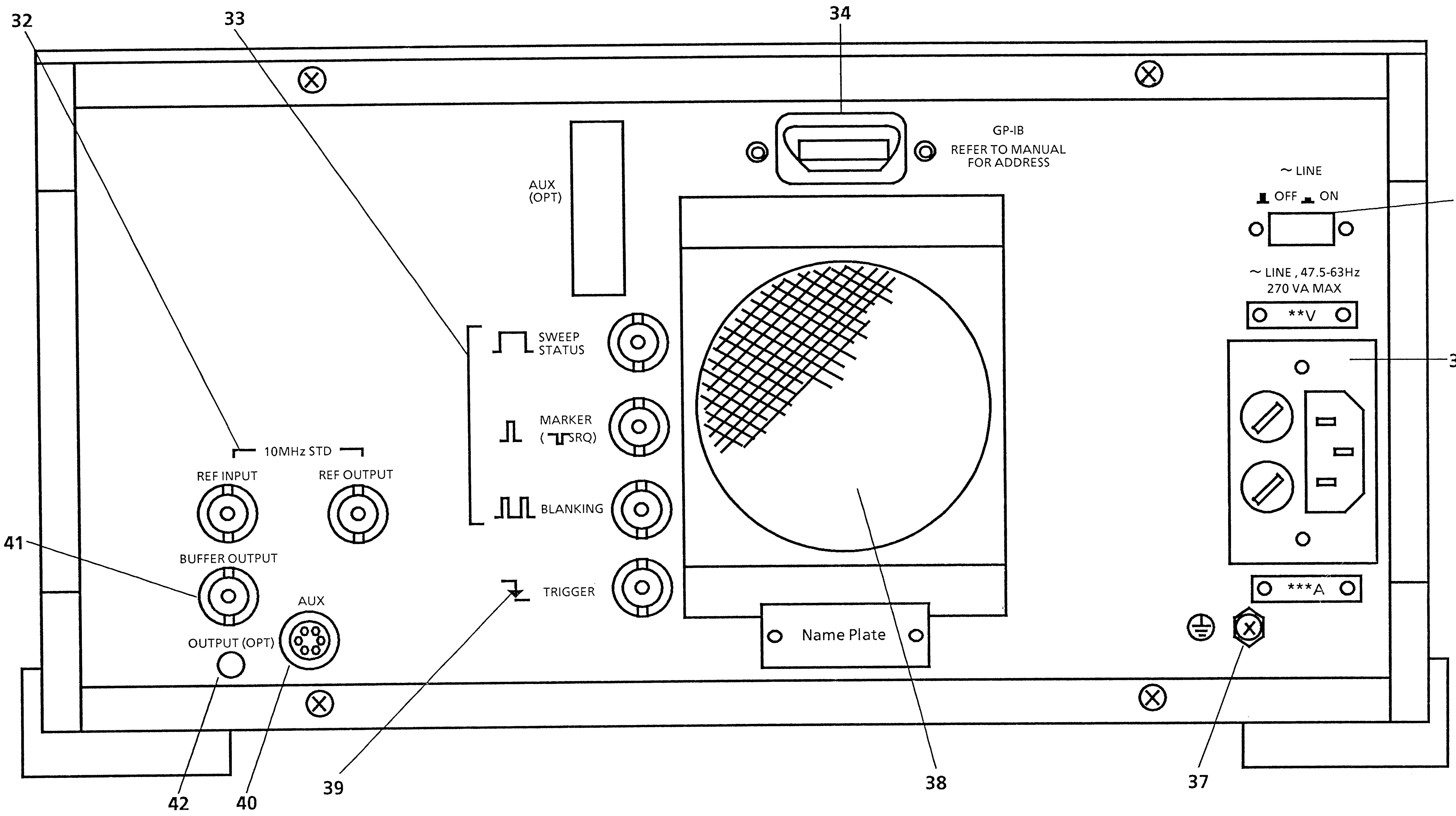

Fig. A-2 Rear Panel

APPENDIX B
PULSE MODULATOR
MA1610A

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MA1610A
Pulse Modulator
Operation Manual

ANRITSU CORPORATION

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SECTION 1
GENERAL

The MA1610A Pulse Modulator is used in combination with the MG3633A Synthesized Signal Generator for obtaining high-speed pulse modulation waveforms.

Output can be ON/OFF speedy by logic of modulation input signal (TTL level, 50Ω termination) for carrier frequency at range in 10 kHz to 2.7 GHz.

The power source required for MA1610A operation is supplied from the AUX terminal on the MG3633A rear panel.

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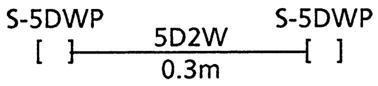
SECTION 2
COMPOSITION AND SPECIFICATIONS

Table 2-1 describes the standard composition and Table 2-2 lists the specifications of the MA1610A, respectively.

2.1 Standard Composition

Table 2-1 Standard Composition

Item	Name	Qty.	Remarks
Instrument	MA1610A Pulse Modulator	1	
Accessories supplied	50Ω coaxial cable	1	
	Power cord	1	1m in length
	Operation manual	1	

2.2 Specifications

Table 2-2 Specifications

Frequency range	10 kHz to 2700 MHz
ON/OFF ratio	≧60 dB (<1000 MHz) ≧40 dB (≧1000 MHz)
Insertion loss	≦2 dB (<1000 MHz) ≦3.5 dB (≧1000 MHz)
Risetime	≦15 ns
Falltime	≦5 ns
Minimum pulse width	20 ns
Maximum pulse rate frequency	10 MHz
Maximum delay time	40 ns
Video feedthrough	≦50 mVp-p
Overshoot/ringing	≦20%
RF input/output	50Ω, N type connector Maximum applied level: AC 200 mW DC 3.5V
Pulse input	50Ω, BNC connector, TTL level
Power supply	From the MG3633A
Ambient temperature, rated range of use	0° to 50°C
Dimensions and weight	57H×131W×43D mm <600g

SECTION 3
OPERATION

3.1 Caution on Handling

3.1.1 Power supply connection

The MA1610A is normally operated using power supplied from the rear panel AUX terminal of the MG3633A. (Refer to Fig. 3-1.)

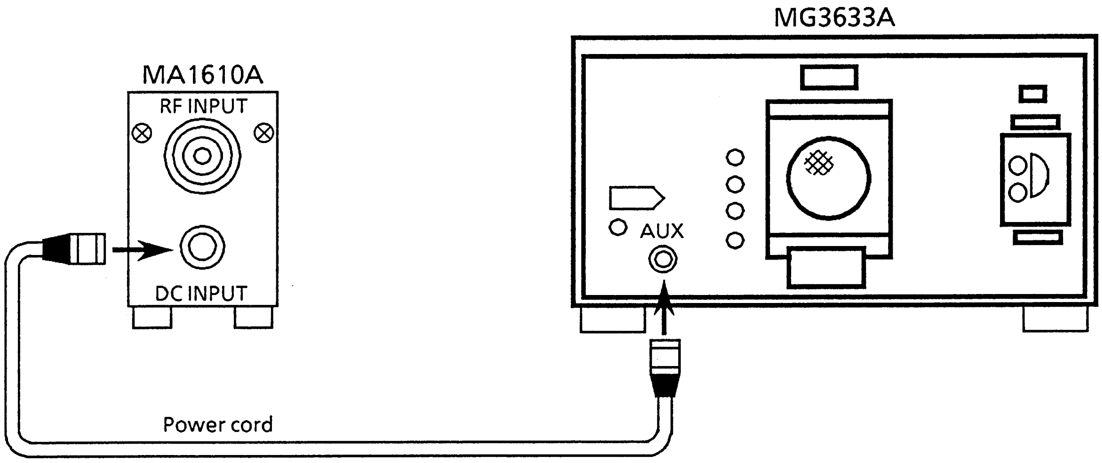


Fig. 3-1 Power Supply Connection

CAUTION:
1. ***Always supply the power for the MA1610A from the MG3633A using the supplied power cord.***
2. ***Be sure to connect power supply cord correctly.***

3.1.2 Operating and storage conditions

The MA1610A is designed to operate normally at ambient temperatures of 0° to 50°C.

Do not use or store the instrument in locations where it may be exposed to:

(1) Severe vibration

(2) Extreme humidity or dust

(3) Direct sunlight

(4) Explosive gases

CAUTION: ***If the instrument is operated at room temperature after being used or stored for a long period at low temperatures, condensation may occur and cause short-circuiting. To prevent this, do not turn the power on until the instrument is completely dry.***

3.1.3 Maximum applied level

CAUTION: Fire may result if more than +23 dBm (200 mW) and 3.5 Vdc are applied to the MA1610A RF input/output terminal from an external source.

3.2 Explanation of Controls

External view and control functions are described in Fig. 3-2 below.

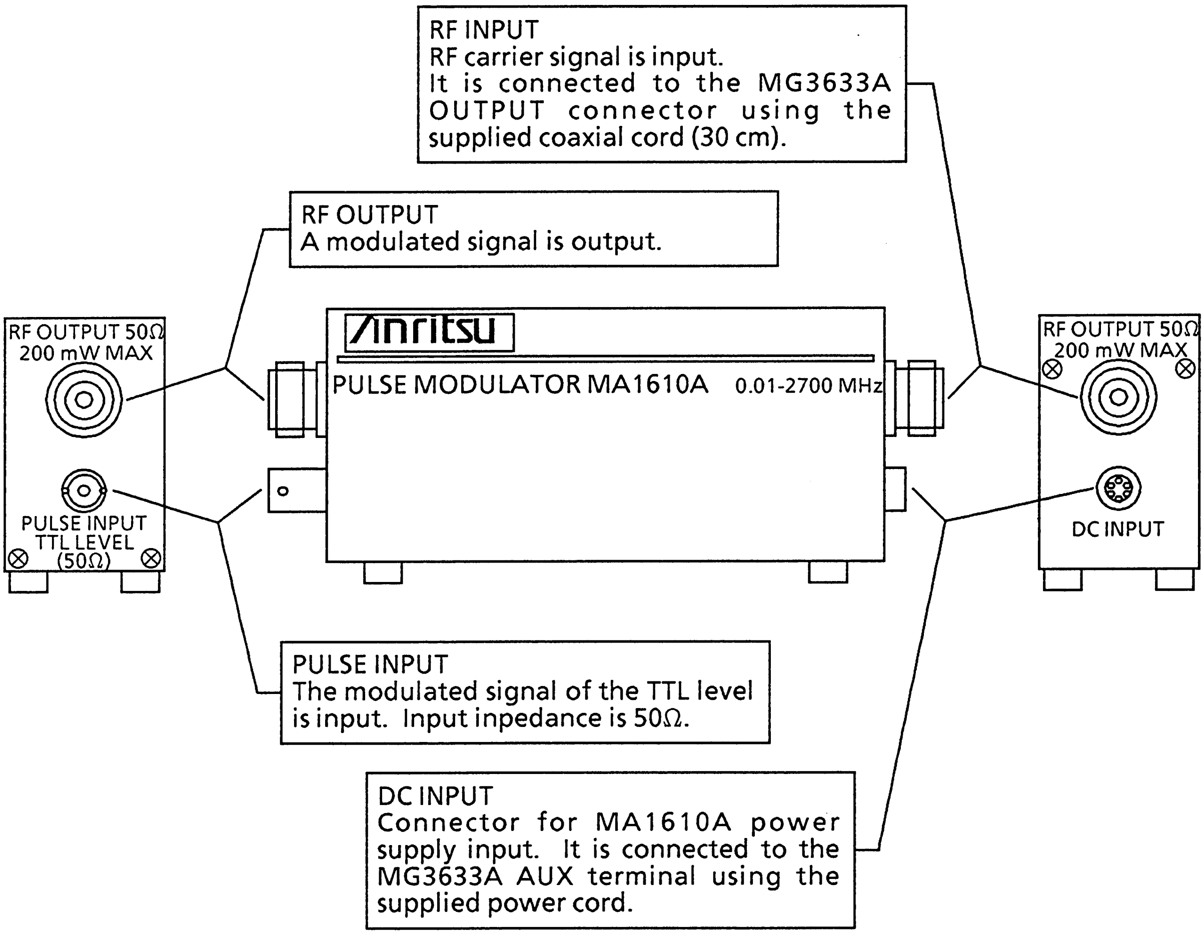


Fig. 3-2 External View and Control Functions

3.3 Operation

The MA1610A is set up together with the MG3633A.

Figure 3-3 shows setup.

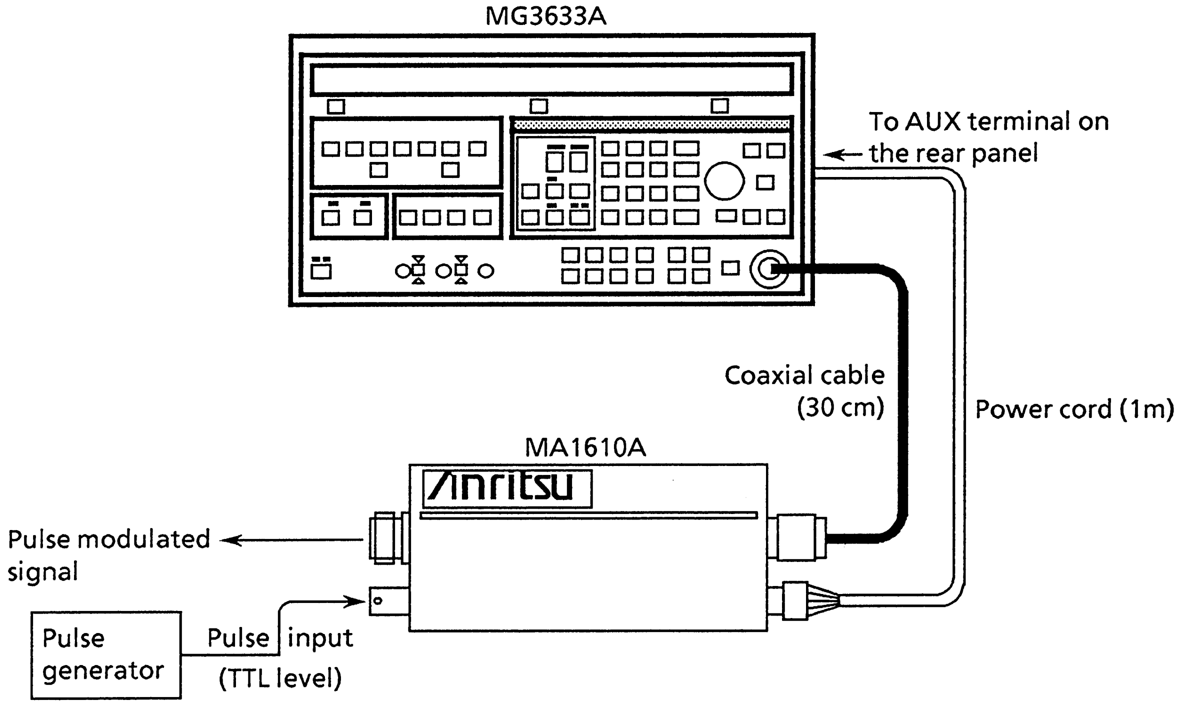


Fig. 3-3 Setup

The MA1610A PULSE INPUT is terminated at 50Ω. A pulse generator that can drive a 50Ω load should be used. The greater the carrier signal level (MG3633A output level) input to the MA1610A, the less effective the video feedthrough. When required that the modulated output level is made low, it is recommended to attenuate it with a PAD after modulation is made by the MA1610A. A carrier level attenuation is not recommended.

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SECTION 4

PRINCIPLES OF OPERATION

The pulse modulator is a high-speed analog switch which controls, by binary digital signals, the output ON/OFF of the high-frequency carrier signal.

When the PULSE INPUT signal is "H" at TTL level, the switches are actuated to change the signal flow from RF INPUT to RF OUTPUT.

When the PULSE INPUT signal is "L" level, the switches are actuated to connect both RF INPUT and RF OUTPUT to the 50Ω terminators, respectively (refer to Fig. 4-1 below).

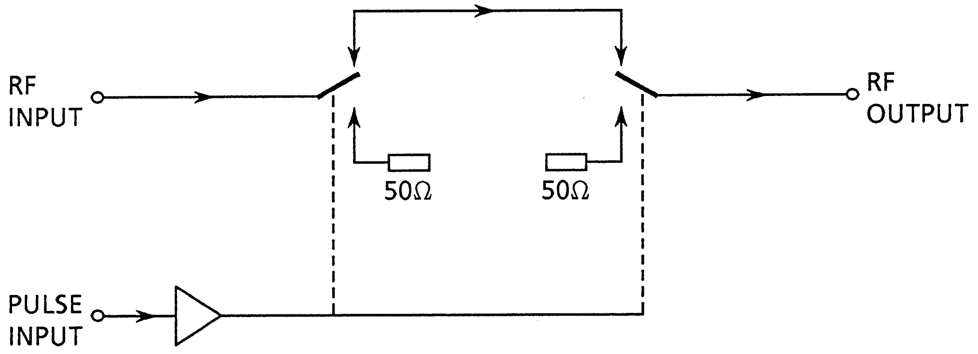
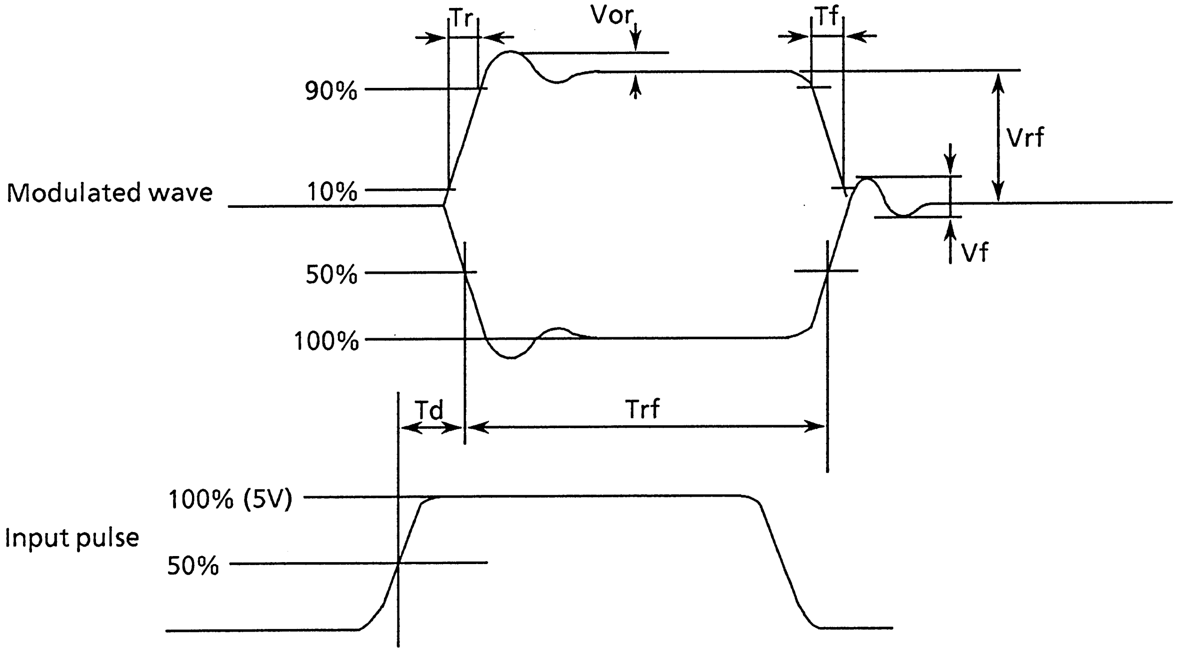


Fig. 4-1 MA1610A Block Diagram

Figure 4-2 shows the relationship between a digital signal applied to the PULSE INPUT and the consequent modulated waveform.



Risetime : Tr
Falltime : Tf
Pulse width : Trf
Delay time : Td
Video feedthrough : Vf
Overshoot/ringing : $\frac{\text{Vor}}{\text{Vrf}} \times 100\ (\%)$

Fig. 4-2 Relationship Between Digital Signal Applied to PULSE INPUT and Consequent Modulated Waveform

SECTION 5
PERFORMANCE CHECK

5.1 Introduction

This section describes how to test electrical performance of the MA1610A in accordance with the specifications described in SECTION 2.

Performance tests are conducted upon receiving an instrument, after repair, or during periodic calibration.

5.2 Preparation of Measurement

5.2.1 Equipment required for performance test

Table 5-1 lists the equipment required for performance test.

Table 5-1 Equipment Required for Performance Test

Equipment	Required performance	Recommended model
Spectrum analyzer	A level of 10 kHz to 2.7 GHz can be measured.	MS612A (Anritsu)
Oscilloscope	50Ω termination mode provided. Waveforms more than 200 MHz and two phenomena can be measured.	
Pulse generator	Pulses with a repetition frequency more than 10 MHz and a minimum pulse-width of less than 10 ns can be generated.	MG418A (Anritsu)
DC power source	0 to +5V and 500 mA can be output.	

5.2.2 Preparation

Supply power from the MG3633A AUX terminal to the MA1610A DC INPUT using the supplied power cord. This instrument meets these specifications in a temperature range of 0° to 50°C.

5.3 ON/OFF Ratio and Insertion Loss Tests

5.3.1 Specifications

ON/OFF ratio : ≧60 dB (<1000 MHz)
≧40 dB (≧1000 MHz)

Insertion loss : ≦2 dB (<1000 MHz)
≦3.5 dB (≧1000 MHz)

5.3.2 Setup

Set up as shown in Fig. 5-1.

Check ON/OFF ratio and insertion loss values over the entire frequency range.

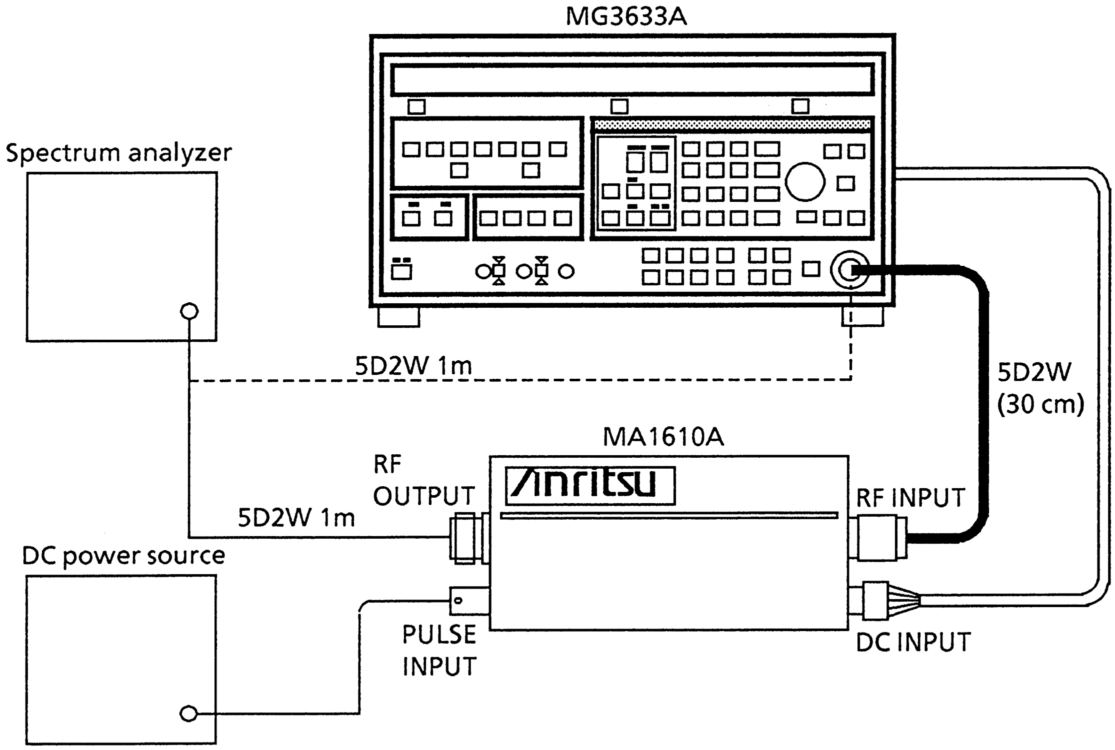


Fig. 5-1 Setup

5.3.3 Procedure

Procedure of ON/OFF ratio and insertion loss tests is as follows:

Step	Procedure
1	Set up connection as indicated with the dotted line of Fig. 5-1.
2	Set the MG3633A to measuring frequency and the output level to +7 dBm.
3	Measure RF OUTPUT with the spectrum analyzer as S (dBm).
4	Set up connections as indicated with solid lines in Fig. 5-1.
5	Apply +5 Vdc to the MA1610A PULSE INPUT.
6	Measure RF OUTPUT with the spectrum analyzer as X_{ON} (dBm).
7	Set the dc voltage to zero.
8	Measure the output with the spectrum analyzer as X_{OFF} (dBm).
9	Calculate ON/OFF ratio and insertion loss according to the following formula. ON/OFF ratio = $X_{ON} - X_{OFF}$ (dB) Insertion loss = $S - X_{ON}$ (dB)
10	Change the measured frequency and repeat steps 1 through 9.

5.4 Modulated Waveform Test

5.4.1 Specifications

Risetime	$\leqq$ 15 ns
Falltime	$\leqq$ 5 ns
Maximum delay time	$\leqq$ 40 ns
Video feedthrough	$\leqq$ 50 m Vp-p
Overshoot/ringing	$\leqq$ 20%

5.4.2 Setup

Set up as shown in Fig. 5-2.

Check the modulated waveform by observing with an oscilloscope.

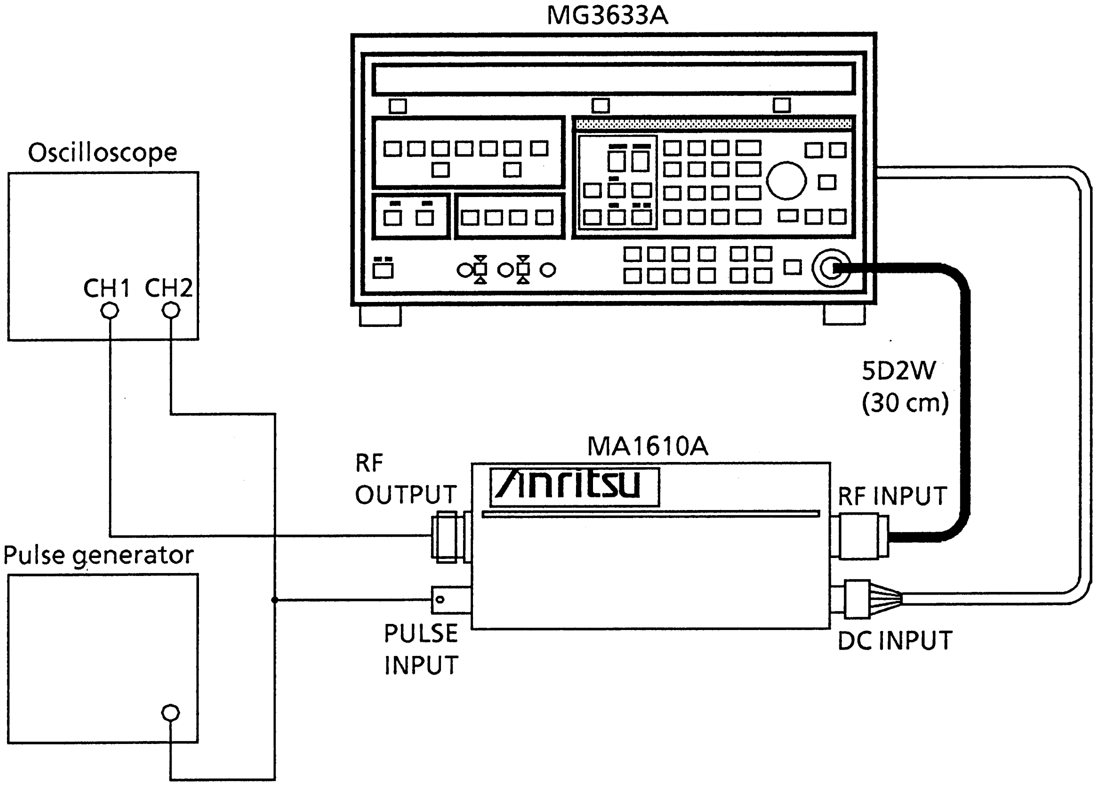


Fig. 5-2 Setup

5.4.3 Procedure

Procedure of modulated waveform test is as follows:

Step	Procedure
1	Set up as shown in Fig. 5-2.
2	Set the MG3633A to a frequency of 100 MHz and an output level of +7 dBm.
3	Set the repetition frequency of the pulse generator to 10 MHz, the pulse-width to 20 ns and the output level to TTL level (0 to +5V).
4	For both CH1 and CH2 of the oscilloscope, set the input mode to DC and 50Ω, and apply a trigger to rise edge of CH2.
5	Adjust the oscilloscope so that a waveform can be seen as shown in Fig. 4-2 and measure Tr, Tf, Td, Vrf and Vor and obtain rise/fall times, delay time and overshoot/ringing.
6	Set the MG3633A output to OFF and measure a video feedthrough Vf.

SECTION 6
CLEANING AND STORAGE

6.1 Cleaning

Always disconnect the power cable before cleaning the cabinet.

To clean the external cabinet:

- Use a soft, dry cloth for wiping off.
- Use a cloth moistened with diluted neutral cleaning liquid if the instrument is very dirty or before long-term storage.

  After insuring that the cabinet has been thoroughly dried, use a soft, dry cloth for wiping off.
- If loose screws are found, tighten them with the appropriate tools.

CAUTION

Never use benzene, thinner, or alcohol to clean the external cabinet; it may damage the coating, or cause deformation or discoloration.

6.2 Storage

This paragraph describes the precautions to take for long-term storage of the MA1610A Pulse Modulator.

6.2.1 Precautions before storage

(1) Before storage, wipe dust, finger-marks, and other dirt off the MA1610A.

(2) Avoid storing the MA1610A where:

1) It may be exposed to direct sunlight or high dust levels.
2) It may be exposed to high humidity.
3) It may be exposed to active gases.
4) It may be exposed to extreme temperatures ($< -20°C$ or $> 60°C$) or high humidity ($\geqq 90\%$).

6.2.2 Recommended storage precautions

The recommended storage conditions are as follows:

- Temperature .... 0 to 30°C
- Humidity .... 40% to 80%
- Stable temperature and humidity over 24-hour period

APPENDIX C
FREQUENCY-RESPONSE COMPENSATION SOFTWARE
MX5126B/MX5251B

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MX5126B/MX5251B

Frequency-Response Compensation Software

Software Operation Manual

ANRITSU CORPORATION

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1. GENERAL

Although the MG3633A has compensation data written at shipment so that the output-level frequency response is flat at the output connector, another data area is available for writing two more sets of compensation data.

The Frequency-Response Compensation Software MX5126B (for PACKET Ⅱe, Ⅲ, and Ⅲs)/ MX5251B (for PACKET V) measures the level at a device terminal (a cable end for example) with a GP-IB controller and a power meter, calculates compensation data from the level measurements so that the frequency response at the measurement point if flat, and writes the data into the MG3633 data compensation area all automatically.

The written data can be selected by special functions SP86 to 88.

Compensation data area

NORMAL	The frequency response is compensated for at the output connector. This is selected by special function 86. The compensation data cannot be rewritten.
USER CAL 1	Compensation data that maximizes the output level is written. This is selected by special function 87. The compensation data can be rewritten by using the Frequency-Response Compensation Software.
USER CAL 2	Compensation data that maximizes the output level is written. This is selected by special function 88. The compensation data can be rewritten by using the Frequency-Response Compensation Software.

2. PREPARATION

2.1 Equipment Required

The following equipment is required to execute the Frequency-Response Compensation Software.

Name	Description
PACKET Ⅱ e, Ⅲ, Ⅲ s or V	Personal technical computer (GP-IB controller) (MX5216B for PACKET Ⅱ e/Ⅲ/Ⅲ s, MX5251B for PACKET V)
ML4803A	Power meter
MA4601A	Power sensor (100 kHz to 5.5 GHz, −30 to +20 dBm)

2.2 Setup

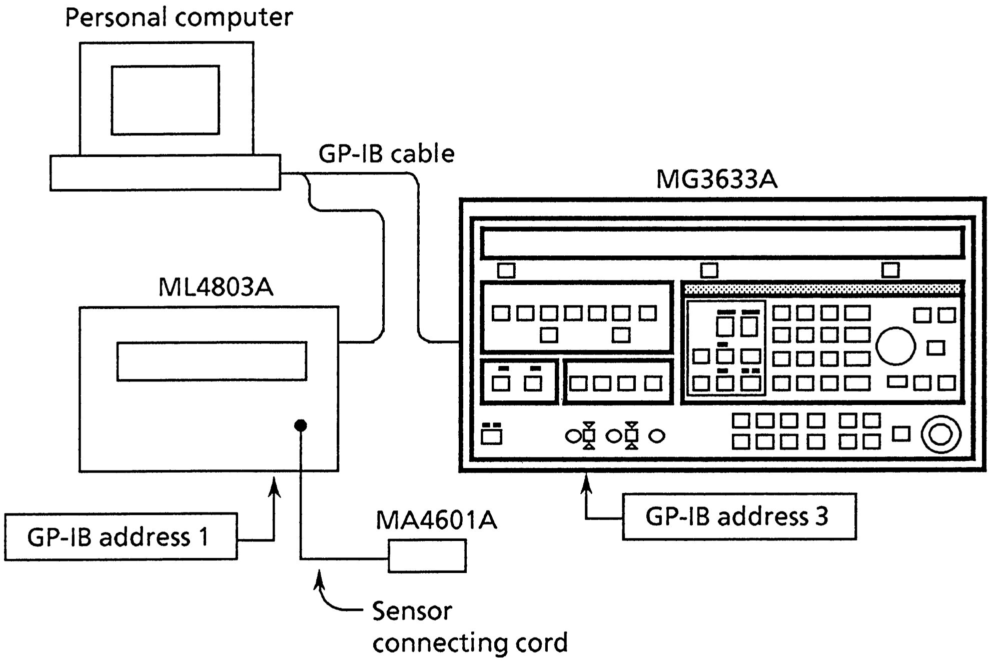
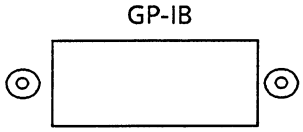
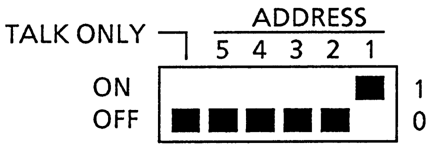


Fig. 2-1 Setup

Step	Procedure
1	Set the MG3633A GP-IB address to 3 as follows: After turning on the MG3633A power, press the following keys. [SPECIAL] [6] [2] — GP-IB address setting code [0] [3] — GP-IB address
2	Set the ML4803A GP-IB address to 1 as shown in the following figures:  
3	Connect the Personal Computer to the MG3633A and the ML4803A with GP-IB cables.
4	Connect the MA4601A to the ML4803A by using a sensor connecting cord.

2.3 Preparation

Step	Procedure
1	Connect each instrument as shown in Fig. 2-1.
2	Insert the program floppy disk into FD drive [0] of the PACKET Ⅱ e/Ⅲ/Ⅲ s or [A] of the PACKET V.
3	Confirm that each instrument is connected correctly; turn on the MG3633A and ML4803A, and warm them up for approx. 30 minutes or more.
4	Turn on the Personal Computer. (The program loads and starts automatically.)

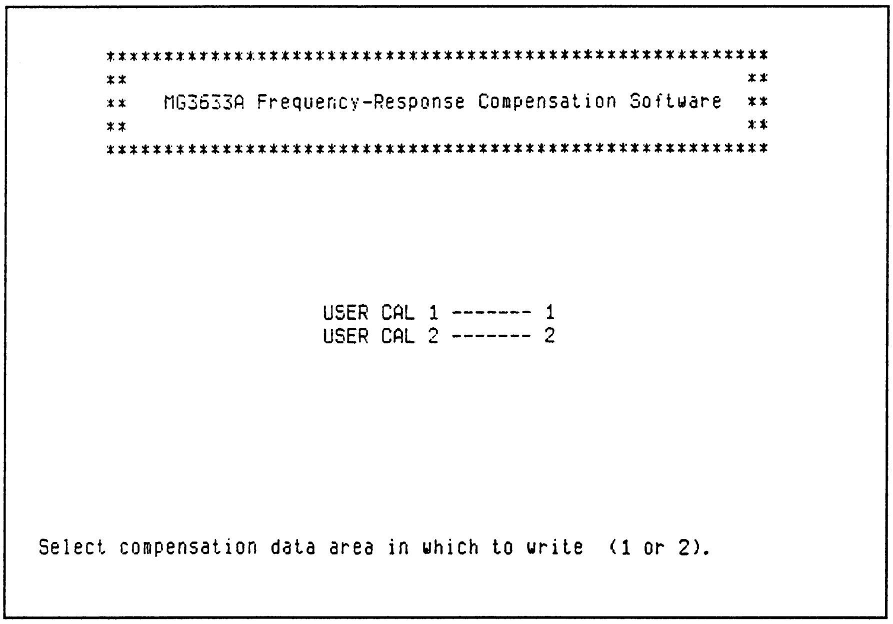
Notes: 1. If using the PACKET VH, turn on the power while pressing [SHIFT] and [F1] at the same time. These keys must be pressed and held until the drive [A] LED is lit.

2. Since this program controls the equipment (except for the power sensor) by GP-IB, do not press the MG3633A and ML4803A panel keys.

3. OPERATION PROCEDURE

[Step 1]

Immediately after the program starts, the following messages are displayed on the screen.



```
**********************************************************
**                                                      **
**   MG3633A Frequency-Response Compensation Software  **
**                                                      **
**********************************************************




                   USER CAL 1 ------- 1
                   USER CAL 2 ------- 2





Select compensation data area in which to write  (1 or 2).
```

Fig. 3-1 Compensation Data Area Selection Screen

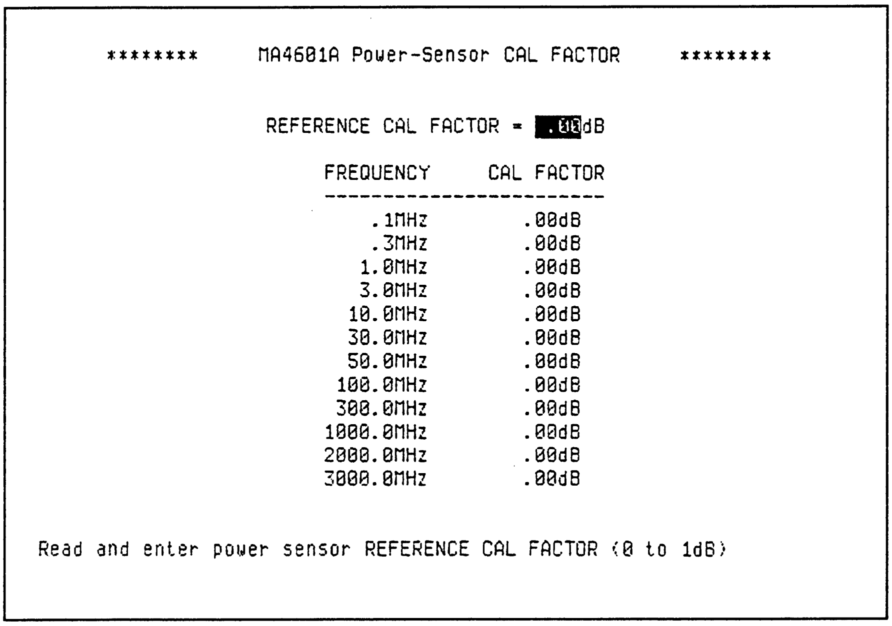
USER CAL 1 ··· Writes compensation data to this area. This data is used by SP87.

USER CAL 2 ··· Writes compensation data to this area. This data is used by SP88.

Press [1] or [2], then press [RETURN] .

[Step 2]

When the compensation data area has been selected, the following message is displayed on the screen.



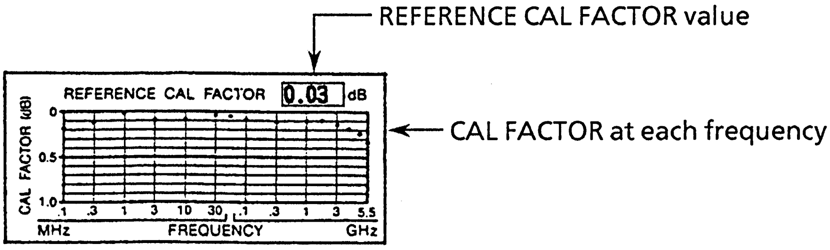
```
********     MA4601A Power-Sensor CAL FACTOR     ********

              REFERENCE CAL FACTOR = .00dB

                   FREQUENCY      CAL FACTOR
                   -------------------------
                      .1MHz          .00dB
                      .3MHz          .00dB
                     1.0MHz          .00dB
                     3.0MHz          .00dB
                    10.0MHz          .00dB
                    30.0MHz          .00dB
                    50.0MHz          .00dB
                   100.0MHz          .00dB
                   300.0MHz          .00dB
                  1000.0MHz          .00dB
                  2000.0MHz          .00dB
                  3000.0MHz          .00dB

Read and enter power sensor REFERENCE CAL FACTOR (0 to 1dB)
```

Fig. 3-2 Power-Sensor CAL FACTOR Entry Screen

Read the REFERENCE CAL FACTOR for the power sensor to be used and the CAL FACTOR at each frequency, then enter the values, and press [RETURN].

Example: [0] [.] [0] [8] [RETURN]

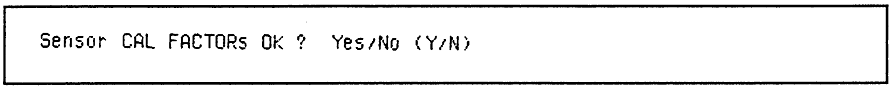
Each time a value is entered, the displayed value is replaced by the entered value and then the CAL FACTOR for the next entry becomes ready.



REFERENCE CAL FACTOR value

CAL FACTOR at each frequency

When all the CAL FACTOR values have been entered, the following message is displayed in the guidance area.



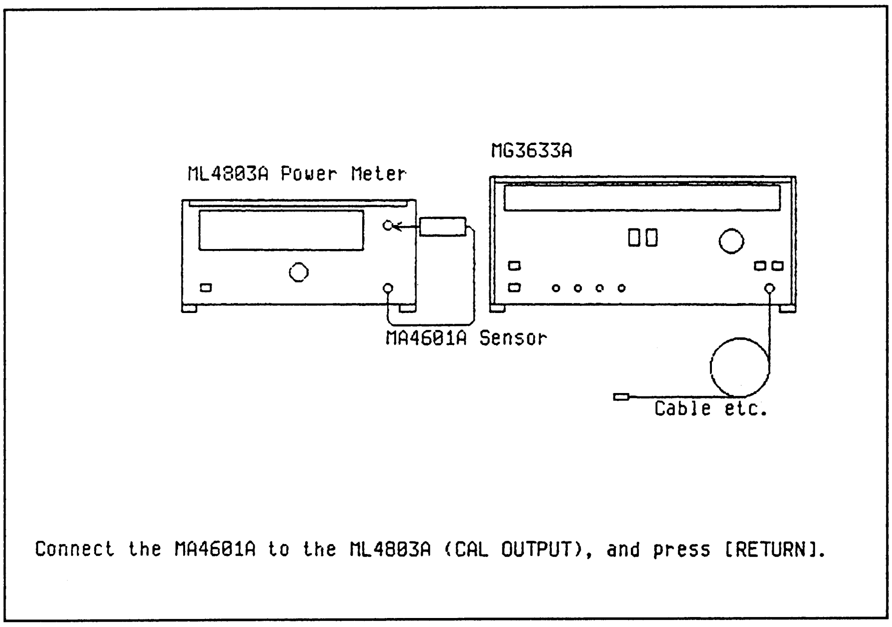
```
Sensor CAL FACTORs OK ?  Yes/No (Y/N)
```

If the currently displayed CAL FACTOR is correct, press [Y] and [RETURN].

If the currently displayed CAL FACTOR is incorrect, press [N] and [RETURN], and enter a new CAL FACTOR.

[Step 3]

After completing entry of the CAL FACTORs for the power sensor, the following message is displayed on the screen.

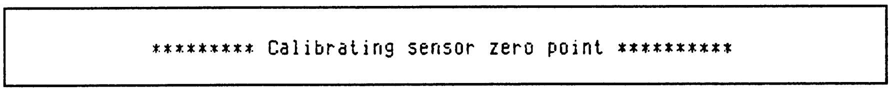


Connect the MA4601A to the ML4803A (CAL OUTPUT), and press [RETURN].

Fig. 3-3 Power Sensor Calibration Screen

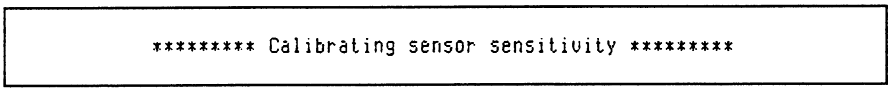
As the message indicates, connect the MA4601A to the ML4803A CAL OUTPUT, and press [RETURN].

The following message are displayed in the guidance area and power sensor calibration is carried out.



********* Calibrating sensor zero point **********

Approx. 7 seconds

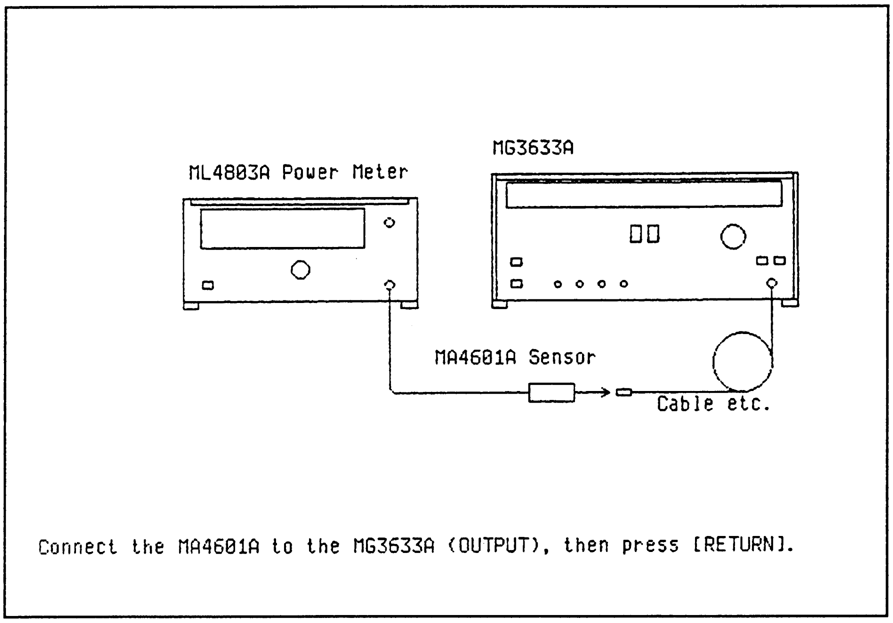


********* Calibrating sensor sensitivity *********

Approx. 3 seconds

[Step 4]

When power sensor calibration is complete, the following message is displayed on the screen.



```
Connect the MA4601A to the MG3633A (OUTPUT), then press [RETURN].
```

Fig. 3-4 Frequency Response Compensation Screen

As the message indicates, connect the MA4601A to the desired compensation point (a cable and for example) and press [RETURN].

The following messages are displayed in sequence in the guidance area, and frequency-response compensation starts.

```
************* Setting EEP-ROM address ************
```

Approx. 7 seconds

```
******** Calculating EEP-ROM initial data ********
```

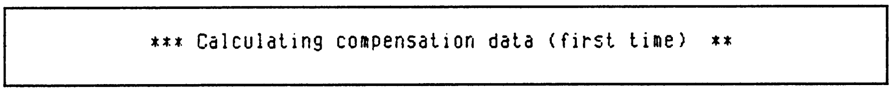
Approx. 3 seconds

```
******** Writing EEP-ROM initial data (400) ******
```

Approx. 45 seconds

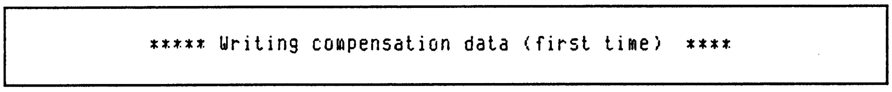
```
********** Measuring level (first time)  *********
```

Approx. 3 minutes



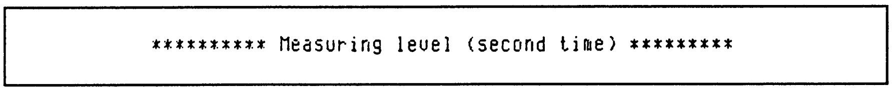
```
*** Calculating compensation data (first time)  **
```

Approx. 2 minutes



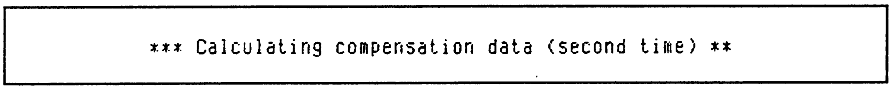
```
***** Writing compensation data (first time)  ****
```

Approx. 1 minute



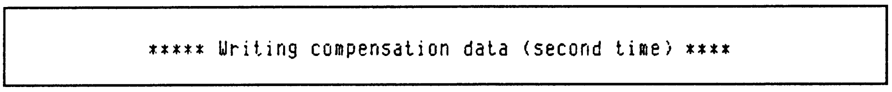
```
********** Measuring level (second time) *********
```

Approx. 3 minutes



```
*** Calculating compensation data (second time) **
```

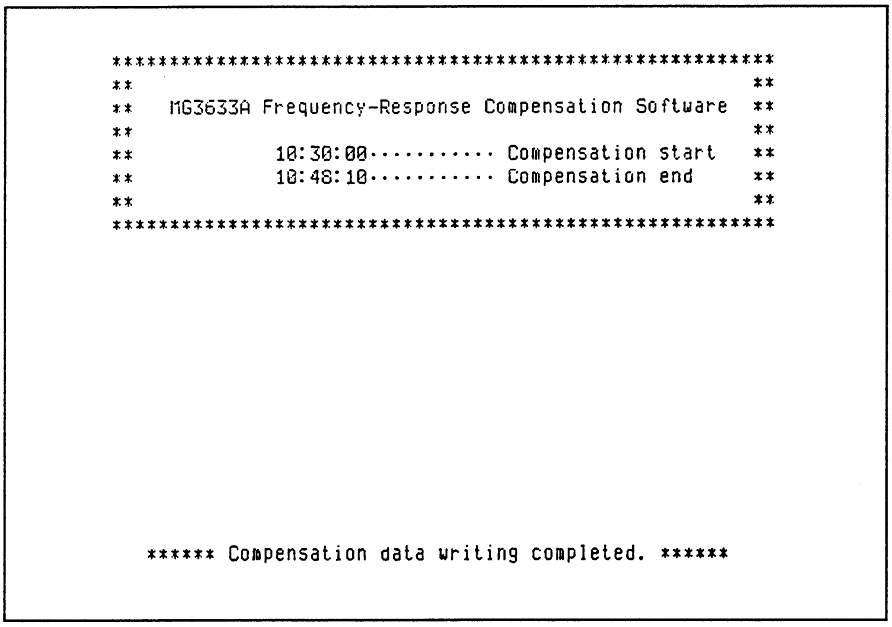
Approx. 2 minutes



```
***** Writing compensation data (second time) ****
```

Approx. 1 minute

When the frequency-response compensation is complete, the following messages are displayed on the screen and the program is terminated.



```
**********************************************************
**                                                      **
**   MG3633A Frequency-Response Compensation Software   **
**                                                      **
**            10:30:00··········· Compensation start    **
**            10:48:10··········· Compensation end      **
**                                                      **
**********************************************************








   ****** Compensation data writing completed. ******
```

Fig. 3-5 Compensation Completion Screen

Note: Do not forcibly stop the program during execution. If it is stopped, abnormal compensation data will be written; so compensate again.

4. ERROR MESSAGE

If any of the error messages shown below are displayed during frequency-response compensation, remove the cause and then follow the message instructions.

```
Input data value incorrect
```

Cause: A value other than 0 to 1 dB has been input for the power sensor CAL FACTOR.

Action: After the error message disappears, enter again.

```
Input data format incorrect
```

Cause: A value other than numeric values has been entered for the power sensor CAL FACTOR.

Action: After the error message disappears, enter again.

```
GP-IB connection incorrect. Check and then press [RETURN].
```

Cause: The GP-IB cable is connected incorrectly, or either the MG3633A or ML4803A GP-IB address is incorrect, or either the MG3633A or ML4803A is in only mode, or another device with the same GP-IB address is connected.

Action: Set the GP-IB address correctly, connect the GP-IB cable securely, and press [RETURN].

```
Cannot compensate because attenuation too large. Retry/Quit (R/Q)
```

Cause: The attenuation between the MG3633A output connector and compensation is too large.

Action: Cannot compensate.
Change the compensation point, then press [R] and [RETURN].
Also, when compensation stops, press [Q] and [RETURN].

Note: The max. compensation range is 5 dB.

5. USE OF COMPENSATION DATA

To use compensation data that has been written in the MG3633A compensation data area by the Frequency-Response Compensation Software, enter the special function code by the panel keys or GP-IB as follows:

For using normal compensation data (compensation for OUTPUT connector)

[SPECIAL] [8] [6]	(GP-IB code: SP86)

For using compensation data written to USER CAL 1

[SPECIAL] [8] [7]	(GP-IB code: SP87)

For using compensation data written to USER CAL 2

[SPECIAL] [8] [8]	(GP-IB code: SP88)

Note: When the MG3633A is initialized ([SPECIAL] [0] [0]), [SPECIAL] [8] [6] is executed automatically and the compensation becomes NORMAL.

MG3633A

Synthesized Signal Generator

GP-IB Operation Manual

ANRITSU CORPORATION

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SECTION 1

GENERAL

The MG3633A Synthesized Signal Generator is equipped with a General Purpose Interface Bus (GP-IB) interface as standard. The GP-IB is an interface bus for measurements performed in accordance with Institute of Electrical and Electronic Engineers (IEEE-488) or International Electrotechnical Commission (IEC-625) standards.

The MG3633A has the following GP-IB functions.

1. Control of all functions except for POWER switch, [LOCAL], and [PANEL LOCK]
2. Reads all setting conditions
3. Displays the GP-IB address on the FREQUENCY display
4. Interrupt and serial polling functions
5. Configures and automatic measuring system by combining the MG3633A with a personal computer and other measuring instruments.

Explanations in this operation manual are based on program examples using the Anritsu.

PACKET V Personal Technical Computer

Notes:

1. For data setting range for the GP-IB, see paragraph 4.12.1 (3) in the separate operation manual.
2. For GP-IB details, refer to the GP-IB BASIC GUIDE (sold separately from ANRITSU).

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SECTION 2
SPECIFICATIONS

2.1 GP-IB Interface Functions

The following table lists GP-IB interface functions for the MG3633A.

GP-IB Interface Functions

Symbol	Interface function	Remarks
SH1	All source handshake functions provided	Data sendable
AH1	All accept handshake functions provided	Data receivable
T5	Basic talker function provided Serial polling function provided Talk only function provided Talker release function by MLA provided	Talker function provided
L3	Basic listener function provided Listen only function provided Listener release function by MTA provided	Listener function provided
TE0	Address extension talker function not provided	Neither talker nor listener provided with function to extend up to secondary address
LE0	Address extension listener function not provided	
SR1	All service request functions provided	Interrupt function provided
RL1	All remote/local functions provided	Local lockout function provided
PP0	Parallel polling function not provided	————
DC1	All device clear function provided	All functions made SP00 initial condition
DT1	Device trigger function provided	————
C0	Control function not provided	Control function not provided

2.2 Device Messages

The MG3633A device messages consist of four types listed below.

- Data request messages
- Status message
- Control messages
- Special function messages

They are listed on a table in the following page:

Note: For these message details, see SECTION 6. APPENDIX A lists the device messages in alphabetical order. APPENDIX B lists the special function codes in numerical order.

GP-IB Data Request Messages (1/2)

Program code	Data contents	Unit
CFOA, FCOA, FROA	Frequency	Hz
FISOA	Step (incremental) frequency	Hz
FOSOA	Offset frequency	Hz
RLFOA	Relative frequency	Hz
REFOA	Reference frequency	Hz
OLOA, APOA	Output level	dBm, dBμ, V
OISOA	Step (incremental) output level	dB
OOSOA	Offset output level	dB
OLMOA	Output level limit value	dBm, dBμ, V
RLOOA	Relative output level	dB
REOOA	Reference output level	dBm, dBμ, V
AFOA	AF frequency	Hz
AISOA	Step (incremental) AF frequency	Hz
RAFOA	Reference AF frequency	Hz
FMOA	FM frequency deviation	Hz
RFMOA	Reference FM frequency deviation	Hz
AMOA	AM modulation factor	%
RAMOA	Reference AM modulation factor	%
PHMOA	∅M phase deviation	rad, deg
RPHOA	Reference ∅M phase deviation	rad, deg
INDOA	FM/∅M internal frequency/phase deviation	Hz, rad, deg
EXDOA	FM/∅M external frequency/phase deviation	Hz, rad, deg
FSAOA	Start frequency	Hz
FSBOA	Stop frequency	Hz
FSPOA	Span frequency	Hz
FSNOA	Number of frequency points	PT
FSZOA	Frequency step size	Hz
OSAOA	Start output level	dBm, dBμ, V
OSBOA	Stop output level	dBm, dBμ, V
OSPOA	Span output level	dB
OSNOA	Number of output level points	PT
ASAOA	Start AF frequency	Hz
ASBOA	Stop AF frequency	Hz
ASPOA	Span AF frequency	Hz
ASNOA	Number of AF frequency points	PT
ASZOA	AF frequency step size	Hz

GP-IB Data Request Messages (2/2)

Program code	Data contents	Unit
FRNOA	Number of frequency memory sweep points	PT
FRMOA	Frequency memory sweep address	PT
FUNOA	Number of function memory sweep points	PT
FUMOA	Function memory sweep address	PT
SWTOA	Sweep time	sec
FTOA	Function memory sweep time	sec
TRGOA	Trigger program	None
SPAOA	Special function status (01 to 20)	None
SPBOA	Special function status (21 to 40)	None
SPCOA	Special function status (41 to 60)	None
SPDOA	Special function status (61 to 80)	None
SPEOA	Special function status (81 to 99)	None
STSOA	Error status	None
OPTOA	Option set status	None
B5	Center frequency	None
B6	Frequency memory data	None
B7	Front panel setting condition	None
B8	Function memory data	None

Note: "CFOA" is set at initialization.
Once data is requested by a data request message, it remains valid until other message is issued. The units of the output level and ∅M are determined by the current units when requested (mV or µV units are automatically determined when V is specified. For examples, 0.01 V → 10 mV and 0.0001 V → 100 µV.)

Status Message Line Assignment

The status meaning of the lower 4 bits (bit 3 to bit 0) depends on the value (1 or 0) of the error bit (bit 5) sent on the line.

When error bit is 1

bit	7	6	5	4	3	2	1	0
Line / Data	DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
1	× *	Service request	Error	Busy	Malfunction error	Self test error	Suspended error	Data error
0	× *	No service request	No Error	Ready	No malfunction error	No self test error	No suspended error	No data error
Sending	0	1/0	1	1/0	1/0	1/0	1/0	1/0

When error bit is 0

bit	7	6	5	4	3	2	1	0
Line / Data	DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
1	× *	Service request	Error	Busy	Trigger program execution completed	Sweep execution completed	Marker position matched	String execution completed
0	× *	No service request	No Error	Ready	Trigger program execution incomplete	Sweep execution incomplete	Marker position not matched	String execution incomplete
Sending	0	1/0	0	1/0	1/0	1/0	1/0	1/0

*: Items marked with × are not used.

GP-IB Control Message (1/6)

	Parameter	Program code
DATA	NUMERAL 0~9	0~9
	MINUS	–
	DECIMAL POINT	●
UNIT	dB	DB
	dBm	DBM, DM
	dBμ	DBU, DU
	V	V
	mV	MV
	μV	UV
	GHz	GHZ, GZ
	MHz	MHZ, MZ
	kHz	KHZ, KZ
	Hz	HZ
	%	PC
	radian	RAD, RD
	degree	DEG, DG
	point	PT
	second	SEC, SC
	milli second	MS
FREQUENCY	FREQUENCY or CENTER FREQUENCY	FR, FC or CF
	FREQUENCY INCREMENTAL STEP	FIS
	INCREMENTAL STEP UP FREQ	UFR
	INCREMENTAL STEP DOWN FREQ	DFR
	KNOB UP FREQ	TFR
	KNOB DOWN FREQ	EFR
	RESET TUNABLE FREQ	ZFR
	FREQ RESOLUTION RIGHT	FSR
	FREQ RESOLUTION LEFT	FSL
	FREQ RESOLUTION 0.01 Hz	R0
	FREQ RESOLUTION 0.1 Hz	R1
	FREQ RESOLUTION 1 Hz	R2
	FREQ RESOLUTION 10 Hz	R3
	FREQ RESOLUTION 100 Hz	R4
	FREQ RESOLUTION 1 kHz	R5
	FREQ RESOLUTION 10 kHz	R6
	FREQ RESOLUTION 100 kHz	R7
	FREQ RESOLUTION 1 MHz	R8
	FREQ RESOLUTION 10 MHz	R9
	FREQ RELATIVE ON	FO
	FREQ RELATIVE OFF	FF
	FREQ OFFSET	FOS

GP-IB Control Message (2/6)

	Parameter	Program code
OUTPUT LEVEL	OUTPUT LEVEL or AMPLITUDE	OL or AP
	OUTPUT LEVEL INCREMENTAL STEP	OIS
	INCREMENTAL STEP UP OUTPUT LEVEL	UOL
	INCREMENTAL STEP DOWN OUTPUT LEVEL	DOL
	KNOB UP OUTPUT LEVEL	TOL
	KNOB DOWN OUTPUT LEVEL	EOL
	RESET TUNABLE OUTPUT LEVEL	ZOL
	OUTPUT LEVEL RESOLUTION RIGHT	OSR
	OUTPUT LEVEL RESOLUTION LEFT	OSL
	OUTPUT LEVEL RESOLUTION 0.1 dB	L0
	OUTPUT LEVEL RESOLUTION 1 dB	L1
	OUTPUT LEVEL RESOLUTION 10 dB	L2
	OUTPUT LEVEL CONTINUOUS MODE SET	LC
	OUTPUT LEVEL NORMAL MODE SET	LN
	OUTPUT LEVEL RELATIVE ON	LO
	OUTPUT LEVEL RELATIVE OFF	LF
	OUTPUT LEVEL ON	RO
	OUTPUT LEVEL OFF	RF
	RPP RESET	RS
	OUTPUT LEVEL OFFSET	OOS
	OUTPUT LEVEL LIMIT	OLM
	OUTPUT LEVEL UNIT dBm or AMPLITUDE UNIT dBm	OLDBM, OLDM or APDBM, APDM
	OUTPUT LEVEL UNIT dBμ or AMPLITUDE UNIT dBμ	OLDBU, OLDU or APDBU, APDU
	OUTPUT LEVEL UNIT V or AMPLITUDE UNIT V	OLV or APV
MODULATION (AM)	AM(AMPLITUDE MODULATION)	AM
	INCREMENTAL STEP UP AM	UAM
	INCREMENTAL STEP DOWN AM	DAM
	KNOB UP AM	TAM
	KNOB DOWN AM	EAM
	RESET TUNABLE AM	ZAM
	AM RESOLUTION RIGHT	AD3
	AM RESOLUTION LEFT	AD4
	AM RESOLUTION 1st DIGIT	AD0
	AM RESOLUTION 2nd DIGIT	AD1
	AM RESOLUTION 3rd DIGIT	AD2
	INT AM MODE ON	A1
	EXT AC AM MODE ON	A2
	EXT DC AM MODE ON	A3
	INT/EXT AC AM MODE ON	A4
	INT/EXT DC AM MODE ON	A5
	AM OFF	A0

GP-IB Control Message (3/6)

	Parameter	Program code
MODULATION (FM)	FM(FREQUENCY MODULATION)	FM
	INCREMENTAL STEP UP FM	UFM
	INCREMENTAL STEP DOWN FM	DFM
	KNOB UP FM	TFM
	KNOB DOWN FM	EFM
	RESET TUNABLE FM	ZFM
	FM RESOLUTION RIGHT	FD3
	FM RESOLUTION LEFT	FD4
	FM RESOLUTION 1st DIGIT	FD0
	FM RESOLUTION 2nd DIGIT	FD1
	FM RESOLUTION 3rd DIGIT	FD2
	INT FM MODE ON	F1
	EXT AC FM MODE ON	F2
	EXT DC FM MODE ON	F3
	INT/EXT AC FM MODE ON	F4
	INT/EXT DC FM MODE ON	F5
	FM OFF	F0
	FREQ CAL	CAL
MODULATION (ØM)	ØM(PHASE MODULATION)	PHM
	INCREMENTAL STEP UP ØM	UPH
	INCREMENTAL STEP DOWN ØM	DPH
	KNOB UP ØM	TPH
	KNOB DOWN ØM	EPH
	RESET TUNABLE ØM	ZPH
	ØM RESOLUTION RIGHT	PD3
	ØM RESOLUTION LEFT	PD4
	ØM RESOLUTION 1st DIGIT	PD0
	ØM RESOLUTION 2nd DIGIT	PD1
	ØM RESOLUTION 3rd DIGIT	PD2
	INT ØM MODE ON	PH1
	EXT AC ØM MODE ON	PH2
	EXT DC ØM MODE ON	PH3
	INT/EXT AC ØM MODE ON	PH4
	INT/EXT DC ØM MODE ON	PH5
	ØM OFF	PH0
	ØM UNIT radian	PHMRAD, PHMRD
	ØM UNIT degree	PHMDEG, PHMDG
MODULATION (FM/ØM)	INT DEVIATION FIX	IND
	EXT DEVIATION FIX	EXD

GP-IB Control Message (4/6)

	Parameter	Program code
AF OSC	AF(AUDIO FREQUENCY)	AF
	INT MOD FREQ OUTPUT AF OSC	M0
	INT MOD FREQ OUTPUT 1 kHz	M1
	INT MOD FREQ OUTPUT 400 Hz	M2
	AF INCREMENTAL STEP	AIS
	INCREMENTAL STEP UP AF	UAF
	INCREMENTAL STEP DOWN AF	DAF
	KNOB UP AF	TAF
	KNOB DOWN AF	EAF
	RESET TUNABLE AF	ZAF
	AF RESOLUTION RIGHT	ASR
	AF RESOLUTION LEFT	ASL
	AF RESOLUTION 0.1 Hz	AR0
	AF RESOLUTION 1 Hz	AR1
	AF RESOLUTION 10 Hz	AR2
	AF RESOLUTION 100 Hz	AR3
	AF RESOLUTION 1 kHz	AR4
	AF RESOLUTION 10 kHz	AR5
SWEEP (FREQ)	FREQ SWEEP START	FSA
	FREQ SWEEP STOP	FSB
	FREQ SWEEP SPAN	FSP
	FREQ SWEEP POINT	FSN
	FREQ SWEEP STEP SIZE	FSZ
	FREQ SWEEP STEP LOG SIZE	FLG
	FREQ SWEEP OFF	SF0
	FREQ SWEEP AUTO	SF1
	FREQ SWEEP SINGLE	SF2
	FREQ SWEEP MANUAL	SF3
	FREQ SWEEP MARKER OFF	SF4
	FREQ SWEEP MARKER ON	SF5
	FREQ SWEEP BREAK	SF6
	FREQ SWEEP CONTINUE	SF7
	FREQ SWEEP STEP UP	SF8
	FREQ SWEEP STEP DOWN	SF9
	FREQ SWEEP START PRESET	SFA
	FREQ SWEEP STOP PRESET	SFB

GP-IB Control Message (5/6)

	Parameter	Program code
SWEEP (OUTPUT LEVEL)	OUTPUT LEVEL SWEEP START	OSA
	OUTPUT LEVEL SWEEP STOP	OSB
	OUTPUT LEVEL SWEEP SPAN	OSP
	OUTPUT LEVEL SWEEP OFF	SO0
	OUTPUT LEVEL SWEEP AUTO	SO1
	OUTPUT LEVEL SWEEP SINGLE	SO2
	OUTPUT LEVEL SWEEP MANUAL	SO3
	OUTPUT LEVEL SWEEP MARKER OFF	SO4
	OUTPUT LEVEL SWEEP MARKER ON	SO5
	OUTPUT LEVEL SWEEP BREAK	SO6
	OUTPUT LEVEL SWEEP CONTINUE	SO7
	OUTPUT LEVEL SWEEP STEP UP	SO8
	OUTPUT LEVEL SWEEP STEP DOWN	SO9
	OUTPUT LEVEL SWEEP START PRESET	SOA
	OUTPUT LEVEL SWEEP STOP PRESET	SOB
SWEEP (AF OSC)	AF SWEEP START	ASA
	AF SWEEP STOP	ASB
	AF SWEEP SPAN	ASP
	AF SWEEP POINT	ASN
	AF SWEEP STEP SIZE	ASZ
	AF SWEEP STEP LOG SIZE	ALG
	AF SWEEP OFF	SA0
	AF SWEEP AUTO	SA1
	AF SWEEP SINGLE	SA2
	AF SWEEP MANUAL	SA3
	AF SWEEP MARKER OFF	SA4
	AF SWEEP MARKER ON	SA5
	AF SWEEP BREAK	SA6
	AF SWEEP CONTINUE	SA7
	AF SWEEP STEP UP	SA8
	AF SWEEP STEP DOWN	SA9
	AF SWEEP START PRESET	SAA
	AF SWEEP STOP PRESET	SAB

GP-IB Control Message (6/6)

	Parameter	Program code
SWEEP (FREQ MEMORY)	FREQ MEMORY SWEEP ADDRESS	FRM
	FREQ MEMORY SWEEP OFF	SR0
	FREQ MEMORY SWEEP AUTO	SR1
	FREQ MEMORY SWEEP SINGLE	SR2
	FREQ MEMORY SWEEP MANUAL	SR3
	FREQ MEMORY SWEEP MARKER OFF	SR4
	FREQ MEMORY SWEEP MARKER ON	SR5
	FREQ MEMORY SWEEP BREAK	SR6
	FREQ MEMORY SWEEP CONTINUE	SR7
	FREQ MEMORY SWEEP STEP UP	SR8
	FREQ MEMORY SWEEP STEP DOWN	SR9
	FREQ MEMORY SWEEP START PRESET	SRA
	FREQ MEMORY SWEEP STOP PRESET	SRB
SWEEP (FUNCTION MEMORY)	FUNCTION MEMORY SWEEP ADDRESS	FUM
	FUNCTION MEMORY SWEEP OFF	SU0
	FUNCTION MEMORY SWEEP AUTO	SU1
	FUNCTION MEMORY SWEEP SINGLE	SU2
	FUNCTION MEMORY SWEEP MANUAL	SU3
	FUNCTION MEMORY SWEEP BREAK	SU6
	FUNCTION MEMORY SWEEP CONTINUE	SU7
	FUNCTION MEMORY SWEEP STEP UP	SU8
	FUNCTION MEMORY SWEEP STEP DOWN	SU9
	FUNCTION MEMORY SWEEP START PRESET	SUA
	FUNCTION MEMORY SWEEP STOP PRESET	SUB
SWEEP TIME	SWEEP TIME	SWT
	FUNCTION MEMORY SWEEP TIME	FT
MEMORY	STORE	ST
	RECALL	RC
	FREQ	FQ
	FUNCTION	FN
SPECIAL	SPECIAL FUNCTION	SP
TRIGGER	TRIGGER PROGRAM SET	TRG
BINARY	BINARY FREQUENCY SET	B1
	BINARY FREQ MEMORY SET	B2
	BINARY PANEL SET	B3
	BINARY FUNCTION MEMORY SET	B4
	BINARY FREQ MEMORY DATA CHECK	CBF
	BINARY FUNCTION MEMORY DATA CHECK	CBU
	BINARY FREQ MEMORY ADDRESS SET	ABF
	BINARY FUNCTION MEMORY ADDRESS SET	ABU

Special Function Message (1/2)

	Parameter (contents of special function)		Program code
Initial	Initialization		SP00
Bell	Bell OFF		SP01
	Bell ON		SP02
Level display	Output level:	open-circuit voltage display (EMF)*	SP03
	Output level:	terminated voltage display	SP04
Limiter	Output level:	limiter OFF*	SP05
	Output level:	limiter ON	SP06
Offset	Output level:	offset mode OFF*	SP07
	Output level:	offset mode ON	SP08
	Frequency:	offset mode OFF*	SP11
	Frequency:	offset mode ON	SP12
Memory protect	Frequency memory:	protect OFF	SP13
	Frequency memory:	protect ON	SP14
	Function memory :	protect OFF	SP15
	Function memory:	protect ON	SP16
MODULATION	FM OSC:	automatic switching	SP17
	FM OSC:	middle fixed	SP18
	FM OSC :	wide fixed	SP19
	ØM OSC:	automatic switching	SP20
	ØM OSC:	middle fixed	SP21
	ØM OSC:	wide fixed	SP22
	FM/ØM:	polarity normal	SP23
	FM/ØM :	polarity invert	SP24
	FM/ØM :	INT/EXT deviation release	SP25
	FM/ØM :	INT deviation fixed	SP26
	FM/ØM:	EXT deviation fixed	SP27
AF OSC	INT MOD:	normal	SP30
	INT MOD:	+ DC applied	SP31
	INT MOD:	− DC applied	SP32
	INT MOD:	± DC external control	SP33
	MOD OUTPUT:	automatic switching	SP35
	MOD OUTPUT:	INT fixed	SP36
	MOD OUTPUT:	AM EXT fixed	SP37
	MOD OUTPUT:	FM/ØM EXT fixed	SP38
SWEEP	SWEEP BLANKING output:	positive logic	SP43
	SWEEP BLANKING output:	negative logic	SP44
	Function memory sweep:	sweep output pattern 1	SP45
	Function memory sweep:	sweep output pattern 2	SP46

*: Items marked with * indicate the status when SP00 is executed.

Special Function Message (2/2)

	Parameter (contents of special function)	Program code
Trigger	Trigger program: setting Trigger program: clear Trigger program: start	SP56 SP57 SP58
GP-IB	GP-IB: talker data with header GP-IB: talker data with no header GP-IB: address display	SP60 SP61 SP63
SRQ	SRQ: ALL MASK* SRQ: ERROR MASK OFF SRQ: BUSY/READY MASK OFF SRQ: MALFUNCTION MASK OFF SRQ: SELF TEST MASK OFF SRQ: SUSPENSION MASK OFF SRQ: DATA ERROR MASK OFF SRQ: TRIGGER PROGRAM END MASK OFF SRQ: SWEEP END MASK OFF SRQ: MARKER POSITION MASK OFF SRQ: STRINGS END MASK OFF	SP70 SP71 SP72 SP73 SP74 SP75 SP76 SP77 SP78 SP79 SP80
Memory clear	Frequency memory: clear Function memory: clear	SP81 SP82
Option	Option display	SP83
Output level correction	Output level correction: normal Output level correction: CAL data 1 (option 07) Output level correction: CAL data 2 (option 07)	SP86 SP87 SP88

*: Items marked with * indicate the status when SP00 is executed.

(Blank)

SECTION 3

PRECAUTIONS BEFORE USING GP-IB

3.1 Connecting and Disconnecting GP-IB Cable

Connect and disconnect the GP-IB cable with the POWER switch set to OFF and with the power cord pulled out.

The reason is described below. Occasionally, the common signal line of the cable may be disconnected faster than the other lines when connecting and disconnecting the cable. At this time, if the power is left on, parts such as ICs in the interface unit may be damaged as a result of AC leak voltage.

3.2 Setting and Confirming GP-IB Address

Set the GP-IB address after turning on the power with front panel keys by SP62.

Address No. 03 is set at the factory so it is not necessary to set the address when 03 is to be used.

Set the GP-IB address as follows:

- After the power is turned on, set the local state and input GP-IB address by SP62.
- When the remote state (REMS) is set, press [LOCAL] to set the local state.
- When the remote with lockout state (RWLS) is set, obtain the local state by executing program.

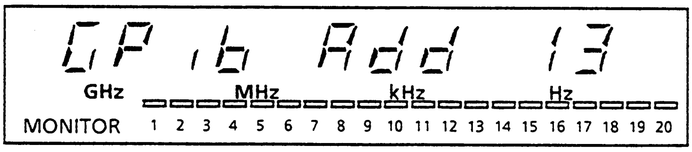
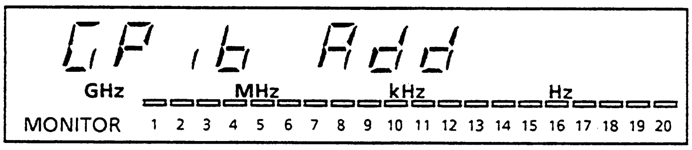
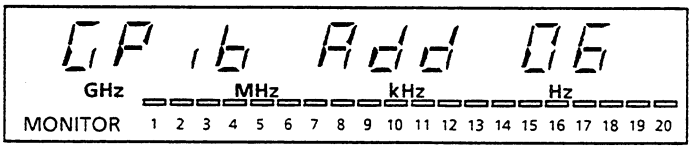
Confirming address by SP63

Press [SPECIAL], [6], [3] (hold [3]). The current address is displayed on the FREQUENCY display while [3] is pressed.

Setting address by SP62

- Press [SPECIAL], [6], [2], then set the address by using the numeric keys [0] to [9].
- Set the address by using two-digit numeric. Addresses 0 (00) to 9 (09) are set by pressing [0] [0] to [0] [9].
- Address setting range: 00 through 30

Example: Set remote status (REMS) to local status, check the current address 13, then change the address to 6.

Step	Key Operation	Verification
1	[LOCAL]	Check REMOTE lamp went out.
	Confirming address	
2	[SPECIAL] [6] [3] ↑ Press and hold.	
	Changing address	
3	[SPECIAL] [6] [2]	
4	[0] [6]	 Frequency is displayed immediately after "6" is keyed-in.

SECTION 4

DEVICE-MESSAGE GENERAL FORMAT

4.1 Comments on Device Message

When using the GP-IB system, actual control may be poor although the IEEE-488 standard has been met mechanically and electrically.

This is because device message conventions have not been observed although interface messages fully meet the IEEE-488 standard.

The GP-IB Interface messages are specifications applied universally to all devices, while device messages are device-dependent. So a device cannot be controlled unless a program is written in accordance with the unique device message specifications decided accordingly for each device.

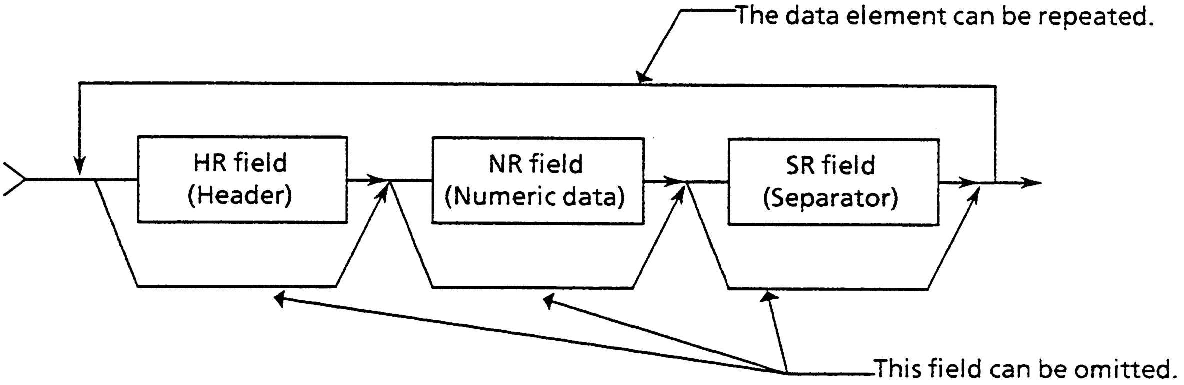
Therefore, a fixed standard within the range which keeps their universality has been established for the code and format of device messages. The first standard (publication 625-2) was issued by IEC in 1980 and was followed by IEEE-Std. 728-1982 in 1982.

To minimize problems and to facilitate use and in consideration of these moves toward standardization, Anritsu has standardized the code and format of its device messages.

4.2 Device-Message General Format

As indicated with the figure below, the general structure of a device message is in three parts: header HR, data NR, and separator SR, in this order.

Also indicated is that any one of the header, numeric data, or separator fields can be omitted, and the data element may be repeated.



Device-Message General Format

4.3 Explanting Each Device Message Element

This paragraph explains HR, NR and SR device message elements.

(1) HR field (Header)

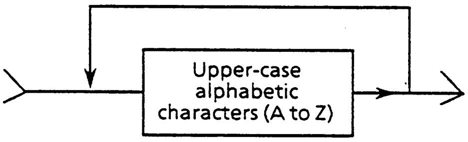
This is used at the beginning of a device message. Generally, it shows the purpose and function of numerical data following the header. If numerical data is not attached, the header expressed some predetermined setting.

Usually, 1 to 4 upper-case alphabetic characters are used as shown in the table in paragraph 2.2. Since the meaning of headers are unique to each device, read the operation manual of the corresponding device.

The header format is usually divided into two: HR1 format, where the header is expressed only as alphabetic characters (A to Z); and HR2 format, where a combination of alphabetic characters and spaces is allowed.

(a) HR1 format

- Combination of upper-case alphabetic characters (A to Z)
- There is no length limit, but 1 to 3 characters are normally used.

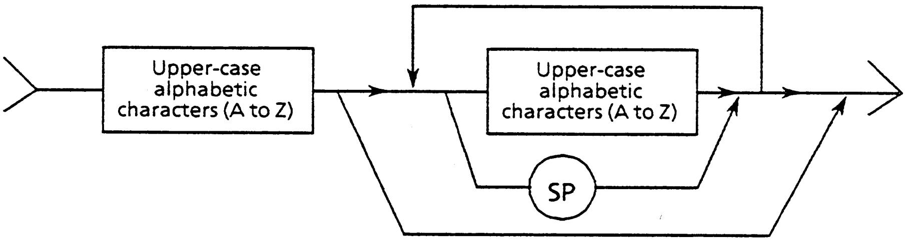


(b) HR2 format

- The first character must be an upper-case alphabetic. All other characters can be any combination of upper-case alphabetic and spaces.

(HR1 format is part of HR2 format but in most cases HR1 format is used (MG3633A uses HR1 format).)

- SP indicates space

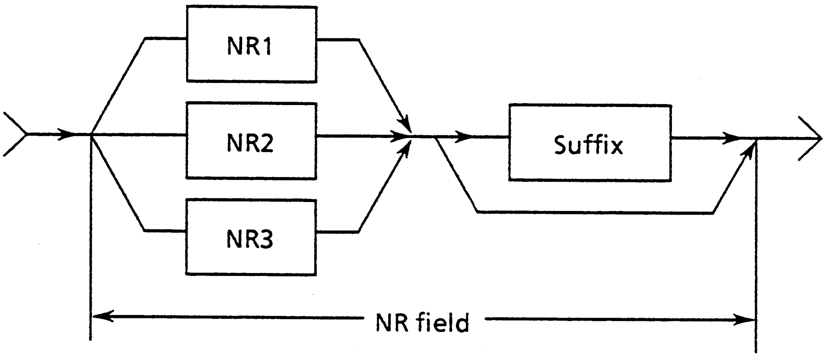


(2) NR field (Numerical Representation)

The NR field contains numeric decimal data for execution of functions indicated by headers.

The NR1 format is for integers, NR2 format is for real numbers, and NR3 format is for exponents. A suffix (unit) can be placed at the end of each format.

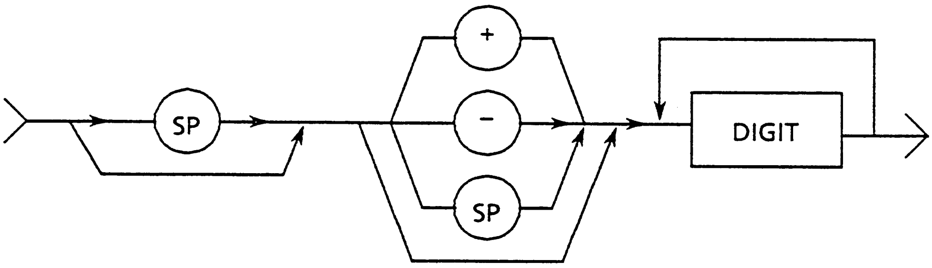
The above-mentioned general format is shown in the figure below.



NR-Field General Format

(a) NR1 format (integer)

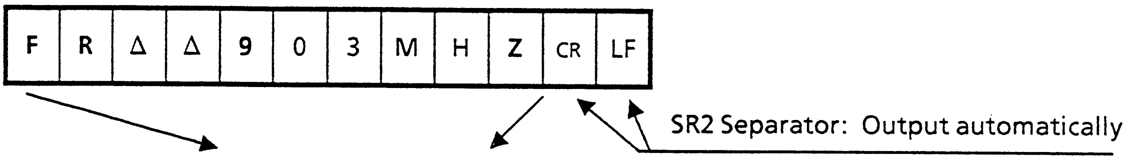
- DIGIT: Numbers 0 to 9
- Space can be inserted at head
- + sign can be replaced with a space or omitted
- Do not use - (minus) sign with the number 0.



NR1 Format Syntax Diagram

Example: Set frequency to 903 MHz.

Format

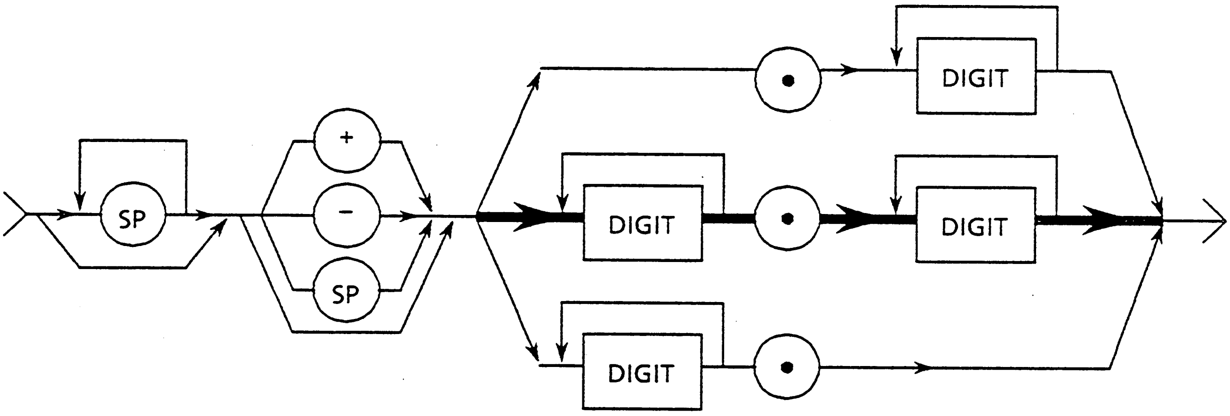


WRITE @103 : "FR 903MHZ"

The above program can be created without space as **WRITE @103 : "FR903MHZ"**.

(b) NR2 format (real number)

- A decimal point must be included.
- The left side of the decimal point is the same as NR1 format,
- The right side of the decimal point uses no spaces.



NR2 Format Syntax Diagram

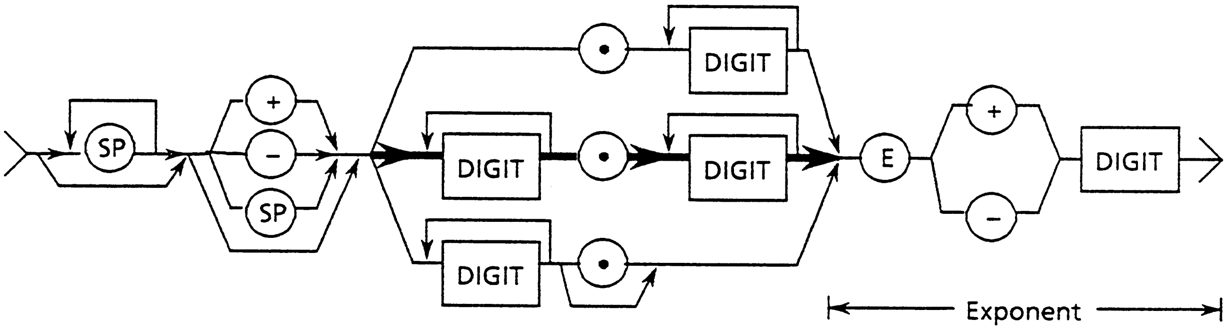
Example: Set frequency deviation to 3.5 kHz (For suffix, see paragraph (d) below

Format	Program
① FM ΔΔ3.5KHZ CR LF V V V HR1 NR2 SR2	WRITE @103:"FM 3.5KHZ"
② FM 3.5KHZ CR LF V V V HR1 NR2 SR2	WRITE @103:"FM3.5KHZ"

(C) NR3 format (Floating point number)

- The left side of E is the same as in NR2 format.
- The standard number of exponent digits is two.

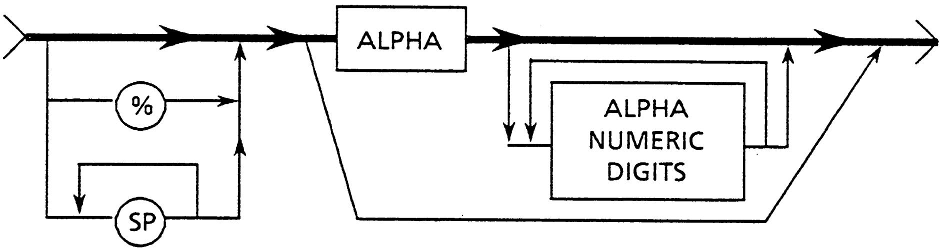
  (Listener must operate regardless of the presence of decimal point.)



NR3 Format Syntax Diagram

(d) Suffix

- The suffix is the last part of the NR field, but there may be a space at the beginning.
- Only a space can be placed right after NR.
- ALPHA NUMERIC DIGITS: In addition to alphanumerics, / and * can be included



Suffix Syntax Diagram

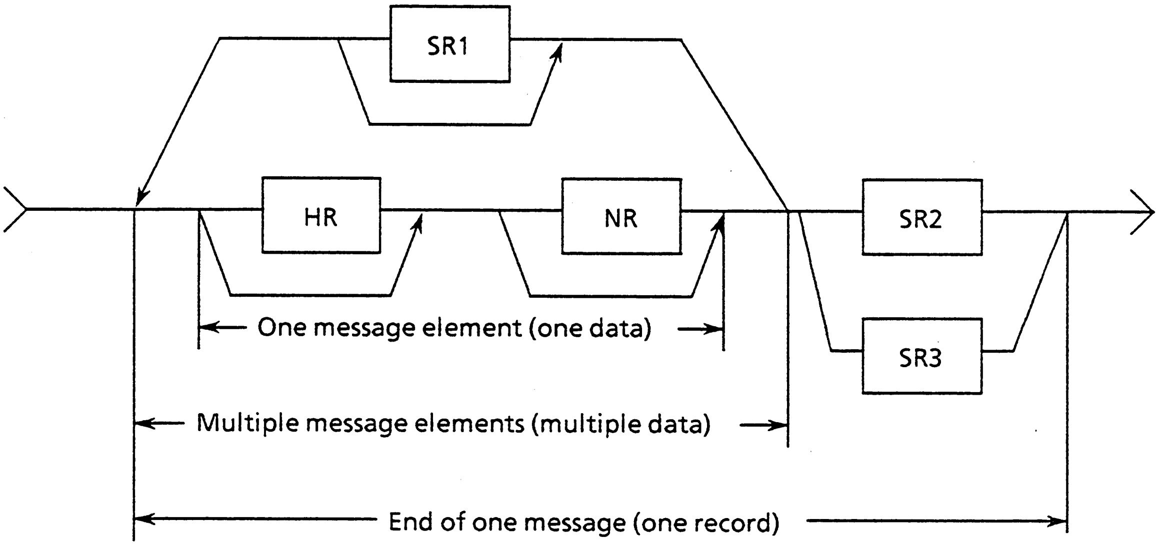
The suffixes used with the MG3633A are shown in the Table below.

Suffix List

Unit	Suffix
GHz	GHZ, GZ
MHz	MHZ, MZ
kHz	KHZ, KZ
Hz	HZ
dBm	DBM, DM
dBμ	DBU, DU
V	V
mV	MV
μV	UV
dB	DB
%	PC
radian	RAD, RD
degree	DEG, DG
point	PT
second	SEC, SC
m second	MS

(3) SR field (Separator)

The figure below shows the general format of device messages that use the SR field type (SR1, SR2, and SR3) expressions



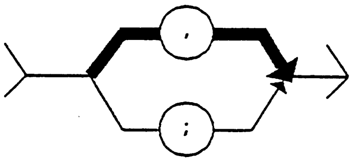
Device-Message General Format

Hierarchy of Separator

Level	Name	ASCII code	Uni-line message	Meaning and usage	
1	SR1 Separator	, ;		Identifies the end of the lowest level of message elements or data fields	
2	SR2 Separator	CR LF		End of record	Sent after the last DAB
3	SR3 Separator		EOI		Sent simultaneously with the last DAB

As shown above, when there are two or more message elements (data) within a message (record), the SR field (SR1) is used to identify them as different data. It (SR2, SR3) is also used to indicate the end of a message (record).

(a) SR1 format



SR1 Syntax Diagram

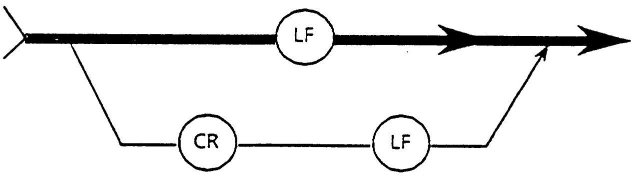
An SR1 separator is the lowest level separator. Two separators exist at this level: the comma (,) and semicolon (;). The lowest order separator of these two is the comma (,) and is, for most applications, the preferred separator. The MG3633A uses a comma.

■ SR1 flexibility

A comma is the preferred SR1 separator, but the following are also recognized for SR1. (Since they are not used in some devices, separation using a comma is recommended.)

- Semicolon (;)
- Only spaces used for part of suffix.
- Separation of message element (data) can be identified explicitly only with HR field

(b) SR2 format



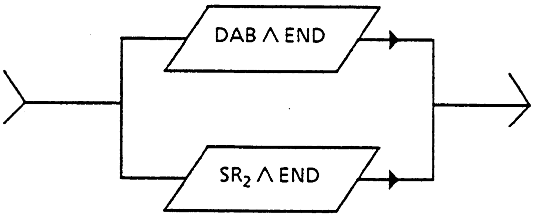
SR2 Syntax Diagram

SR2 is used to indicate the end of a message (record) generally expressed in one line. It is recommended that the Line Feed (LF) code is used. However, at present, carriage return (CR) code is also allowed for the following reasons.

1. Compatibility. Most products on the market use CR·LF code.
2. Generally, it is enough for the listener to recognize only the last LF as the separator and to ignore the CR code.
   However, if the CR code is actually used, as with a printer, the CR code is required.

The MG3633A can accept a CR and LF, or simply an LF.

(c) SR3 format



SR3 Syntax Diagram

SR3 is the highest level separator. In response to this, the END message (using the EOI line simultaneously with the last data byte, as shown above) is sent and received. The SR3 is used to indicate the end of binary data and the transfer completion of multiple messages. Generally, release (or modification) of the talker/listener specification is performed after SR3 is transferred.

The last data byte may be SR2

SECTION 5
FORMAT OF MG3633A DEVICE MESSAGE

The following device-message formats used for the MG3633A are explained in this section.

- Format of control message
- Format of data request message
- Format of talker output message other than status message

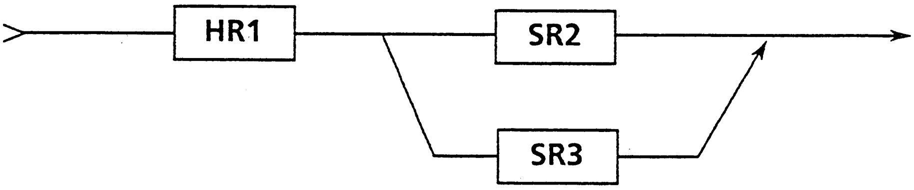
Note: Status message is described in Section 8.

5.1 Format of Control Message

There are three types of control messages to control the MG3633A.

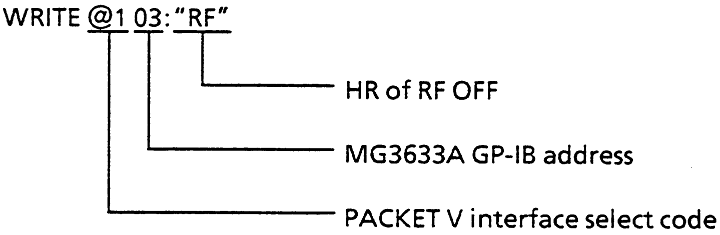
This explanation uses the PACKET V command. In the PACKET V WRITE statement, SR2 (CR LF) is output automatically at the end of the message.

(1) Control-message format 1



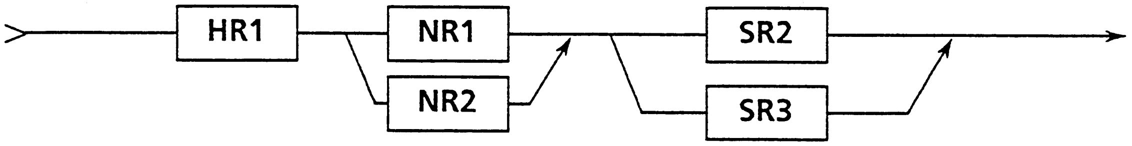
Example

Turn off output level



```
WRITE @1 03:"RF"
```

(2) Control-message format 2

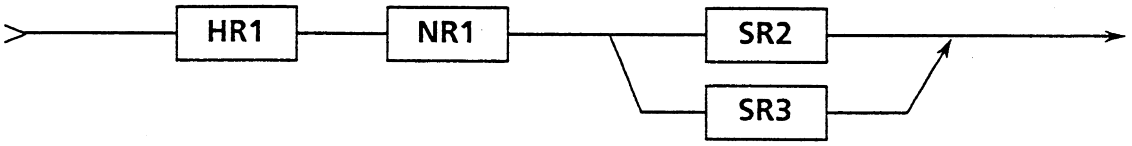


Example

Set carrier frequency to 123 MHz.

WRITE @103:"FR123MHZ"

(3) Control-message format 3



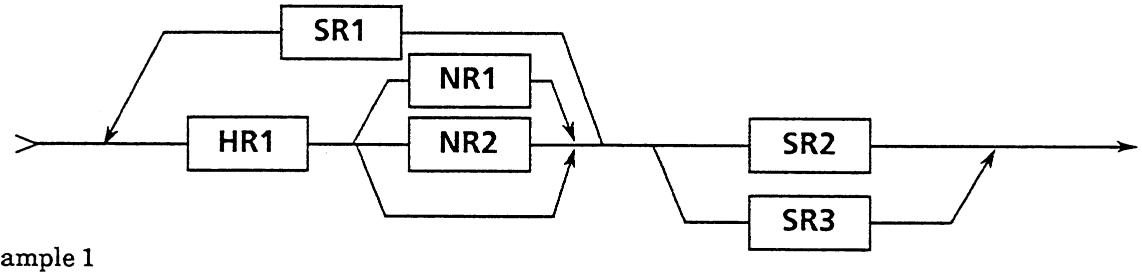
Example

Store center frequency to frequency memory 24.

WRITE @103:"FQ24ST"

(4) Control-message format 4

This format transfers multiple control messages at a time.



Example 1

WRITE @103:"FR10MHZ, OL-10DBM, FM75KHZ"

Frequency 10 MHz, Output level - 10 dBm, FM 75 kHz

Example 2

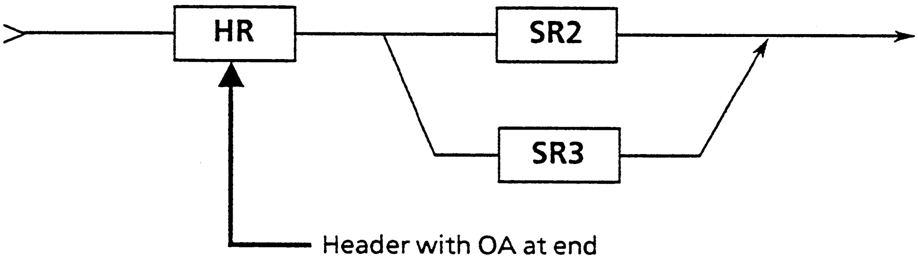
WRITE @103:"F 1, M 1"

5.2 Format of Data Request Message

The data request message reads data such as MG3633A-set values (FREQ, OUTPUT LEVEL, etc.), frequency memory, and function memory.

To read data from the MG3633A, the data request message must be sent to the MG3633A from the controller immediately before reading data. When the MG3633A becomes the talker after receiving data request messages, it sends the data and the CR LF and END message (EOI) at the end of the data.

In the MG3633A, the data request message has the following format.



Data Request Message

The HR field consists of 4 or 5 characters and OA is attached to the last. For example, the header to read the AM modulation factor is AMOA.

Example

Setting and reading of a 3.5 kHz frequency deviation

```
10 WRITE @103:"SP61"
20 WRITE @103:"FM3.5KHZ"
30 WRITE @103:"FMOA"
40 READ @103:A
50 PRINT A/1000;"KHz"
60 END
```

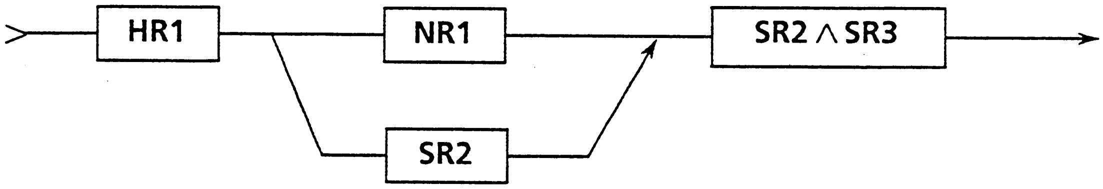
Line 10:	Specifies talker output message format with non-header
Line 20:	Control message
Line 30:	Data request message
Line 40:	The data sent from the MG3633A (talker) by the data request message is stored into variable A at the controller (listener).
Line 50:	Displays 3.5 kHz

5.3 Format of Talker Output Message

When the MG3633A becomes the talker, it sends the panel setting data and measured results specified by the previously received data request message.

There two message formats as shown below.

(1) Data-output format 1 (with header)



The message is output with a header and unit.

The units are determined for each measurement item as shown in the data request message table in paragraph 2.2.

The message is output with a header and units after SP00 (initialization) is executed.

This format can be specified using SP60.

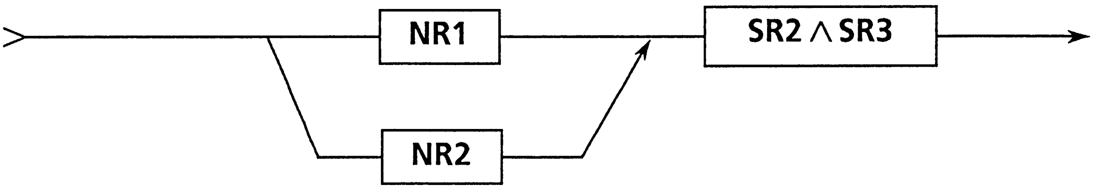
Example

Setting and reading a center frequency of 123.456 MHz

```
10 DIM A$*100
20 WRITE @103:"SP60"
30 WRITE @103:"FR123.456MHz"
40 WRITE @103:"FROA"
50 READ @103:A$
60 PRINT A$
70 END
```

```
Output results:     FR  123456000.00 HZ
```

(2) Data-output format 2 (without header)



The message is output without header and unit. This format can be specified using SP61.

Example

Setting and reading a center frequency of 123.456 MHz

```
10 WRITE @103:"SP61"
20 WRITE @103:"FR123.456MHZ"
30 WRITE @103:"FROA"
40 READ @103:A
50 PRINT A
60 END
```

```
Output results:      123456000.00
```

(Blank)

SECTION 6
DETAILS OF DEVICE MESSAGES

6.1 Setting Frequency

The program codes for frequency settings are shown in the table below.

Program Codes for Setting Frequency

	Parameter	Program code
FREQUENCY	FREQUENCY or CENTER FREQUENCY	FR, FC or CF
	FREQUENCY INCREMENTAL STEP	FIS
	INCREMENTAL STEP UP FREQ	UFR
	INCREMENTAL STEP DOWN FREQ	DFR
	KNOB UP FREQ	TFR
	KNOB DOWN FREQ	EFR
	RESET TUNABLE FREQ	ZFR
	FREQ RESOLUTION RIGHT	FSR
	FREQ RESOLUTION LEFT	FSL
	FREQ RESOLUTION 0.01 Hz	R0
	FREQ RESOLUTION 0.1 Hz	R1
	FREQ RESOLUTION 1 Hz	R2
	FREQ RESOLUTION 10 Hz	R3
	FREQ RESOLUTION 100 Hz	R4
	FREQ RESOLUTION 1 kHz	R5
	FREQ RESOLUTION 10 kHz	R6
	FREQ RESOLUTION 100 kHz	R7
	FREQ RESOLUTION 1 MHz	R8
	FREQ RESOLUTION 10 MHz	R9
	FREQ RELATIVE ON	FO
	FREQ RELATIVE OFF	FF
	FREQ OFFSET	FOS

(1) Setting frequency

Example

The various control messages shown below are used to set 100 MHz.

```
WRITE @103:"FR100000000.00"
WRITE @103:"FR100000000.00HZ"
WRITE @103:"FR100000KHZ"
WRITE @103:"FR100MHZ"
WRITE @103:"FR0.1GHZ"
WRITE @103:"FC0.1GHZ"
WRITE @103:"CF0.1GHZ"
```

Note: Four frequency units Hz, kHz, MHz, and GHz can be used. The corresponding suffix codes used are as follows:

Hz	:	"HZ"
kHz	:	"KHZ", "KZ"
MHz	:	"MHZ", "MZ"
GHz	:	"GHZ", "GZ"

When the suffix codes are omitted, they are regarded as "HZ".

(2) Setting frequency and resolution using rotary knob

The frequency can be set with any resolution within an appropriate range of the current frequency setting.

Example

```
100 WRITE @103:"FR100MHZ"      ..........  Set frequency to 100 MHz.
110 WRITE @103:"R8"     ..................  Set resolution to 1 MHz.
120 FOR I = 1 TO 10 STEP 1          }
130 WRITE @103:"TFR"(or"EFR")       }  Increase (or decrease) the frequency by 1 MHz
140 NEXT I                          }  from 100 MHz to 110 MHz (or 90 MHz)
150 END
```

Note: The value adjusted to by the rotary knob can be canceled by the "ZFR" program code to reset the previous frequency set using "FR", "FC", or "CF" program codes in the RELATIVE OFF mode.

(3) Setting frequency using [INCREMENT]

Frequency can be set in any chosen step within an appropriate range of the current frequency setting.

Example

```
100 WRITE @103:"FR100MHZ"    ............  Set frequency to 100 MHz.
110 WRITE @103:"FIS1MHZ"  ..................  Set increment frequency to 1 MHz.
120 FOR I = 1 TO 10 STEP 1          \
130 WRITE @103:"UFR"(or"DFR")        >  Increase (or decrease) the frequency by 1 MHz
140 NEXT I                          /   from 100 MHz to 110 MHz (or 90 MHz)
150 END
```

Note: The value adjusted to using [INCREMENT] can be canceled by the "ZFR" program code to reset the previous frequency set using the "FR", "FC", or "CF" program codes.

(4) Setting relative frequency mode

Program code	Command
FO	Turn ON relative frequency mode
FF	Turn OFF relative frequency mode

Example

```
100 WRITE @103:"FR500MHZ"    ..........  Set frequency to 500 MHz.
110 WRITE @103:"FO"    ........................  Set relative frequency mode.
120 END
```

(5) Setting offset frequency

Program code	Command
SP11	Turn OFF frequency offset mode
SP12	Turn ON frequency offset mode

Example

```
100 WRITE @103:"FR500MHZ"     ............  Set frequency to 500 MHz.
110 WRITE @103:"FOS10MHZ"     ............  Set offset frequency to 10 MHz.
120 WRITE @103:"SP12"    ........................  Turn on frequency offset mode.
130 END
```

6.2 Data Request Message for Frequency

To read the frequency data from the MG3633A, the required program code of the data request messages shown in the table below is sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Frequency

Program code	Data contents	Units
CFOA, FCOA, FROA	Frequency	Hz
FISOA	Step (incremental) frequency	Hz
FOSOA	Offset frequency	Hz
RLFOA	Relative frequency	Hz
REFOA	Reference frequency	Hz

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the data sent from the MG3633A (talker), with the frequency data format shown in the table below.

Output Format of Messages Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
CFOA, FCOA, FROA	FRΔsdddddddddd.ddHZ	sdddddddddd.dd	The header sent from the MG3633A talker is always "FR" when any one of the CFOA, FCOA, and FROA program codes is set as a data request message.
FISOA	FISΔsdddddddddd.ddHZ	Δdddddddddd.dd	————
FOSOA	FOSsdddddddddd.ddHZ	sdddddddddd.dd	Sent with sign (+ or −)
RLFOA	RLFsdddddddddd.ddHZ	sdddddddddd.dd	Sent with sign (+ or −)
REFOA	REFsdddddddddd.ddHZ	sdddddddddd.dd	————

Note: In the output format of the frequency message sent from a talker, the leading zero is replaced by a space. However zeros to the right of the decimal point are sent.

(1) Reading frequency

The absolute value of the frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FR100MHZ"    ···········  Set frequency to 100 MHz.
120 WRITE @103:"FROA"     ················  Request reading of set frequency.
130 READ @103:A$     ························  Read data.
140 PRINT A$  ·······························  Output the read value at the specified device.
150 END


Output results:      FR   100000000.00HZ
```

(2) Reading step frequency

The step (incremental) value of the frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FIS1MHZ"   ················  Set step frequency to 1 MHz.
120 WRITE @103:"FISOA"  ····················  Request reading of step frequency.
130 READ @103:A$     ························  Read data.
140 PRINT A$  ·······························  Output the read value at the specified device.
150 END


Output results:      FIS   1000000.00HZ
```

(3) Reading relative frequency

The relative value of the frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FR500MHZ"    ···········  Set frequency to 500 MHz.
120 WRITE @103:"FO"     ····················  Set relative frequency mode.
130 WRITE @103:"FIS10MHZ"    ···········  Set step frequency to 10 MHz.
140 WRITE @103:"UFR"    ····················  Increase frequency by 10 MHz.
150 WRITE @103:"RLFOA"     ················  Request reading of relative frequency.
160 READ  @103:A$    ························  Read data.
170 PRINT A$  ·······························  Output the read value at the specified device.
180 END


Output results:      RLF +   10000000.00HZ
```

(4) Reading frequency offset value

The offset value of the frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FOS10MHZ"    ...........  Set frequency offset value to 10 MHz.
120 WRITE @103:"FOSOA        ................  Request reading of frequency offset value.
130 READ @103:A$    ............................  Read data.
140 PRINT A$  .........................................  Output the read value at the specified device.
150 END
```

```
Output results:      FOS +   10000000.00MHZ
```

(5) Reading reference frequency

The reference frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FR100MHZ"    ...........  Set frequency to 100 MHz.
130 WRITE @103:"R8"     .......................  Set resolution to 1 MHz.
140 WRITE @103:"TFR"    .......................  Increase frequency by 1 MHz.
150 WRITE @103:"REFOA"    ................  Request reading of reference frequency.
160 READ @103:A$    ............................  Read data.
170 PRINT A$  .........................................  Output the read value at the specified device.
180 END
```

```
Output results:      REF   100000000.00HZ
```

6.3 Setting Output Level

The program codes for setting the output level are shown in the table below.

Program Code for Setting Output Level

	Parameter	Program code
OUTPUT LEVEL	OUTPUT LEVEL or AMPLITUDE	OL or AP
	OUTPUT LEVEL INCREMENTAL STEP	OIS
	INCREMENTAL STEP UP OUTPUT LEVEL	UOL
	INCREMENTAL STEP DOWN OUTPUT LEVEL	DOL
	KNOB UP OUTPUT LEVEL	TOL
	KNOB DOWN OUTPUT LEVEL	EOL
	RESET TUNABLE OUTPUT LEVEL	ZOL
	OUTPUT LEVEL RESOLUTION RIGHT	OSR
	OUTPUT LEVEL RESOLUTION LEFT	OSL
	OUTPUT LEVEL RESOLUTION 0.1 dB	L0
	OUTPUT LEVEL RESOLUTION 1 dB	L1
	OUTPUT LEVEL RESOLUTION 10 dB	L2
	OUTPUT LEVEL CONTINUOUS MODE SET	LC
	OUTPUT LEVEL NORMAL MODE SET	LN
	OUTPUT LEVEL RELATIVE ON	LO
	OUTPUT LEVEL RELATIVE OFF	LF
	OUTPUT LEVEL ON	RO
	OUTPUT LEVEL OFF	RF
	RPP RESET	RS
	OUTPUT LEVEL OFFSET	OOS
	OUTPUT LEVEL LIMIT	OLM
	OUTPUT LEVEL UNIT dBm or AMPLITUDE UNIT dBm	OLDBM, OLDM or APDBM, APDM
	OUTPUT LEVEL UNIT dBμ or AMPLITUDE UNIT dBμ	OLDBU, OLDU or APDBU, APDU
	OUTPUT LEVEL UNIT V or AMPLITUDE UNIT V	OLV or APV

(1) Setting output level using data keys

Example

The various control messages shown below are used.

```
WRITE @103:"OL + 17"
WRITE @103:"OL + 17DBM"
WRITE @103:"OL + 130DBU"
WRITE @103:"OL6.32V"
WRITE @103:"OL999MV"
WRITE @103:"OL999UV"
WRITE @103:"AP999UV"
```

Note: Five output level units dBm, dBµ, V, mV, and µV can be used.

dBm : "DBM"、 "DM"
dBµ : "DBU"、 "DU"
V : "V"
mV : "MV"
µV : "UV"

When the suffix codes are omitted, they are regarded as DBM.

(2) Setting output level and resolution using rotary knob

The output level can be set with any resolution within an appropriate range of the current output level setting.

Example

```
100 WRITE @103:"OL0DBM"  ..................  Set output level to 0 dBm.
110 WRITE @103:"L0"      ..................  Set resolution to 0.1 dB.
120 FOR I = 1 TO 10 STEP 1          }
130 WRITE @103:"TOL"(or"EOL")       }  Increase (or decrease) output level by 0.1 dBm
140 NEXT I                          }  from 0 dBm to 1 dBm (or −1 dBm).
150 END
```

Note: The value adjusted to using the rotary knob can be canceled by the "ZOL" program code to reset the previous output level set by the "OL" or "AP" program codes in the RELATIVE OFF mode.

(3) Setting output level using [INCREMENT]

The output level can be set with any step size within an appropriate range of the current output level setting.

Example

```
100 WRITE @103:"OL0DBM"     ..................   Set output level to 0 dBm.
110 WRITE @103:"OIS1DB"     ..................   Set step output level to 1 dB.
120 FOR I = 1 TO 10 STEP 1          \
130 WRITE @103:"UOL"(or"DOL")        >  Increase (or decrease) output level by 1 dB from
140 NEXT I                          /   0 dBm to +10 dBm (or -10 dBm).
150 END
```

Note: The value adjusted to using [INCREMENT] can be canceled by the "ZOL" program code to reset the previous output level set by the "OL" or "AP" program codes in the RELATIVE OFF mode.

Decibel (dB) units are used for the step output level and the corresponding suffix code is DB. When the suffix codes are omitted, they are regarded as DB.

(4) Setting relative output level mode

Program code	Command
LO	Turn ON relative output level mode
LF	Turn OFF relative output level mode

Example

```
100 WRITE @103:"OL-30DBM"   ............   Set output level to -30 dBm.
110 WRITE @103:"LO"     ......................   Set relative output level mode.
120 END
```

(5) ON/OFF control of output level

Program code	Command
RO	Turn ON output level
RF	Turn OFF output level

Example

```
100 WRITE @103:"OL-30DBM"   ............   Set the output level to -30 dBm.
110 WRITE @103:"RF"     ......................   Turn off the output level.
120 WAIT DELAY 1
130 WRITE @103:"RO"     ......................   Turn on the output level (-30 dBm.)
140 END
```

(6) Releasing reverse power protection (RPP) circuit

The "RS" program code is sent to release the RPP.

Example

```
100 WRITE @103:"RS"          ························  Release the RPP circuit operation.
110 END
```

(7) Setting offset output level

Program code	Command
SP07	Turn OFF output level offset mode
SP08	Turn ON output level offset mode

Example

```
100 WRITE @103:"OL-30DBM"     ···········  Set the output level to −30 dBm.
110 WRITE @103:"OOS10DB"      ···········  Set the offset output level to 10 dB.
120 WRITE @103:"SP08"  ······················  Turn the output level offset mode ON.
130 END
```

Note: Decibel (dB) units are used for offset output level and the corresponding suffix code is DB.
When the suffix codes is omitted, they are regarded as DB.

(8) Setting output level upper limit value

Program code	Command
SP05	Turn OFF output level limit mode
SP06	Turn ON output level limit mode

Example

```
100 WRITE @103:"OL – 30DBM"   ··········  Set output level to −30 dBm.
110 WRITE @103:"OLM – 10DBM"       ····  Set output level limit value to 10 dBm.
120 WRITE @103:"SP06"  ······················  Turn on output level limit mode.
130 END
```

(9) Changing output level units

The output level units are changed as described below.

Program code	Command
OLDBM OLDM APDBM APDM	Changes output level units to dBm.
OLDBU OLDU APDBU APDU	Changes output level units to dBμ.
OLV APV	Changes output level units to V.

Example

```
100 WRITE @103:"OL-30DBM"    ..........  Set output level to -30 dBm.
110 WRITE @103:"OLDBU"   ...............  Change output level units to dBμ
                                          (-30 dBm → +83 dBμ).
120 END
```

6.4 Data Request Messages for Output Level

To read the output level data from the MG3633A, the required program code of the data request messages shown in the table below is sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Output Level

Program code	Data contents	Unit
OLOA, APOA	Output level	dBm, dBμ, V
OISOA	Step (incremental) output level	dB
OOSOA	Offset output level	dB
OLMOA	Output level limit value	dBm, dBμ, V
RLOOA	Relative output level	dB
REOOA	Reference output level	dBm, dBμ, V

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the data sent from the MG3633A (talker), with the output level data format shown in the table below.

Output Format of Message Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
OLOA,APOA	OLΔsddd.dDBM OLΔsddd.dDBU OLΔd.ddddddddV	sddd.d sddd.d d.dddddddd	● The header sent from the MG3633A talker is always "OL" when either OLOA or APOA is set as a data request message. ● The same unit as that set on the panel is set.
OISOA	OISΔddd.dDB	Δddd.d	————
OOSOA	OOSsddd.dDB	sddd.d	Sent with + or – sign.
OLMOA	OLMsddd.dDBM OLMsddd.dDBU OLMd.ddddddddV	sddd.d sddd.d d.dddddddd	The same units as those set on the panel are set.
RLOOA	RLOsddd.dDB	sddd.d	Sent with + or – sign.
REOOA	REOsddd.dDBM REOsddd.dDBU REOd.ddddddddV	sddd.d sddd.d d.dddddddd	The same units as those set on the panel are set.

Note: In the output format of the output level message sent from a talker, the leading zero is replaced by a space, but zeros to the right of the decimal point are sent.

(1) Reading output level

The absolute value of the output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OL-10DBM"      ··········  Set output level to −10 dBm.
120 WRITE @103:"OLOA"      ················  Request reading of output level.
130 READ @103:A$  ··························  Read data.
140 PRINT A$  ··································  Output the read value at the specified device.
150 END
```

```
Output results:      OL  -  10.0DBM
```

(2) Reading step output level

The increment value of the output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OIS10DB"    ················  Set step level to 10 dB.
120 WRITE @103:"OISOA"      ················  Request reading of step level.
130 READ @103:A$  ··························  Read data.
140 PRINT A$  ··································  Output the read value at the specified device.
150 END
```

```
Output results:      OIS  -  10.0DBM
```

(3) Reading output level offset value

The offset value of the output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OOS10DB"       ··········  Set output level offset to 10 dB.
120 WRITE @103:"OOSOA"      ················  Request reading of output level offset.
130 READ @103:A$  ··························  Read data.
140 PRINT A$  ··································  Output the read value at the specified device.
150 END
```

```
Output results:      OOS +  10.0DB
```

(4) Reading output level limit value

The limit value of the output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OLM-10DBM"  ...........  Set output level limit to -10 dBm.
120 WRITE @103:"OLMOA"  ...............  Request reading of output level limit.
130 READ @103:A$  .....................  Read data.
140 PRINT A$  .........................  Output the read value at the specified device.
150 END

Output results:     OLM- 10.0DBM
```

(5) Reading relative output level

The relative value of the output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OL-10DBM"  ............  Set output level to -10 dBm.
120 WRITE @103:"LO"  ..................  Set relative output level mode.
130 WRITE @103:"OIS10DB"  .............  Set step level to 10 dB.
140 WRITE @103:"DOL"  .................  Decrease output level by 10 dB.
150 WRITE @103:"RLOOA"  ...............  Request reading of relative output level.
160 READ @103:A$  .....................  Read data.
170 PRINT A$  .........................  Output the read value at the specified device.
180 END

Output results:     RLO- 10.0DBM
```

(6) Reading reference output level

The reference output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103 "OL-10DBM"  ............  Set output level to -10 dBm.
130 WRITE @103:"L0"  ..................  Set resolution to 0.1 dB.
140 WRITE @103:"TOL"  .................  Increase output level by 10 dB.
150 WRITE @103:"REOOA"  ...............  Request reading of reference output level.
160 READ @103:A$  .....................  Read data.
170 PRINT A$  .........................  Output the read value at the specified device.
180 END

Output results:     RLO- 10.0DBM
```

6.5 Setting AM modulation

The program codes for setting AM modulation are shown in the table below.

Program Codes for Setting AM Modulation

	Parameter	Program code
MODULATION (AM)	AM(AMPLITUDE MODULATION)	AM
	INCREMENTAL STEP UP AM	UAM
	INCREMENTAL STEP DOWN AM	DAM
	KNOB UP AM	TAM
	KNOB DOWN AM	EAM
	RESET TUNABLE AM	ZAM
	AM RESOLUTION RIGHT	AD3
	AM RESOLUTION LEFT	AD4
	AM RESOLUTION 1st DIGIT	AD0
	AM RESOLUTION 2nd DIGIT	AD1
	AM RESOLUTION 3rd DIGIT	AD2
	INT AM MODE ON	A1
	EXT AC AM MODE ON	A2
	EXT DC AM MODE ON	A3
	INT/EXT AC AM MODE ON	A4
	INT/EXT DC AM MODE ON	A5
	AM OFF	A0

(1) Setting AM modulation factor using data keys

Example

The control messages shown below are used to set a value of 10%.

```
WRITE @103:"AM10PC"
WRITE @103:"AM10"
```

Note: The % unit is used for the AM modulation factor and the corresponding suffix code is PC. Omission of the suffix code is regarded as "PC".

(2) Setting AM modulation factor and resolution using rotary knob

The AM modulation factor can be set with any resolution within an appropriate range of the current AM modulation factor setting.

Example

```
100 WRITE @103:"AM30PC"   ..................   Set AM modulation factor to 30%.
110 WRITE @103:"AD0"   ........................   Specify resolution to the lowest digit.
120 FOR I = 1 TO 10 STEP 1                 ⎫
130 WRITE @103:"TAM"(or"EAM")              ⎬  Increase (or decrease) the AM modulation factor
140 NEXT I                                 ⎭  by 0.1% from 30% to 31% (or 29%).
150 END
```

Note: The value adjusted to by turning the rotary knob can be canceled by the "ZAM" program code to reset the previous AM modulation factor set by the "AM" program code.

(3) Setting AM modulation factor using [INCREMENT]

The AM modulation factor can be set at an interval of 10% within an appropriate range of the current AM modulation factor setting.

Example

```
100 WRITE @103:"AM40PC"   ..................   Set AM modulation factor to 40%.
110 FOR I = 1 TO 3 STEP 1                  ⎫
120 WRITE @103:"UAM"(or"DAM")              ⎬  Increase (or decrease) the AM modulation factor
130 NEXT I                                 ⎭  by 10% from 40% to 70% (or 10%).
140 END
```

Note: The value increased or decreased by pressing [INCREMENT] can be canceled by the "ZAM" program code to reset the previous AM factor set by the "AM" program code.

(4) ON/OFF control of AM modulation

Sending the program codes listed below produce the indicated AM modulation commands.

Program code	Command
A0	Turn OFF AM modulation
A1	Turn ON INT modulation mode
A2	Turn ON EXT AC modulation mode
A3	Turn ON EXT DC modulation mode
A4	Turn ON INT/EXT AC modulation mode
A5	Turn ON INT/EXT DC modulation mode

Example

```
100 WRITE @103:"A1"        ........................  Select INT modulation mode.
110 WRITE @103:"AM30PC"    ...................       Set AM modulation factor to 30%.
120 END
```

6.6 Setting FM Modulation

The program codes for setting FM modulation are shown in the table below.

Program Codes for Setting FM Modulation

	Parameter	Program code
MODULATION (FM)	FM (FREQUENCY MODULATION)	FM
	INCREMENTAL STEP UP FM	UFM
	INCREMENTAL STEP DOWN FM	DFM
	KNOB UP FM	TFM
	KNOB DOWN FM	EFM
	RESET TUNABLE FM	ZFM
	FM RESOLUTION RIGHT	FD3
	FM RESOLUTION LEFT	FD4
	FM RESOLUTION 1st DIGIT	FD0
	FM RESOLUTION 2nd DIGIT	FD1
	FM RESOLUTION 3rd DIGIT	FD2
	INT FM MODE ON	F1
	EXT AC FM MODE ON	F2
	EXT DC FM MODE ON	F3
	INT/EXT AC FM MODE ON	F4
	INT/EXT DC FM MODE ON	F5
	FM OFF	F0
	FREQ CAL	CAL

(1) Setting FM frequency deviation using data keys

Example

The various control messages shown below are used to set 3.5 kHz deviation.

```
WRITE @103:"FM3500"
WRITE @103:"FM3500HZ"
WRITE @103:"FM3.5KHZ"
WRITE @103:"FM0.0035MHZ"
WRITE @103:"FM0.0000035GHZ"
```

Note: Four FM frequency deviation units Hz, kHz, MHz, and GHz can be used. The corresponding suffix codes used are as follows:

Hz : "HZ"
kHz : "KHZ", "KZ"
MHz : "MHZ", "MZ"
GHz : "GHZ", "GZ"

When the suffix codes are omitted, they are regarded as HZ.

(2) Setting FM frequency deviation and resolution using rotary knob

The FM frequency deviation can be set with any resolution within an appropriate range of the current FM frequency deviation setting.

Example

```
100 WRITE @103:"FM3.5KHZ"      ············  Set FM frequency deviation to 3.5 kHz.
110 WRITE @103:"FD1"   ······················  Specify the resolution to 100 Hz digit.
120 FOR I = 1 TO 5 STEP 1                 ⎫
130 WRITE @103:"TFM"(or"EFM")             ⎬  Increase (or decrease) FM frequency deviation
140 NEXT I                                ⎭  by 100 Hz from 3.5 kHz to 4 kHz (or 3 kHz.)
150 END
```

Note: The value adjusted to using the rotary knob can be canceled by the "ZFM" program code to reset the previous FM frequency deviation set by the "FM" program code.

(3) Setting FM frequency deviation using [INCREMENT]

The FM frequency deviation can be increased by 10times or decreased to by one-tenth the currently-set FM frequency deviation.

Example

```
100 WRITE @103:"FM3.5KHZ"         ..........  Set the FM frequency deviation to 3.5 kHz.
110 WRITE @103:"UFM"(or"DFM")     .....       Increase the FM frequency deviation by 10 times
                                              (or decrease it by one-tenth).
120 END
```

Note: The value adjusted to using [INCREMENT] can be canceled by the "ZFM" program code to reset the previous FM frequency deviation set by the "FM" program code.

(4) ON/OFF control of FM modulation

Sending the program codes listed below produce the indicated FM modulation commands.

Program code	Command
F0	Turn OFF FM modulation
F1	Turn ON INT modulation mode
F2	Turn ON EXT AC modulation mode
F3	Turn ON EXT DC modulation mode
F4	Turn ON INT/EXT AC modulation mode
F5	Turn ON INT/EXT DC modulation mode

Example

```
100 WRITE @103:"F1"               ......................  Select INT modulation mode.
110 WRITE @103:"FM3.5KHZ"         ..........              Set FM frequency deviation to 3.5 kHz.
120 END
```

(5) Frequency calibration

The frequency is calibrated at EXT DC FM mode.

The "CAL" program code is sent to calibrate the frequency.

Example

```
100 WRITE @103:"F3"(or"F5") ..........     Select EXT DC modulation (or INT/EXT DC
                                           modulation).
110 WRITE @103:"CAL"        ...................... Calibrate frequency.
120 END
```

6.7 Setting ∅M Modulation

The program codes for setting ∅M modulation are shown in the table below.

Program Codes for Setting ∅M Modulation

	Parameter	Program code
MODULATION (∅M)	∅M(PHASE MODULATION)	PHM
	INCREMENTAL STEP UP ∅M	UPH
	INCREMENTAL STEP DOWN ∅M	DPH
	KNOB UP ∅M	TPH
	KNOB DOWN ∅M	EPH
	RESET TUNABLE ∅M	ZPH
	∅M RESOLUTION RIGHT	PD3
	∅M RESOLUTION LEFT	PD4
	∅M RESOLUTION 1st DIGIT	PD0
	∅M RESOLUTION 2nd DIGIT	PD1
	∅M RESOLUTION 3rd DIGIT	PD2
	INT ∅M MODE ON	PH1
	EXT AC ∅M MODE ON	PH2
	EXT DC ∅M MODE ON	PH3
	INT/EXT AC ∅M MODE ON	PH4
	INT/EXT DC ∅M MODE ON	PH5
	∅M OFF	PH0
	∅M UNIT radian	PHMRAD, or PHMRD
	∅M UNIT degree	PHMDEG, or PHMDG

(1) Setting ∅M phase deviation using data keys

Example

The control messages shown below are used to set 30 rad (or deg.).

```
WRITE @103:"PHM30.0"
WRITE @103:"PHM30.0RAD"
WRITE @103:"PHM30.0DEG"
```

Note: The two ∅M modulation units rad and deg can be used. The corresponding suffix codes used are as follows:

rad : “RAD”, “RD”
deg : “DEG”, “DG”

When the suffix codes are omitted, they are regarded as “RAD”.

(2) Setting ∅M phase deviation and resolution using rotary knob

The ∅M phase deviation can be set with any resolution within an appropriate range of the current ∅M phase deviation setting.

Example

```
100 WRITE @103:"PHM30.0RAD"  ···········  Set ∅M phase deviation to 30 rad.
110 WRITE @103:"PD0"  ······················  Specify resolution to the lowest digit.
120 FOR I = 1 TO 10 STEP 1              ⎫
130 WRITE @103:"TPH"(or"EPH")           ⎬  Increase (or decrease) ∅M phase deviation by
140 NEXT I                              ⎭  0.1 rad from 30 rad to 31 rad (or 29 rad).
150 END
```

Note: The value adjusted to using the rotary knob can be canceled by the "ZPH" program code to reset the previous ∅M phase deviation set by the "∅M" program code.

(3) Setting ∅M phase deviation using [INCREMENT]

The ∅M phase deviation can be increased by 10 times or decreased by one-tenth around the currently-set ∅M phase deviation.

Example

```
100 WRITE @103:"PHM30RAD"  ··········  Set ∅M phase deviation to 30 rad.
110 WRITE @103:"UPH"(or"DPH") ····     Increase ∅M phase deviation by 10 times (or
                                       decrease it by one-tenth).
120 END
```

Note: The value adjusted to using [INCREMENT] can be canceled by the "ZPH" program code to reset the previous ∅M phase deviation set by the "∅M" program code.

(4) ON/OFF control of ∅M modulation

Sending the program codes listed below produce the indicated ∅M modulation commands.

Program code	Command
PH0	Turn OFF ∅M modulation
PH1	Turn ON INT modulation mode
PH2	Turn ON EXT AC modulation mode
PH3	Turn ON EXT DC modulation mode
PH4	Turn ON INT/EXT AC modulation mode
PH5	Turn ON INT/EXT DC modulation mode

Example

```
100 WRITE @103:"PH1"   ........................  Select INT modulation mode.
110 WRITE @103:"PHM30RAD"   ............  Set ∅M phase deviation to 30 rad.
120 END
```

(5) Changing ∅M phase deviation units

The ∅M phase deviation are changed as follows.

Program code	Command
PHMDEG PHMDG	Changes ∅M phase deviation units to deg.
PHMRAD PHMRD	Changes ∅M phase deviation units to rad.

Example

```
100 WRITE @103:"PHMDEG"   ..................  Change ∅M phase deviation units to deg.
110 END
```

6.8 Setting Fixed Data for Frequency and Phase Deviations

The program codes for setting fixed frequency and phase deviations data are shown in the table below.

Program Codes for Setting Fixed Frequency and Phase Deviations Data

	Parameter	Program code
MODULATION (FM/ØM)	INT DEVIATION FIX EXT DEVIATION FIX	IND EXD

(1) Setting fixed frequency deviation data

Example 1

WRITE @103:"IND3.5KHZ" ·················· Set fixed INT frequency deviation data to 3.5 kHz.

Example 2

WRITE @103:"EXD3.5KHZ" ·············· Set fixed EXT frequency deviation data to 3.5 kHz.

(2) Setting fixed phase deviation data

Example 1

WRITE @103:"IND30RAD" ················· Set fixed INT phase deviation data to 30 rad.

Example 2

WRITE @103:"EXD30RAD" ················· Set fixed EXT phase deviation data to 30 rad.

6.9 Data Request Messages for AM/FM/∅M Modulation

To read the modulation data from the MG3633A, the required program code of the data request messages shown in the table below is sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Modulation

Program code	Data contents	Units
FMOA	FM frequency deviation	Hz
RFMOA	Reference FM frequency deviation	Hz
AMOA	AM modulation factor	%
RAMOA	Reference AM modulation factor	%
PHMOA	∅M phase deviation	rad or deg
RPHOA	Reference ∅M phase deviation	rad or deg
INDOA	Fixed FM/∅M INT frequency and phase deviations data	Hz/rad, deg
EXDOA	Fixed FM/∅M EXT frequency and phase deviations data	Hz/rad, deg

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the data sent from the MG3633A (talker) with the modulation data output format shown in the table below.

Output Format of Message Sent from Talker (1/2)

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
FMOA	FMΔdddddd0HZ	dddddd0	During frequency deviation measurements, the talker always sends 0 as the 1 Hz digit.
RFMOA	RFMdddddd0Hz	dddddd0	
AMOA	AMΔddd.dPC	ddd.d	—
RAMOA	RAMddd.dPC	ddd.d	—
PHMOA	PHMΔddd.ddRAD PHMΔddd.dDEG	Δddd.dd Δddd.d	The same units as those set on the panel are sent.

Output Format of Message Sent from Talker (2/2)

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
RPHOA	PPHΔddd.ddRAD RPHΔddd.dDEG	Δddd.dd Δddd.d	The same units as those set on the panel are sent.
INDOA	INDdddddd0HZ INDΔddd.ddRAD INDΔddd.dDEG	dddddd0 Δddd.dd Δddd.d	● Hertz (Hz) units are sent for FM, and rad or deg is sent for ØM. ● In FM mode, the talker always sends 0 as the 1 Hz digit. ● In ØM mode, the same unts as those set on the panel are sent. ● When the modulation is off, the FM data is sent.
EXDOA	EXDdddddd0HZ EXDΔddd.ddRAD EXDΔddd.dDEG	dddddd0 Δddd.dd Δddd.d	

Note: In the output format of the modulation message sent from a talker, the leading zero is replaced by a space. However, zeros to the right of the decimal point are sent for data other than FM data.

(1) Reading AM modulation factor

The value of the AM modulation factor is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"AM30PC"   ·················  Set AM modulation factor to 30%.
120 WRITE @103:"AMOA"     ·················  Request reading of AM modulation factor.
130 READ @103:A$      ·······················  Read data.
140 PRINT A$   ·······························  Output the read value at the specified device.
150 END


Output results:      AM  30.0PC
```

(2) Reading reference AM modulation factor

The reference AM modulation factor is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"AM30PC"   ················  Set AM modulation factor to 30%.
120 WRITE @103:"AD0"   ·····················  Specify resolution to the lowest digit.
130 WRITE @103:"TAM"   ····················  Increase AM modulation factor by 0.1%.
140 WRITE @103:"RAMOA"    ················  Request reading of the reference AM modulation
                                              factor.
150 READ @103:A$      ······················  Read the data.
160 PRINT A$   ······························  Output the read value at the specified device.
170 END


Output results:      RAM  30.0PC
```

(3) Reading FM frequency deviation

The FM frequency deviation value is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FM3.5KHZ"     ···········  Set FM frequency deviation to 3.5 kHz.
120 WRITE @103:"FMOA"     ·················  Request reading of FM frequency deviation.
130 WRITE @103:A$     ·······················  Read data.
140 PRINT A$   ·······························  Output the read value at the specified device.
150 END


Output results:      FM   3500HZ
```

(4) Reading reference FM frequency deviation

The reference FM frequency deviation is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FM3.5KHZ"    ...........  Set FM frequency deviation to 3.5 kHz.
120 WRITE @103:"FD0"   ......................  Specify resolution to the lowest digit.
130 WRITE @103:"TFM"   ......................  Increase FM frequency deviation by 0.01 kHz.
140 WRITE @103:"RFMOA"    ................  Request reading of reference FM frequency
                                          deviation.
150 READ @103:A$   ..........................  Read data.
160 PRINT A$  .......................................  Output the read value at the specified device.
170 END
```

```
Output results:     RFM   3500HZ
```

(5) Reading ∅M phase deviation

The value of the ∅M phase deviation is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"PHM30.0RAD"  ...........  Set ∅M phase deviation to 30 rad.
120 WRITE @103:"PHMOA"    ................  Request reading of ∅M phase deviation.
130 WRITE @103:A$   ..........................  Read data.
140 PRINT A$  .......................................  Output the read value at the specified device.
150 END
```

```
Output results:     PHM   30.00RAD
```

(6) Reading reference ∅M phase deviation

The reference ∅M phase deviation is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"PHM30.0RAD"  ..........  Set ∅M phase deviation to 30 rad.
120 WRITE @103:"PD0"  ....................  Specify resolution to the lowest digit.
130 WRITE @103:"TPH"  ....................  Increase ∅M phase deviation by 0.1 rad.
140 WRITE @103:"RPHOA"  ...............  Request reading of reference ∅M phase
                                          deviation.
150 READ @103:A$  ........................  Read data.
160 PRINT A$  ..............................  Output the read value at the specified device.
170 END
```

```
Output results:     RPH  30.00RAD
```

(7) Reading fixed data for frequency and phase deviations

Example 1

The value of the fixed INT FM frequency deviation data is read using the following method.

```
100 DIM A$*100
110 WRITE @103:"IND3.5KHZ"  ..........  Set fixed INT frequency deviation data to 3.5
                                         kHz.
120 WRITE @103:"INDOA"  ...............  Request reading of fixed INT frequency
                                         deviation data.
130 READ @103:A$  ........................  Read data.
140 PRINT A$  ..............................  Output the read value at the specified device.
150 END
```

```
Output results:     IND  3500HZ
```

Example 2

The value of the fixed EXT FM frequency deviation data is read using the following method.

```
100 DIM A$*100
110 WRITE @103:"EXD3.5KHZ"  ..........  Set fixed EXT frequency deviation data to 3.5
                                         kHz.
120 WRITE @103:"EXDOA"  ...............  Request reading of fixed EXT frequency
                                         deviation data.
130 READ @103:A$  ........................  Read data.
140 PRINT A$  ..............................  Output the read value at the specified device.
150 END
```

```
Output results:     EXD  3500HZ
```

Example 3

The value of the fixed INT phase deviation data is read using the following method.

```
100 DIM A$*100
110 WRITE @103:"IND30.0RAD"  ············  Set fixed INT phase deviation data to 30 rad.
120 WRITE @103:"INDOA"       ··················  Request reading of fixed INT phase deviation
                                                 data.
130 READ @103:A$             ·····························  Read data.
140 PRINT A$                 ··········································  Output the read value at the specified device.
150 END
```

```
Output results:     IND  30.00RAD
```

xample 4

The value of the fixed EXT phase deviation data is read using the following method.

```
100 DIM A$*100
110 WRITE @103:"EXD30.0RAD"  ············  Set fixed EXT phase deviation data to 30 rad.
120 WRITE @103:"EXDOA        ··················  Request reading of fixed EXT phase deviation
                                                 data.
130 READ @103:A$             ·····························  Read data.
140 PRINT A$                 ··········································  Output the read value at the specified device.
150 END
```

```
Output results:     EXD  30.00RAD
```

6.10 Setting AF Modulation Frequency

The program codes for setting AF modulation frequency are shown in the table below.

Program Codes for Setting AF Frequency

	Parameter	Program code
AF OSC	AF(AUDIO FREQUENCY)	AF
	INT MOD FREQ OUTPUT AF OSC	M0
	INT MOD FREQ OUTPUT 1 kHz	M1
	INT MOD FREQ OUTPUT 400 Hz	M2
	AF INCREMENTAL STEP	AIS
	INCREMENTAL STEP UP AF	UAF
	INCREMENTAL STEP DOWN AF	DAF
	KNOB UP AF	TAF
	KNOB DOWN AF	EAF
	RESET TUNABLE AF	ZAF
	AF RESOLUTION RIGHT	ASR
	AF RESOLUTION LEFT	ASL
	AF RESOLUTION 0.1 Hz	AR0
	AF RESOLUTION 1 Hz	AR1
	AF RESOLUTION 10 Hz	AR2
	AF RESOLUTION 100 Hz	AR3
	AF RESOLUTION 1 kHz	AR4
	AF RESOLUTION 10 kHz	AR5

1) Changing INT modulation frequency

Sending the program codes listed below produce the indicated internal modulation frequency commands.

Program code	Command
M0	Sets INT mod. freq. to AF frequency
M1	Sets INT mod. freq. to 1 kHz
M2	Sets INT mod. freq. to 400 Hz

Example

```
100 WRITE @103:"M1"     ························  Fix INT modulation frequency to 1 kHz.
110 END
```

(2) Setting AF frequency using data keys

Example

The various control messages shown below are used to set AF 1 kHz.

```
WRITE @103:"AF1000.0"
WRITE @103:"AF1000.0HZ"
WRITE @103:"AF1.0000KHZ"
WRITE @103:"AF0.0010000MHZ"
WRITE @103:"AF0.0000010000GHZ"
```

Note: The four AF frequency units Hz, kHz, MHz, and GHz can be used. The corresponding suffix codes used are as follows:

Hz : "HZ"
kHz : "KHZ", "KZ"
MHz : "MHZ", "MZ"
GHz : "GHZ", "GZ"

When the suffix codes are omitted, they are regarded as "HZ".

(3) Setting AF frequency and resolution using rotary knob

The AF frequency can be set with any resolution within an appropriate range of the current AF frequency setting.

Example

```
100 WRITE @103:"AF2KHZ"  ················  Set AF frequency to 2 kHz.
110 WRITE @103:"AR3"  ·····················  Set resolution to 100 Hz.
120 FOR I = 1 TO 10 STEP              ⎫
130 WRITE @103:"TAF"(or"EAF")         ⎬  Increase (or decrease) AF frequency by 100 Hz
140 NEXT I                            ⎭  from 2 kHz to 3 kHz (or 1 kHz).
150 END
```

Note: The value adjusted to using the rotary knob can be canceled by the "ZAF" program code to reset the previous AF frequency set by the "AF" program code.

(4) Setting AF frequency using [INCREMENT]

The AF frequency can be set using any step size within an appropriate range of the current AF frequency setting.

Example

```
100 WRITE @103:"AF2KHZ"    ..................  Set AF frequency to 2 kHz.
110 WRITE @103:"AIS100HZ"  ..................  Set resolution to 100 Hz.
120 FOR I = 1 TO 10 STEP 1                 \
130 WRITE @103:"UAF"(or"DAF")               >  Increase (or decrease) AF frequency by 100 Hz
140 NEXT I                                 /   from 2 kHz to 3 kHz (or 1 kHz).
150 END
```

Note: The value adjusted to using [INCREMENT] can be canceled by the "ZAF" program code to reset the previous AF frequency set by the "AF" program code.

6.11 Data Request Messages for AF Modulation Frequency

To read the AF modulation frequency data from the MG3633A, the required program code of the data request messages shown in the table below is sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for AF Frequency

Program code	Data contents	Units
AFOA	AF frequency	Hz
AISOA	Step (incremental) AF frequency	Hz
RAFOA	Reference AF frequency	Hz

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the data sent from the MG3633A (talker), with the AF frequency data output format shown in the table below.

Output Format of Message Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
AFOA	AFΔdddddd.dHZ	dddddd.d	————
AISOA	AISΔddddd.dHZ	Δddddd.d	————
RAFOA	RAFdddddd.dHZ	dddddd.d	————

Note: In the output format of the AF message sent from a talker, the leading zero is replaced by a space. However, zeros to the right of the decimal point are sent.

(1) Reading AF frequency

The value of the AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"AF1KHZ"  ..................  Set AF frequency to 1 kHz.
120 WRITE @103:"AFOA"  ....................  Request reading of AF frequency.
130 READ @103:A$  .........................  Read data.
140 PRINT A$  .............................  Output the read value at the specified device.
150 END
```

```
Output results:     AF  1000.0HZ
```

(2) Reading step AF frequency

The value of the step AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"AIS100HZ"  ················  Set step Af frequency to 100 Hz.
120 WRITE @103:"AISOA"     ················  Request reading of step AF frequency.
130 READ @103:A$  ···························  Read data.
140 PRINT A$  ·······························  Output the read value at the specified device.
150 END
```

```
Output results:      AIS   100.0HZ
```

(3) Reading reference AF frequency

The value of the reference AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"AF2KHZ"   ················  Set AF frequency to 2 kHz.
120 WRITE @103:"AR3"  ······················  Set resolution to 100 Hz.
130 WRITE @103:"TAF"  ······················  Increase AF frequency by 100 Hz.
140 WRITE @103:"RAFOA"    ················  Request reading of reference AF frequency.
150 READ @103:A$  ···························  Read data.
160 PRINT A$  ·······························  Output the read value at the specified device.
170 END
```

```
Output results:      RAF  2000.0HZ
```

6.12 Executing Frequency Sweep

The program codes for the frequency sweep are shown in the table below.

Program Codes for Executing Frequency Sweep

	Parameter	Program code
SWEEP (FREQ)	FREQ SWEEP START	FSA
	FREQ SWEEP STOP	FSB
	FREQ SWEEP SPAN	FSP
	FREQ SWEEP STEP POINT	FSN
	FREQ SWEEP STEP SIZE	FSZ
	FREQ SWEEP LOG	FLG
	FREQ SWEEP OFF	SF0
	FREQ SWEEP AUTO	SF1
	FREQ SWEEP SINGLE	SF2
	FREQ SWEEP MANUAL	SF3
	FREQ SWEEP MARKER OFF	SF4
	FREQ SWEEP MARKER ON	SF5
	FREQ SWEEP BREAK	SF6
	FREQ SWEEP CONTINUE	SF7
	FREQ SWEEP STEP UP	SF8
	FREQ SWEEP STEP DOWN	SF9
	FREQ SWEEP START PRESET	SFA
	FREQ SWEEP STOP PRESET	SFB

Note: The four frequency units Hz, kHz, MHz, and GHz can be used. The corresponding suffix codes used are as follows:

Hz : "HZ"
kHz : "KHZ", "KZ"
MHz : "MHZ", "MZ"
GHz : "GHZ", "GZ"

When the suffix codes are omitted, they are regarded as "HZ".

(1) Setting start-stop sweep

The start (FSA) and stop (FSB) frequencies are set to execute sweep.

Example 1

The various control messages shown below are used to set a 10 MHz start frequency.

```
WRITE @103:"FSA10000000.00"
WRITE @103:"FSA10000000.00HZ"
WRITE @103:"FSA10000.00000KHZ"
WRITE @103:"FSA10.00000000MHZ"
WRITE @103:"FSA0.01000000000GHZ"
```

Example 2

The various control messages shown below are used to set a 100 MHz stop frequency.

```
WRITE @103:"FSB100000000.00"
WRITE @103:"FSB100000000.00HZ"
WRITE @103:"FSB100000.00000KHZ"
WRITE @103:"FSB100.00000000MHZ"
WRITE @103:"FSB0.10000000000GHZ"
```

(2) Setting center-span sweep

The span frequency (FSP) is set to sweep with the set frequency as the center.

Example

The various control messages shown below are used to set a 10 MHz span frequency.

```
WRITE @103:"FSP10000000.00"
WRITE @103:"FSP10000000.00HZ"
WRITE @103:"FSP10000.00000KHZ"
WRITE @103:"FSP10.00000000MHZ"
WRITE @103:"FSP0.01000000000GHZ"
```

(3) Switching the method of specifying frequency sweep step

There are three ways to specify the sweep step:

setting the number of frequency sweep points (FSN);
setting the frequency sweep step size (FSZ); or
setting the frequency sweep to LOG (fixed at 1% steps) (FLG).

Example 1

The control messages shown below are sent to set 100 frequency sweep points.

```
WRITE @103:"FSN100"
WRITE @103:"FSN100PT"
```

Note: Omission of the suffix codes is regarded as "PT".

Example 2

The various control messages shown below are sent to set a 10 MHz frequency sweep step size.

```
WRITE @103:"FSZ10000000.00"
WRITE @103:"FSZ10000000.00HZ"
WRITE @103:"FSZ10000.00000KHZ"
WRITE @103:"FSZ10.00000000MHZ"
WRITE @103:"FSZ0.01000000000GHZ"
```

Example 3

The program code shown below is sent to set the frequency sweep to LOG (fixed at 1% steps).

```
100 WRITE @103:"FLG"    ························    Set frequency LOG sweep mode.
110 END
```

(4) Controlling frequency sweep

Sending the program codes listed below produce the indicated frequency sweep commands.

Program code	Command
SF0	Terminates sweep
SF1	Starts auto-sweep
SF2	Starts single sweep
SF3	Starts manual sweep
SF6	Suspends sweep
SF7	Resumes sweep
SF8	Manual sweep moves one-step up
SF9	Manual sweep moves one-step down

Example

```
100 WRITE @103:"SF1"    ........................  Freq. auto-sweep started
110 WRITE @103:"SF6"    ........................  Freq. sweep suspended
120 WRITE @103:"SF7"    ........................  Freq. sweep resumed
130 WRITE @103:"SF0"    ........................  Freq. sweep terminated
140 END
```

(5) ON/OFF control of frequency sweep marker function

Sending the program codes listed below produce the indicated frequency sweep marker function commands.

Program code	Command
SF4	Turns OFF freq. sweep marker function
SF5	Turns ON freq. sweep marker function

Example

```
100 WRITE @103:"SF5"    ........................  Turn ON freq. sweep marker function
110 END
```

(6) Presetting start/stop frequencies

Sending the program codes listed below produce the indicated commands.

Program code	Command
SFA	Sets current freq. to start freq.
SFB	Sets current freq. to stop freq.

Example

```
100 WRITE @103:"FSA10MHZ"    ..........  Start freq. set to 10 MHz
110 WRITE @103:"SFA"   .....................  Current freq. set to start freq.
120 END
```

6.13 Data Request Messages for Frequency Sweep

To read the frequency sweep data from the MG3633A, the required program codes for data request messages below are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Frequency Sweep

Program code	Data contents	Units
FSAOA	Start frequency	Hz
FSBOA	Stop frequency	Hz
FSPOA	Span frequency	Hz
FSNOA	Number of frequency sweep points	PT
FSZOA	Frequency step size	Hz

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the frequency sweep data sent from the MG3633A (talker), with the output format shown below.

Output Format of Messages Sent from Talker

△ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
FSAOA	FSAsdddddddddd.ddHZ	sdddddddddd.dd	————
FSBOA	FSBsdddddddddd.ddHZ	sdddddddddd.dd	————
FSPOA	FSP△dddddddddd.ddHZ	△dddddddddd.dd	————
FSNOA	FSN△ddddddddddddPT	△dddddddddddd	————
FSZOA	FSZ△dddddddddd.ddHZ	△dddddddddd.dd	————

Note: In the output format of the frequency sweep message sent from a talker, the leading zero is replaced by a space. However, zeros to the right of the decimal point are sent for a program code other then FSNOA.

(1) Reading start frequency

The value of the start frequency is read using the following method (FSAOA).

Example

```
100 DIM A$*100
110 WRITE @103:"FSA10MHZ"   ..........   Set start frequency to 10 MHz.
120 WRITE @103:"FSAOA"   ................   Request reading of start frequency.
130 READ @103:A$   ...........................   Read data.
140 PRINT A$   ....................................   Output the read value at the specified device.
150 END


Output results:      FSA   10000000.00HZ
```

(2) Reading stop frequency

The value of the stop frequency is read using the following method (FSBOA).

Example

```
100 DIM A$*100
110 WRITE @103:"FSB100MHZ"   ..........   Set stop frequency to 100 MHz
120 WRITE @103:"FSBOA"   ................   Request reading of stop frequency.
130 READ @103:A$   ...........................   Read data.
140 PRINT A$   ....................................   Output the read value at the specified device.
150 END


Output results:      FSB   100000000.00HZ
```

(3) Reading span frequency

The value of the span frequency is read using the following method (FSPOA).

Example

```
100 DIM A$*100
110 WRITE @103:"FSP10MHZ"   ..........   Set span frequency to 10 MHz.
120 WRITE @103:"FSPOA"   ................   Request reading of span frequency.
130 READ @103:A$   ...........................   Read data.
140 PRINT A$   ....................................   Output the read value at the specified device.
150 END


Output results:      FSP   10000000.00HZ
```

(4) Reading the number of frequency sweep points

The value of the number of frequency sweep points is read using the following method (FSNOA).

Example

```
100 DIM A$*100
110 WRITE @103:"FSN100PT"      ············  Set number of frequency sweep points to 100
                                             points.
120 WRITE @103:"FSNOA"      ·················  Request reading of number of frequency sweep
                                             points.
130 READ @103:A$   ··························  Read data.
140 PRINT A$  ·······························  Output the read value at the specified device.
150 END


Output results:      FSN      100PT
```

(5) Reading sweep step frequency

The value of sweep step frequency is read using the following method (FSZOA).

Example

```
100 DIM A$*100
110 WRITE @103:"FSZ100HZ"      ············  Set sweep step frequency to 100 Hz.
120 WRITE @103:"FSZOA"      ·················  Request reading of sweep step frequency.
130 READ @103:A$   ··························  Read data.
140 PRINT A$  ·······························  Output the read value at the specified device.
150 END


Output results:      FSZ     100.00HZ
```

6.14 Executing Output Level Sweep

The program codes for the output level sweep are shown in the table below.

Program Codes for Executing Output Level Sweep

	Parameter	Program code
SWEEP (OUTPUT LEVEL)	OUTPUT LEVEL SWEEP START	OSA
	OUTPUT LEVEL SWEEP STOP	OSB
	OUTPUT LEVEL SWEEP SPAN	OSP
	OUTPUT LEVEL SWEEP OFF	SO0
	OUTPUT LEVEL SWEEP AUTO	SO1
	OUTPUT LEVEL SWEEP SINGLE	SO2
	OUTPUT LEVEL SWEEP MANUAL	SO3
	OUTPUT LEVEL SWEEP MARKER OFF	SO4
	OUTPUT LEVEL SWEEP MARKER ON	SO5
	OUTPUT LEVEL SWEEP BREAK	SO6
	OUTPUT LEVEL SWEEP CONTINUE	SO7
	OUTPUT LEVEL SWEEP STEP UP	SO8
	OUTPUT LEVEL SWEEP STEP DOWN	SO9
	OUTPUT LEVEL SWEEP START PRESET	SOA
	OUTPUT LEVEL SWEEP STOP PRESET	SOB

(1) Setting start-stop level sweep

The start (OSA) and stop (OSB) output levels are set to execute the level sweep.

Example 1

The various control messages shown below are used to set the start output level.

```
WRITE @103:"OSA-143.0"
WRITE @103:"OSA-143.0DBM"
WRITE @103:"OSA-30.0DBU"
WRITE @103:"OSA1.00V"
WRITE @103:"OSA1.00MV"
WRITE @103:"OSA0.032UV"
```

Example 2

The various control messages shown below are used to set the stop output level.

```
WRITE @103:"OSB23.0"
WRITE @103:"OSB23.0DBM"
WRITE @103:"OSB136.0DBU"
WRITE @103:"OSB6.32V"
WRITE @103:"OSB999MV"
WRITE @103:"OSB999UV"
```

Note: The five output level sweep units dBm, dBμ, V, mV, and μV can be used. The corresponding suffix codes are as follows:

dBm : "DBM", "DB"
dBμ : "DBU", "DU"
V : "V"
mV : "MV"
μV : "UV"

When the suffix codes are omitted, they are regarded as "DBM".

(2) Setting center-span level sweep

The span output level (OSP) is set to seep with the current output level as the center.

Example

The control messages shown below are used to set the 10 dB span output level.

```
WRITE @103:"OSP10.0"
WRITE @103:"OSP10.0DB"
```

Note: The dB unit is used and the suffix code corresponding to the unit is as "DB".

When the suffix codes are omitted, they are regarded as "DB".

(3) Controlling output level sweep

Sending the program codes listed below produce the indicated output level sweep marker function commands.

Program code	Command
SO0	Terminates sweep
SO1	Starts auto-sweep
SO2	Starts single sweep
SO3	Starts manual sweep
SO6	Suspends sweep
SO7	Resumes sweep
SO8	Manual sweep moves one-step up
SO9	Manual sweep moves one-step down

Example

```
100 WRITE @103:"SO1"    ......................    Output level auto-sweep started
110 WRITE @103:"SO6"    ......................    Output level sweep suspended
120 WRITE @103:"SO7"    ......................    Output level sweep resumed
130 WRITE @103:"SO0"    ......................    Output level sweep terminated
140 END
```

(4) ON/OFF control of output level sweep marker function

Sending the program codes listed below produce the indicated output level sweep marker function commands.

Program code	Command
SO4	Turns OFF output level sweep marker function
SO5	Turns ON output level sweep marker function

Example

```
100 WRITE @103:"SO5"    ......................    Output level sweep marker function ON.
110 END
```

(5) Presetting start/stop output levels

Sending the program codes listed below produce the indicated output level commands.

Program code	Command
SOA	Sets current output level to start output level
SOB	Sets current output level to stop output level

Example

```
100 WRITE @103:"OSA-30DBM"  ···········  Start output level set to −30 dBm
110 WRITE @103:"SOA"  ························  Current output level set to start output level
120 END
```

6.15 Data Request Messages for Output Level Sweep

To read the output level sweep data from the MG3633A, the required program codes for data request messages (below) are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Output Level Sweep

Program code	Data contents	Units
OSAOA	Start output level	dBm, dBμ, V
OSBOA	Stop output level	dBm, dBμ, V
OSPOA	Span output level	dB
OSNOA	Number of output level points	PT

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the output level sweep data sent from the MG3633A (talker) with format shown below.

Output Format of Message Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
OSAOA	OSA addd.dDBM OSA sddd.dDBU OSA d.dddddddddV	sddd.d sddd.d d.dddddddd	The same unit as that set on the panel is sent.
OSBOA	OSB sddd.dDBM OSB sddd.dDBU OSB d.dddddddddV	sddd.d sddd.d d.ddddddddd	
OSPOA	OSPΔΔdd.dDB	ΔΔdd.d	————
OSPOA	OSNΔdddPT	Δddd	————

Note: In the output format for output level sweep messages sent from a talker, the leading zero is replaced by a space. However, zeros to the right of the decimal point are sent for program codes other than OSNOA.

(1) Reading start output level

The value of the start output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OSA-50DBM"  ..........   Set start output level to −50 dBm.
120 WRITE @103:"OSAOA"   ................   Request reading of start output level.
130 READ @103:A$   ..........................   Read data.
140 PRINT A$   ....................................   Output the read value at the specified device.
150 END
```

```
Output results:      OSA- 50.0DBM
```

(2) Reading the stop output level

The value of the stop output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OSB10DBM"   ..........   Set the stop output level to 10 dBm.
120 WRITE @103:"OSBOA"   ................   Request reading of the stop output level.
130 READ @103:A$   ..........................   Read the data.
140 PRINT A$   ....................................   Output the read value at the specified device.
150 END
```

```
Output results:      OSB  10.0DBM
```

(3) Reading span output level

The span output level is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OSP20DB"   ................   Set span output level to 20 dB.
120 WRITE @103:"OSPOA"   ................   Request reading of span output level.
130 READ @103:A$   ..........................   Read data.
140 PRINT A$   ....................................   Output the read value at the specified device.
150 END
```

```
Output results:      OSP  20.0DB
```

(4) Reading the number of output level sweep points

The number of output level sweep points is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OSNOA"    ..................    Request reading of number of output level sweep
                                                points.
120 READ @103:A$    ............................    Read data.
130 PRINT A$    ......................................    Output the read value at the specified device.
140 END
```

```
Output results:     OSN   100PT
```

6.16 Executing AF Frequency Sweep

The program codes for the AF frequency sweep are shown in the table below.

Program Codes for Executing AF Frequency Sweep

	Parameter	Program code
SWEEP (AF OSC)	AF SWEEP START	ASA
	AF SWEEP STOP	ASB
	AF SWEEP SPAN	ASP
	AF SWEEP STEP POINT	ASN
	AF SWEEP STEP SIZE	ASZ
	AF SWEEP LOG	ALG
	AF SWEEP OFF	SA0
	AF SWEEP AUTO	SA1
	AF SWEEP SINGLE	SA2
	AF SWEEP MANUAL	SA3
	AF SWEEP MARKER OFF	SA4
	AF SWEEP MARKER ON	SA5
	AF SWEEP BREAK	SA6
	AF SWEEP CONTINUE	SA7
	AF SWEEP STEP UP	SA8
	AF SWEEP STEP DOWN	SA9
	AF SWEEP START PRESET	SAA
	AF SWEEP STOP PRESET	SAB

Note: The four start/stop AF frequency sweep units Hz, kHz, MHz, and GHz can be used. The corresponding suffix codes are as follows:

Hz : "HZ"
kHz : "KHZ", "KZ"
MHz : "MHZ", "MZ"
GHz : "GHZ", "GZ"

When the suffix codes are omitted, they are regarded as "HZ".

(1) Setting start-stop sweep

The start and stop AF frequencies are set to execute the sweep.

Example 1

The various control messages shown below are used to set a 1 kHz start AF frequency.

```
WRITE @103:"ASA1000.0"
WRITE @103:"ASA1000.0HZ"
WRITE @103:"ASA1.0000KHZ"
WRITE @103:"ASA0.0010000MHZ"
WRITE @103:"ASA0.0000010000GHZ"
```

Example 2

The various control messages shown below are used to set a 100 kHz stop AF frequency.

```
WRITE @103:"ASB100000.0"
WRITE @103:"ASB100000.0HZ"
WRITE @103:"ASB100.0000KHZ"
WRITE @103:"ASB0.1000000MHZ"
WRITE @103:"ASB0.0001000000GHZ"
```

(2) Setting center-span sweep

The span AF frequency is set to sweep with the current AF frequency as the center.

Example

The various control messages shown below are used to set a 100 kHz span AF frequency.

```
WRITE @103:"ASP100000.0"
WRITE @103:"ASP100000.0HZ"
WRITE @103:"ASP100.0000KHZ"
WRITE @103:"ASP0.1000000MHZ"
WRITE @103:"ASP0.0001000000GHZ"
```

(3) Specifying number of AF frequency sweep steps

There are three methods for specifying a desired number of AF frequency sweep steps:

1. by setting the number of AF frequency sweep points (ASN);
2. by setting the AF frequency sweep step size (ASZ); and
3. by setting the AF frequency sweep to LOG, fixed at 1% steps (ALG).

Example 1

Sending control messages below sets 100 AF frequency sweep points.

```
WRITE @103:"ASN100"
WRITE @103:"ASN100PT"
```

Note: When the suffix codes are omitted, they are regarded as "PT".

Example 2

The control messages shown below are sent to set a 10 Hz AF frequency sweep step size.

```
WRITE @103:"ASZ10.0"
WRITE @103:"ASZ10.0HZ"
WRITE @103:"ASZ0.01KHZ"
WRITE @103:"ASZ0.0000100MHZ"
WRITE @103:"ASZ0.0000000100GHZ"
```

Example 3

The program codes shown below are sent to set the AF frequency sweep to LOG (fixed at 1% steps).

```
100 WRITE @103:"ALG"   ........................   Set AF frequency LOG sweep mode.
110 END
```

(4) Controlling AF frequency sweep

Sending the program codes listed below produce the indicated AF frequency sweep commands.

Program code	Command
SA0	Terminates sweep
SA1	Starts auto-sweep
SA2	Starts single sweep
SA3	Starts manual sweep
SA6	Suspends sweep
SA7	Resumes sweep
SA8	Manual sweep moves one-step up
SA9	Manual sweep moves one-step down

Example

```
100 WRITE @103:"SA1"   ......................   AF freq. auto-sweep started
110 WRITE @103:"SA6"   ......................   AF freq. sweep suspended
120 WRITE @103:"SA7"   ......................   AF freq. sweep resumed
130 WRITE @103:"SA0"   ......................   AF freq. sweep terminated
140 END
```

(5) ON/OFF control of AF frequency sweep marker function

Sending the program codes listed below produce the indicated AF frequency sweep marker function commands.

Program code	Command
SA4	Turns OFF AF frequency sweep marker function
SA5	Turns ON AF frequency sweep marker function

Example

```
100 WRITE @103:"SA5"     ........................   AF freq. sweep marker function ON
110 END
```

(6) Presetting start/stop AF frequencies

Sending the program codes listed below produce the indicated AF frequency commands.

Program code	Command
SAA	Sets current AF freq. to start AF freq.
SAB	Sets current AF freq. to stop AF freq.

Example

```
100 WRITE @103:"AF10KHZ"  ................   AF freq. set to 10 kHz.
110 WRITE @103:"SAA"     ........................   Current AF freq. set to start AF freq.
120 END
```

6.17 Data Request Messages for AF Frequency Sweep

To read the AF frequency sweep data from the MG3633A, the required program codes for data request messages (below) are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for AF Frequency Sweep

Program code	Data contents	Units
ASAOA	Start AF frequency	Hz
ASBOA	Stop AF frequency	Hz
ASPOA	Span AF frequency	Hz
ASNOA	Number of AF frequency points	PT
ASZOA	AF frequency step size	Hz

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads AF frequency sweep data sent from the MG3633A (talker), with format shown in the table below.

Output Format of Messages Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
ASAOA	ASAdddddd.dHZ	dddddd.d	———————
ASBOA	ASBdddddd.dHZ	dddddd.d	———————
ASPOA	ASPΔddddd.dHZ	Δddddd.d	———————
ASNOA	ASNΔddddddPT	Δdddddd	———————
ASZOA	ASZdddddd.dHZ	dddddd.d	———————

Note: In the output format of the AF frequency sweep message sent from a talker, the leading zero is replaced by a space. However, zeros to the right of the decimal point are sent for program codes other than ASNOA.

(1) Reading start AF frequency

The value of the start AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"ASA10KHZ"     ···········  Set start AF frequency to 10 kHz.
120 WRITE @103:"ASAOA"     ················  Request reading of start AF frequency.
130 READ @103:A$     ·····························  Read data.
140 PRINT A$  ·········································  Output the read value at the specified device.
150 END
```

```
Output results:     ASA  10000.0HZ
```

(2) Reading stop AF frequency

The stop AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"ASB100KHZ"     ···········  Set the stop AF frequency to 100 kHz.
120 WRITE @103:"ASBOA"     ················  Request reading of the stop AF frequency.
130 READ @103:A$     ·····························  Read data.
140 PRINT A$  ·········································  Output the read value at the specified device.
150 END
```

```
Output results:     ASB100000.0HZ
```

(3) Reading span AF frequency

The value of the span AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"ASP10KHZ"     ···········  Set span AF frequency to 10 kHz.
120 WRITE @103:"ASPOA"     ················  Request reading of span AF frequency.
130 READ @103:A$     ·····························  Read data.
140 PRINT A$  ·········································  Output the read value at the specified device.
150 END
```

```
Output results:     ASP  10000.0HZ
```

(4) Reading number of AF frequency sweep points

The value of the number of AF frequency sweep points is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"ASN100PT"     ···········  Set the number of AF frequency sweep points to
                                           100.
120 WRITE @103:"ASNOA"      ················  Request reading of number of AF frequency
                                           sweep points.
130 READ @103:A$     ···························  Read data.
140 PRINT A$   ··································  Output the read value at the specified device.
150 END


Output results:      ASA 100 PT
```

(5) Reading sweep step AF frequency

The value of the sweep step AF frequency is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"ASZ100HZ"     ···········  Set the AF frequency sweep step to 100 Hz.
120 WRITE @103:"ASZOA      ················  Request reading of AF frequency sweep step.
130 READ @103:A$     ···························  Read data.
140 PRINT A$   ··································  Output the read value at the specified device.
150 END


Output results:      ASZ   100.00HZ
```

6.18 Executing Frequency Memory Sweep

The program codes for the frequency memory sweep are shown in the table below.

Program Codes for Executing Frequency Memory Sweep

	Parameter	Program code
SWEEP (FREQ MEMORY)	FREQ MEMORY SWEEP ADDRESS	FRM
	FREQ MEMORY SWEEP OFF	SR0
	FREQ MEMORY SWEEP AUTO	SR1
	FREQ MEMORY SWEEP SINGLE	SR2
	FREQ MEMORY SWEEP MANUAL	SR3
	FREQ MEMORY SWEEP MARKER OFF	SR4
	FREQ MEMORY SWEEP MARKER ON	SR5
	FREQ MEMORY SWEEP BREAK	SR6
	FREQ MEMORY SWEEP CONTINUE	SR7
	FREQ MEMORY SWEEP STEP UP	SR8
	FREQ MEMORY SWEEP STEP DOWN	SR9
	FREQ MEMORY SWEEP START PRESET	SRA
	FREQ MEMORY SWEEP STOP PRESET	SRB

(1) Setting frequency-memory sweep addresses

Example

The control messages shown below are sent to set the frequency-memory sweep addresses.

```
WRITE @103:"FRM5.10..20.6"      ··········· Set frequency-memory sweep addresses to 5, 10,
                                            ···, 20, and 6.
WRITE @103:"FRM5.10..20.6PT"
```

Note: When suffix codes are omitted, they are regarded as "PT".

(2) Controlling frequency memory sweepe

Sending the program codes listed below produce the indicated frequency memory sweep commands.

Program code	Command
SR0	Terminates sweep
SR1	Starts auto-sweep
SR2	Starts single sweep
SR3	Starts manual sweep
SR6	Suspends sweep
SR7	Resumes sweep
SR8	Manual sweep moves one-step up
SR9	Manual sweep moves one-step down

Example

```
100 WRITE @103:"SR1"   ......................   Freq. memory auto-sweep started
110 WRITE @103:"SR6"   ......................   Freq. memory sweep suspended
120 WRITE @103:"SR7"   ......................   Freq. memory sweep resumed
130 WRITE @103:"SR0"   ......................   Freq. memory sweep terminated
140 END
```

(3) ON/OFF control of frequency-memory sweep marker function

Sending the program codes listed below produce the indicated frequency-memory sweep marker function commands.

Program code	Command
SR4	Turns OFF freq. memory sweep marker function
SR5	Turns ON freq. memory sweep marker function

Example

```
100 WRITE @103:"SR5"   ......................   Freq. memory sweep marker function ON
110 END
```

(4) Presetting start/stop frequency memories

Sending the program codes listed below produce the indicated frequency memory commands.

Program code	Command
SRA	Sets current frequency to start freq. memory
SRB	Sets current frequency to stop freq. memory

Example

```
100 WRITE @103:"FC10MHZ"   ..................  Set center frequency (CF) to 10 MHz.
110 WRITE @103:"FQ1ST"     ..................  Store CF in the first address of the frequency
                                               memory.
120 WRITE @103:"FC50MHZ"       ...........     Set frequency to 50 MHz.
130 WRITE @103:"FRM1..10PT"    ...........     Set frequency-memory sweep addresses to 1 to
                                               10.
140 WRITE @103:"SRA"    ......................  Set frequency to start-frequency memory data
                                               (10 MHz).
150 END
```

6.19 Data Request Messages for Frequency Memory Sweep

To read the frequency-memory sweep data from the MG3633A, the required program codes for data request messages (below) are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Frequency Memory Sweep

Program code	Data contents	Unit
FRNOA	Number of frequency-memory sweep points	PT
FRMOA	Frequency-memory sweep address	PT

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads frequency-memory sweep data sent from the MG3633A (talker) with format shown in the table below.

Output Format of Message Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
FRNOA	FRNΔddddPT	Δdddd	The talker sends a space to replace the leading zeros.
FRMOA	FRMΔddd.ddd.··· ···.dddPT	Δddd.ddd.······ ···.dddPT	Leading zeros in data separated by periods are sent justified to the left.

(1) Reading number of frequency-memory sweep points

The number of frequency-memory sweep points is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FRM1.5.8PT"    ............  Set frequency-memory sweep addresses 1, 5, and
                                             8.
120 WRITE @103:"FRNOA"    ..................  Request reading the number of frequency-
                                             memory sweep points.
130 READ @103:A$    .........................  Read data.
140 PRINT A$    .............................  Output the read value at the specified device.
150 END
```

```
Output results:      FRN   3PT
```

(2) Reading frequency-memory sweep addresses

The frequency-memory sweep addresses are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FRM1.5.8PT"    ............  Set frequency-memory sweep addresses to 1, 5,
                                             and 8.
120 WRITE @103:"FRMOA"    ..................  Request reading of the frequency-memory sweep
                                             addresses.
130 READ @103:A$    .........................  Read data.
140 PRINT A$    .............................  Output the read value at the specified device.
150 END
```

```
Output results:      FRM   1.5.8PT
```

6.20 Executing Function Memory Sweep

The program codes for the function memory sweep are shown in the table below.

Program Codes for Executing Function Memory Sweep

	Parameter	Program code
SWEEP (FUNCTION MEMORY)	FUNCTION MEMORY SWEEP ADDRESS	FUM
	FUNCTION MEMORY SWEEP OFF	SU0
	FUNCTION MEMORY SWEEP AUTO	SU1
	FUNCTION MEMORY SWEEP SINGLE	SU2
	FUNCTION MEMORY SWEEP MANUAL	SU3
	FUNCTION MEMORY SWEEP BREAK	SU6
	FUNCTION MEMORY SWEEP CONTINUE	SU7
	FUNCTION MEMORY SWEEP STEP UP	SU8
	FUNCTION MEMORY SWEEP STEP DOWN	SU9
	FUNCTION MEMORY SWEEP START PRESET	SUA
	FUNCTION MEMORY SWEEP STOP PRESET	SUB

(1) Setting function-memory sweep addresses

Example

The control messages shown below are sent to set the function-memory sweep addresses.

```
WRITE @103:"FUM5.10..20.6"      ..........  Set the function-memory sweep addresses to 5,
                                            10, ...., 20, and 6.
WRITE @103:"FUM5.10..20.6PT"
```

Note: When suffix codes are omitted, they are regarded as "PT".

(2) Controlling function memory sweep

Sending the program codes listed below produce the indicated function memory (F.M.) sweep commands.

Program code	Command
SU0	Terminates sweep
SU1	Starts auto-sweep
SU2	Starts single sweep
SU3	Starts manual sweep
SU6	Suspends sweep
SU7	Resumes sweep
SU8	Manual sweep moves one-step up
SU9	Manual sweep moves one-step down

Example

```
100 WRITE @103:"SU1"    ····················   F.M. auto-sweep started
110 WRITE @103:"SU6"    ····················   F.M. sweep suspended
120 WRITE @103:"SU7"    ····················   F.M. sweep resumed
130 WRITE @103:"SU0"    ····················   F.M. sweep terminated
140 END
```

(3) Presetting start/stop function memories

Sending the program codes listed below produce the indicated function memory (F.M.) commands.

Program code	Command
SUA	Sets current front-panel settings to start F.M.
SUB	Sets current front-panel settings to stop F.M.

Example

```
100 WRITE @103:"FN1ST"      .................  Store front panel settings in the first address of
                                               the function memory.
110 WRITE @103:"SP00"
120 WRITE @103:"FUM1..10PT" ...........        Set function-memory sweep addresses to 1 to 10.
130 WRITE @103:"SUA"        ......................  Set current panel settings to start-function
                                               memory data (first address function memory)
140 END
```

6.21 Data Request Messages for Function Memory Sweep

The read the function memory sweep data from the MG3633A, the required program code of the data request messages shown in the table below is sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Function Memory Sweep

Program code	Data contents	Unit
FUNOA	Number of function-memory sweep points	PT
FUMOA	Function-memory sweep address	PT

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads function memory sweep data sent from the MG3633A (talker), with format shown in the table below.

Output Format of Message Sent from Talker

△ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
FUNOA	FUN△dddPT	△△ddd	The talker sends a space to replace leading zeros.
FUMOA	FUM△dd.dd.dd.··· ···.ddPT	△dd.dd.dd.··· ···.dd	Leading zeros in data separated by periods are sent justified to the left.

(1) Reading the number of function memory sweep points

The number of function-memory sweep points is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FUM1.5.8PT"    ...........  Set function-memory sweep addresses to 1, 5,
                                            and 8.
120 WRITE @103:"FUNOA"    .................  Request reading of number of function-memory
                                            sweep points.
130 READ @103:A$    .........................  Read data.
140 PRINT A$   ...................................  Output the read value the specified device.
150 END
```

```
Output results:      FUN   3PT
```

(2) Reading function-memory sweep addresses

The function-memory sweep addresses are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FUM1.5.8PT"    ...........  Set function-memory sweep addresses to 1, 5,
                                            and 8.
120 WRITE @103:"FUMOA"    .................  Request reading of function-memory sweep
                                            addresses.
130 READ @103:A$    .........................  Read data.
140 PRINT A$   ...................................  Output the read value at the specified device.
150 END
```

```
Output results:      FUM  1.5.8PT
```

6.22 Setting Sweep Time

The program codes for setting the sweep time are shown in the table below.

Program Codes for Setting Sweep Time

	Parameter	Program code
SWEEP TIME	SWEEP TIME FUNCTION MEMORY SWEEP TIME	SWT FT

Note: The sweep time units sec or ms can be used. The corresponding suffix codes are as follows:

ms : "MS"
sec : "SEC", "SC"

When suffix codes are omitted, they are regarded as "SEC".

(1) Setting sweep time

Example

The control messages shown below are sent to set a 100 ms sweep time.

```
WRITE @103:"SWT0.1"
WRITE @103:"SWT100MS"
WRITE @103:"SWT0.1SEC"
```

(2) Setting function-memory sweep time

Example

The following control messages shown below are sent to set a 100 ms function-memory sweep time.

```
WRITE @103:"FT0.1"
WRITE @103:"FT100MS"
WRITE @103:"FT0.1SEC"
```

6.23 Data Request Messages for Sweep Time

To read the sweep time data from the MG3633A, the required program codes for data request messages (below) are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Sweep Time

Program code	Data contents	Unit
SWTOA	Sweep time	sec
FTOA	Function-memory sweep time	sec

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads sweep time data sent from the MG3633A (talker), with format shown in the table below.

Output Format of Messages Sent from Talker

△ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
SWTOA	SWTddd.dddddSEC	ddd.ddddd	————
FTOA	FT△ddd.dddddSEC	ddd.ddddd	————

Note: In the output format of the sweep time message sent from a talker, the leading zeros are replaced by a space. However, zeros to the right of the decimal point are sent.

(1) Reading sweep time

The sweep time is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"SWT100MS"   ···········   Set sweep time to 100 ms.
120 WRITE @103:"SWTOA"   ················   Request reading of sweep time.
130 READ @103:A$   ···························   Read data.
140 PRINT A$   ·······································   Output the read value at the specified device.
150 END


Output results:      SWT  0.10000SEC
```

(2) Reading function-memory sweep time

The function-memory sweep time is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"FT100MS"   ···············   Set function-memory sweep time to 100 ms.
120 WRITE @103:"FTOA"   ·····················   Request reading of function-memory sweep
                                                time.
130 READ @103:A$   ···························   Read data.
140 PRINT A$   ·······································   Output the read value at the specified device.
150 END


Output results:      FT   0.10000SEC
```

6.24 Executing Memory Function

The program codes for the memory function are shown in the table below.

Program Codes for Executing Memory Function

	Parameter	Program code
MEMORY	STORE	ST
	RECALL	RC
	FREQ	FQ
	FUNCTION	FN

(1) Storing frequency memory

The center frequency is stored in the frequency memory.

Example

The control message shown below is sent to store the center frequency in the frequency memory.

WRITE @103:"FQ24ST" ························ Store the center frequency in address 24 of the frequency memory.

(2) Recalling frequency memory

The data stored in the frequency memory is recalled as the center frequency.

Example

The control message shown below is sent to recall the center frequency from the frequency memory.

WRITE @103:"FQ24RC" ························ Recall the data from address 24 of the frequency memory as the center frequency.

(3) Storing function memory

The front panel settings are stored in the function memory.

Example

The control message shown below is sent to store the panel settings in the function memory.

WRITE @103:"FN4ST" ························ Store the panel settings in address 4 of the function memory.

(4) Recalling function memory

The data from the function memory is recalled to the front panel.

Example

The control message shown below is sent to recall data from the function memory.

WRITE @103:"FN4RC" ························ Recall the data from address 24 of the function memory to the front panel.

6.25 Executing Special Functions

The program codes for the Special Functions are shown in the table below.

Program Codes for Executing Special Functions

	Parameter	Program code
SPECIAL	SPECIAL FUNCTION	SP

(1) Executing Special Functions

Example

The control message shown below is sent to execute the Special Functions.

WRITE @103:"SP00" ···························· Set the MG3633A to initial status.

Note: The special function program code SP must be followed by two numeral digits (00 to 99).

6.26 Data Request Messages for Special Function

To read the special function status data from the MG3633A, the required program codes for data request messages (below) are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Special Function Status

Program code	Data contents	Unit
SPAOA	Special Functions (01 to 20)	None
SPBOA	Special Functions (21 to 40)	None
SPCOA	Special Functions (41 to 60)	None
SPDOA	Special Functions (61 to 80)	None
SPEOA	Special Functions (81 to 99)	None

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads special function status data sent from the MG3633A (talker), with format shown in the table below.

Output Format of Messages Sent from Talker

Δ : Space s : Sign d : Data(0 or 1)

Program code	With header (SP60)	Without header (SP61)	Remarks
SPAOA	SPAΔdddddddddddddddddddd	Δdddddddddddddddddddd	
SPBOA	SPBΔdddddddddddddddddddd	Δdddddddddddddddddddd	
SPCOA	SPCΔdddddddddddddddddddd	Δdddddddddddddddddddd	
SPDOA	SPDΔdddddddddddddddddddd	Δdddddddddddddddddddd	
SPEOA	SPEΔdddddddddddddddddddd	Δdddddddddddddddddddd	

Note: For the data output format of the special function message sent from a talker, "0" is "not set" and "1" is "set" status (paragraph 4.11.1 in a separate opereration manual). For example, SPAΔ00001000010000100001 means SP5, 10, 15, and 20 are set.

(1) Reading special functions

(a) The 01 to 20 special functions are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"SP00"  ........................   Perform initialization
120 WRITE @103:"SPAOA"   ..................   Request reading of 01 to 20 Special Functions.
130 READ @103:A$   ...............................   Read the data.
140 PRINT A$  ..............................................   Output the read value at the specified device.
150 END
```

```
Output results:     SPA    01101010001010101001
```

(b) The 21 to 40 special functions are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"SP00"  ........................   Perform initialization.
120 WRITE @103:"SPBOA"   ..................   Request reading of 21 to 40 Special Functions.
130 READ @103:A$   ...............................   Read data.
140 PRINT A$  ..............................................   Output the read value at the specified device.
150 END
```

```
Output results:     SPB    00101000010000100000
```

(c) The 41 to 60 special functions are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"SP00"  ........................   Perform initialization.
120 WRITE @103:"SPCOA"   ..................   Request reading of 41 to 60 Special Functions.
130 READ @103:A$   ...............................   Read data.
140 PRINT A$  ..............................................   Output the read value at the specified device.
150 END
```

```
Output results:     SPC    00101000000000000001
```

(d) The 61 to 80 special functions are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"SP00"    ·······················  Perform initialization.
120 WRITE @103:"SPDOA"      ················  Request reading of 61 to 80 Special Functions.
130 READ @103:A$    ·····························  Read data.
140 PRINT A$  ······································  Output the read value at the specified device.
150 END
```

```
Output results:     SPD   00000000010000000000
```

(e) The 81 to 99 special functions are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"SP00"    ·······················  Perform initialization.
120 WRITE @103:"SPEOA"      ················  Request reading of 81 to 99 Special Functions.
130 READ @103:A$    ·····························  Read data.
140 PRINT A$  ······································  Output the read value at the specified device.
150 END
```

```
Output results:     SPE   00000100000000000000
```

6.27 Setting Trigger Program

The program codes for setting the trigger program are shown in the table below.

Program Codes for Settings Trigger Program

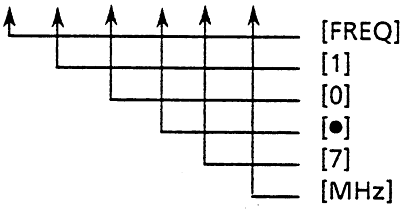
	Parameter	Program code
TRIGGER	TRIGGER PROGRAM SET	TRG

(1) Setting trigger program

Example

The control messages shown below are sent to set the trigger program.

```
WRITE @103:" TRG30. 01. 00. 10. 07. 13" ···· Set center frequency to 10.7 MHz.
```



Note: See paragraph 4.11.18 in a separate operation manual for key codes.

6.28 Data Request Message for Trigger Program

To read the trigger program data from the MG3633A, the required program code for the data request message (below) is sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Trigger Program

Program code	Data contents	Unit
TRGOA	Trigger program	None

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the trigger program data sent from the MG3633A (talker) with format shown in the table below.

Output Format of Messages Sent from Talker

△ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
TRGOA	TRG△dd.dd.dd.····.dd	△dd.dd.dd.····.dd	The data separated by periods are sent as two fixed digits in which "0" is also used as a significant digit.

(1) Reading trigger program

The trigger program is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"TRG30.01.00.10.07.13" ···  Set center frequency to 10.7 MHz.
120 WRITE @103:"TRGOA"  ···················  Request reading of trigger program.
130 READ @103:A$  ·························  Read data.
140 PRINT A$  ·····························  Output the read value at the specified
                                             device.
150 END
```

```
Output results:    TRG   30.01.00.10.07.13
```

6.29 Data Request Messages for Error Status and Option Settings

To read error status and option settings from the MG3633A, the required program codes for data request messages (below) are sent from the controller (talker) to the MG3633A (listener).

Data Request Messages for Error Status and Option Settings

Program code	Data contents	Unit
STSOA	Error status	None
OPTOA	Option setting condition	None

After sending the above message, the MG3633A and controller are specified as the talker and listener, respectively.

The controller (listener) reads the data sent from the MG3633A (talker) with data format shown in the table below.

Output Format of Message Sent from Talker

Δ : Space s : Sign d : Data

Program code	With header (SP60)	Without header (SP61)	Remarks
STSOA	STSΔdd	Δdd	The data is sent as two fixed digits in which "0" is also used as a significant digit.
OPTOA	OPTΔdddddddddddddddddddd	Δdddddddddddddddddddd	"0" is "not set" and "1" is "set" status (paragraph 4.11.26 in a separate operation manual).

(1) Reading error status

Error status is read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"STSOA"    ················  Request reading of error status.
120 READ @103:A$    ··························  Read data.
130 PRINT A$    ····································  Output the read value at the specified device.
140 END


Output results:      STS   01
```

(2) Reading option setting conditions

The option setting conditions are read using the following method.

Example

```
100 DIM A$*100
110 WRITE @103:"OPTOA"    ················  Request reading of option setting conditions.
120 READ @103:A$    ··························  Read data.
130 PRINT A$    ····································  Output the read value at the specified device.
140 END


Output results:      OPTΔ10000000000000000000 ········ Option 01 is set.
```

6.30 High-Speed Data Transfer

The program codes for high-speed data transfer are shown below.
These data request messages shown below are sent to specify data to be sent from the MG3633A.

Program Codes for High-Speed Data Transfer

	Parameter	Program code
BINARY	BINARY FREQUENCY SET	B1
	BINARY FREQ MEMORY SET	B2
	BINARY PANEL SET	B3
	BINARY FUNCTION MEMORY SET	B4
	BINARY FREQ MEMORY DATA CHECK	CBF
	BINARY FUNCTION MEMORY DATA CHECK	CBU
	BINARY FREQ MEMORY ADDRESS SET	ABF
	BINARY FUNCTION MEMORY ADDRESS SET	ABU

These data request messages shown below are sent to specify data to be sent from the MG3633A.

Then, specify the MG3633A as the talker and read the data.

Data Request Messages for High-Speed Data Transfer

Program code	Data contents	Unit
B5	Center frequency	None
B6	Frequency memory data	None
B7	Front panel settings	None
B8	Function memory data	None

Notes:
1. The MG3633A does not accept other program codes (from the time when the high-speed transfer data request messages are sent) until reading of the data is completed.
2. When transfer time exceeds 10 s, transfer is interrupted. So, when the number of data to be transferred is large, divide the number.
3. Set the number of bytes to be transfered to the value which is specified for the personal computer.
4. Following program examples use BASIC language of a PACKET V Personal Computer (Anritsu).

(1) High-speed frequency data transfer

The high-speed transfer of frequency data is performed using the following method.

Example 1

Set the frequencies 903 012 500.00 Hz and 2 456 789 012.34 Hz.

```
100 OPTION BASE 1  ..................................  Declare subscript lower limit of array
                                                       variable to 1.
110 DIM INT B(6), I, J                                 Define variable area.
120 DIM F$*12
130 TERM IS ""  .....................................  No terminator.
140 FOR J = 1 TO 2
150 READ F$
160 FOR I = 1 TO 3                                     Convert the frequency data to the packed-
170 LET A = HVAL(F$(I*4 - 3:I*4))                      BCD format and store it in array variable
180 LET B(I + (J - 1)*3) = A                           B ( ).
190 NEXT I
200 NEXT J
210 WRITE @103:"B1"  ................................  Send control message "B1".
220 EOI ON
230 MAT WRITE @1 USING"WH":B  .......................  Send array variable B (  ) data of 2 bytes
                                                       at the same time.
240 EOI OFF
250 STOP
260 DATA "090301250000"  ............................  Set frequency data 1.
270 DATA "245678901234"  ............................  Set frequency data 2.
280 END
```

Note: Data format is the packed-BCD (where 1 byte represents two-digit integer), where 6 bytes represent one frequency and the resolution (least digit) is 0.01 Hz. The MG3633A performs I/O settings each time data is received.

Example 2

Set 100 MHz frequency and read the frequency using high-speed transfer.

```
100 OPTION BASE 1  ..............................  Declare subscript lower limit of array variable
                                                   to 1.
110 DIM INT B(3), I                                Define variable area.
120 DIM F$*12
130 WRITE @103:"FR100MHZ"  ......................  Set frequency to 100 MHz.
140 WRITE @103:"B5"  ............................  Request high-speed reading of frequency.
150 MAT READ @103 USING"WH":B  ..................  Read data of 2 bytes at the same time.
160 LET F$ = HSTR$(B(1), 4)&HSTR$(B(2), 4)&HSTR$(B(3), 4)
                     ............................  Convert the packed-BCD format data to
                                                   hexadecimal data.
170 PRINT F$  ...................................  Output the read value at the specified device.
180 END
```

(2) High-speed data transfer to frequency memory

The high-speed frequency-data transfer to the frequency memory is performed using the following method.

Example 1

Set the frequencies 903 012 500.00 Hz to the frequency × address 0.

```
100 OPTION BASE 1          ..........................   Declare subscript lower limit of array
                                                        variable to 1.
110 DIM INT B(3), I,                                 ┐  Define variable area.
120 DIM F$*12                                        ┘
130 TERM IS ""     .................................    No terminator.
140 READ F$                                          ┐
150 FOR I = 1 TO 3                                   │  Convert frequency data to the packed-
160 LET A = HVAL(F$(I*4 - 3:I*4))                    │  BCD format and store it in array variable
170 LET B(I) = A                                     │  B ( ).
180 NEXT I                                           ┘
190 WRITE @103:"B2"          .......................    Send control message "B2".
200 EOI ON
210 MAT WRITE @1 USING"WH":B         ...........        Send array variable B ( ) data of 2 bytes at
                                                        the same time.
220 EOI OFF
230 STOP
240 DATA "090301250000"       .....................     Set frequency data.
250 END
```

Note: Data format is the packed-BCD (where 1 byte represents two-digit integer), where 6 bytes represent one frequency and the resolution (least digit) is 0.01 Hz.

Example 2

Read the data from addresses 50 to 52 of the frequency memory using high-speed transfer.

```
100 OPTION BASE 1          .........................  Declare subscript lower limit of array
                                                      variable to 1.
110 DIM INT B(9), I, J                                Define variable area.
120 DIM F$*12
130 WRITE @103:"FR100MHZ"                             Set frequency to 100 MHz.
140 WRITE @103:"FQ50ST"                               Store current frequency in frequency
                                                      memory address 50.
150 WRITE @103:"FR101MHZ"                             Set frequency to 101 MHz.
160 WRITE @103:"FQ51ST"                               Store current frequency in frequency
                                                      memory address 51.
170 WRITE @103:"FR102MHZ"                             Set frequency to 102 MHz.
180 WRITE @103:"FQ52ST"                               Store current frequency in frequency
                                                      memory address 52.
190 WRITE @103:"ABF50.52"    .....................    Specify frequency memory address.
200 WRITE @103:"B6"      .........................    Request high-speed reading of the
                                                      frequency.
210 MAT READ @103 USING"WH":B      ...........        Read data of 2 bytes at the same time.
220 FOR J = 1 TO 3
230 LET F$ = ""
240 FOR I = 1 TO 3
250 LET F$ = F$&HSTR$(B(I + (J - 1)*3), 4)  .........  Convert the packed-BCD format data to
260 NEXT I                                            hexadecimal data..
270 PRINT F$   .......................................  Output the read value at the specified
280 NEXT J                                            device.
290 END
```

```
Output results:    010000000000
                   010100000000
                   010200000000
```

Note: The address-specified range is valid unless it is specified to other address. The initial status can take the whole range (0 to 999).

(3) High-speed data transfer of front-panel settings

The high-speed data transfer of the front-panel settings is performed using the following method.

Example 1

Read the current front-panel settings, save them in a file named “PANEL”.

```
100 OPTION BASE 1             ····························  Declare subscript lower limit of array variable
                                                            to 1.
110 DIM INT B(800)            ····························  Define the variable area.
120 WRITE @103:"FR200MHZ"     ··········                    Set frequency to 200 MHz.
130 WRITE @103:"OL-10DBM"     ··········                    Set output level to −10 dBm.
140 WRITE @103:"OIS6DB"       ················              Set increment output level to 6 dB.
150 WRITE @103:"AM30PC"       ················              Set AM modulation factor to 30%.
160 WRITE @103:"B7"           ······················        Request high-speed reading of front-panel
                                                            settings.
170 MAT READ @103 USING "B":B ··········                    Read data.
180 MAT SAVE "PANEL",B        ················              Save front-panel settings.
190 END
```

Example 2

Change the front-panel settings to the settings saved in a file named “PANEL”.

```
100 OPTION BASE 1             ····························  Declare subscript lower limit of array variable
                                                            to 1.
110 DIM INT B(800)            ····························  Define the modulation.
120 TERM IS ""                ··································  No terminator.
130 MAT LOAD "PANEL", B       ····················          Load front-panel settings.
140 WRITE @103:"B3"           ················              Send control message "B3".
150 EOI ON
160 MAT WRITE @1 USING "B":B  ······                        Send array variable B ( ) data.
170 EOI OFF
180 END
```

Note: Data format is the packed-BCD (where 1 byte represents two-digit integer), where 800 bytes represent one front-panel settings.

(4) High-speed transfer of function memory data

The high-speed transfer of function memory data is performed as described below.

Example

Read the data from function memories 10 to 14, save it in the file named “FUNCTION”, and store it in 60 to 64 function memories.

```
100 OPTION BASE 1  ..............................  Declare subscript lower limit of array variable
                                                   to 1.
110 DIM INT B(4000)  ............................  Define variable area.
120 WRITE @103:"ABU10.14"      ..........          Specify function memory address.
130 WRITE @103:"B8"     ........................   Request high-speed reading of front-panel
                                                   settings.
140 MAT READ @103 USING"B":B ........              Read data.
150 MAT SAVE "FUNCTION", B  ............           Save function memory settings.
160 WRITE @103:"ABU60.64"   ............           Specify function memory address.
170 TERM IS ""   ..................................  No terminator.
180 WRITE @103:"B4"  ..........................    Send “B4” control message.
190 EOI ON
200 MAT WRITE @1 USING"B":B  ..........            Send array variable B ( ) data.
210 EOI OFF
220 END
```

Note: The address-specified range is valid unless it is specified to other range.
The initial status can take the whole range (0 to 99).

(5) Checking memory data

Program code	Command
CBF	Checks frequency-memory data
CBU	Checks function-memory data

Example

```
100 WRITE @103:"CBF"      ........................  Check the frequency memory data.
110 END
```

Note: If an error occurs with the frequency or function memory data check, 10 MHz or the initial status contents will be stored in all the addresses, respectively.

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SECTION 7
TALK/LISTEN ONLY MODES

The MG3633A talk or listen-only model can be set using Special Functions.

The "Only" mode can turned off by executing SP64.

7.1 Talk-Only Mode

In the talk-only mode, three functions can be selected as described below.

1. Talk-only mode for carrier frequency (SP65)

The talker sends carrier frequency data only when the carrier frequency data varies. The output format is the same as the talker output message format with the header and unit.

Output example

FR△△360300000.00Hz △: Space

2. Talk-only mode for output level (SP66)

The talker sends the output level data only when the output level data varies.

The output format is the same as the talker output message format with the header and unit.

Output example

OL △−△15.0DBM

3. Talk-only mode for both carrier frequency and output level (SP67)

The talker sends both the carrier frequency and output level data simultaneously when either the carrier frequency or output level data varies.

The output format is as shown below.

Output example

FR△△360300000.00Hz , OL △−△15.0DBM

7.2 Listen-Only Mode

The listen-only mode is set by executing SP68. All the MG3633A control messages are subject codes.

Notes:
1. The front-panel keys can be operated in either the talk-only or listen-only mode.
2. When the talk-only or listen-only mode is changed to other state, turn off and then turn on the pow

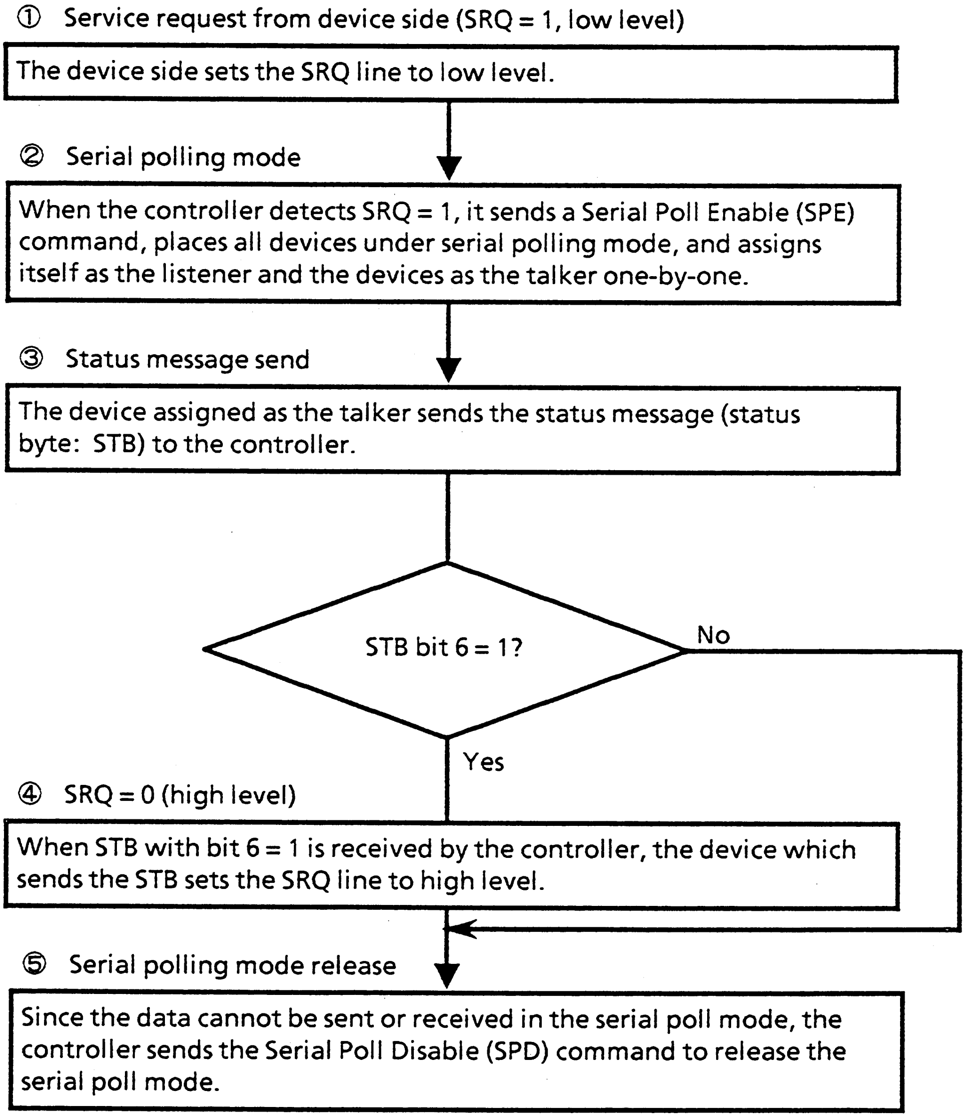
(Blank)

SECTION 8
PROGRAMMING

8.1 Programming Using Status Message

In a similar manner in which a talker or listener issues an SRQ signal on the GP-IB, an interruption can be sent to the controller. The controller checks which talker or listener issued the SRQ interruption signal; this is called polling. Of the two types of polling, serial and parallel, the MG3633A uses serial polling.

The following figure shows the serial polling operation.



① Service request from device side (SRQ = 1, low level)

The device side sets the SRQ line to low level.

② Serial polling mode

When the controller detects SRQ = 1, it sends a Serial Poll Enable (SPE) command, places all devices under serial polling mode, and assigns itself as the listener and the devices as the talker one-by-one.

③ Status message send

The device assigned as the talker sends the status message (status byte: STB) to the controller.

④ SRQ = 0 (high level)

When STB with bit 6 = 1 is received by the controller, the device which sends the STB sets the SRQ line to high level.

⑤ Serial polling mode release

Since the data cannot be sent or received in the serial poll mode, the controller sends the Serial Poll Disable (SPD) command to release the serial poll mode.

Serial Polling Mode

Using the PACKET V Personal Technical Computer, the following statement is used as a command to process items ② to ⑤ in the flowchart above.

```
STATUS @ device number:  numeric variable
```

erial polling to the MG3633A with address No. 03 is described as shown below.

```
STATUS  @103 : S
```

- S: The contents of the status data (weight) are input in variable S.
- 03: Specify the MG3633A (address No. 03) as talker.
- @1: GP-IB interface select code 1

Each bit of the status data byte (STB) has a meaning as shown below.

The status meaning of the lower 4 bits (bit 3 to bit 0) depends on the value (1 or 0) of error bit (bit 5).

- **When error bit is 1**

bit	7	6	5	4	3	2	1	0
Line / Data	DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
1	×*	Service request (SRQ)	ERROR	BUSY	Malfunction (error)	Self test error	Suspension error	Data error
0	×*	No service request	NO ERROR	READY	No malfunction (No error)	No self test error	No suspension error	No data error
Weight	128	64	32	16	8	4	2	1
Sending	0	1/0	1	1/0	1/0	1/0	1/0	1/0
Special Function to mask off	×	×	SP71	SP72	SP73	SP74	SP75	SP76

*: × means unused.

- **When error bit is 0**

bit	7	6	5	4	3	2	1	0
Line / Data	DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
1	×*	Service request (SRQ)	ERROR	BUSY	Trigger program execution completed	Sweep execution completed	Marker position marked	String execution completed
0	×*	No service request	NO ERROR	READY	Trogger program execution incomplete	Sweep execution incomplete	Marker position not matched	String execution incomplete
Weight	128	64	32	16	8	4	2	1
Sending	0	1/0	0	1/0	1/0	1/0	1/0	1/0
Special Function to mask off	×	×	SP71	SP72	SP77	SP78	SP79	SP80

* : × means unused.

Note: The special function SP70 is used to mask the STB.

As described above, when the controller requests a status byte from a talker or listener, the serial poll method determines, by the status byte contents, which talker or listener generated the SRQ. The talker or listener that generated the SRQ sets bit 6 (SRQ message) of the status byte to 1. Other bits indicate the status when the SRQ is generated.

Special Functions 70 to 80 are used as commands to turn on/off SRQ generation (shown below) before performing a serial poll in the program.

SP70 : Masks all SRQs
(ALL MASK)

SP71 : Releases SRQ mask concerning ERROR
(ERROR MASK OFF)

SP72 : Releases SRQ mask concerning BUSY
(BUSY/READY MASK OFF)

SP73 : Releases SRQ mask concerning MAL-FUNCTION ERROR
(MAL-FUNCTION ERROR MASK OFF)

SP74 : Releases SRQ mask concerning SELF TEST ERROR
(SELF TEST ERROR MASK OFF)

SP75 : Releases SRQ mask concerning SUSPENSION ERROR
(SUSPENSION ERROR MASK OFF)

SP76 : Releases SRQ mask concerning DATA ERROR
(DATA ERROR MASK OFF)

SP77 : Releases SRQ mask concerning TRIGGER PROGRAM END
(TRIGGER PROGRAM END MASK OFF)

SP78 : Releases SRQ mask concerning SWEEP END
(SWEEP END MASK OFF)

SP79 : Releases SRQ mask concerning MARKER POSITION
(MARKER POSITION MASK OFF)

SP80 : Releases SRQ mask concerning STRING END
(STRING END MASK OFF)

For example, when WRITE @103:"SP71" is sent, the MG3633A performs a service request to the controller with bit 6 = 1 only when bit 5 = 1 (when an error occurs).

Then, when STATUS @ 103:S is performed, the contents of S are 96, since bit 6 = 1 and bit 5 = 1 ($S=2^6+2^5=96$).

The BIT(N, S) function is used to detect the bit position in the binary value of the numeric variable S (≦65535).

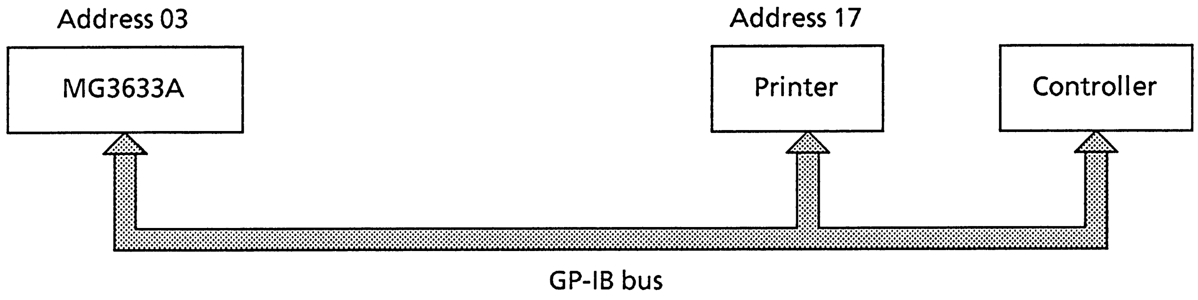
(N specifies bit position of numeric expression S)

Function	Name of function	Example	Meaning
BIT (N, S)	Bit check	In HSTR$(16385,4) = 4001 4001 = 0100 0000 0000 0001 BIT (15,16385) = 0 BIT (0,16385) = 1	Checks that the bit at position N of the numeric expression S is 0 or 1.

The service request is made from the device regardless of the current process being performed by the controller, SO is an interruption process from the device to the controller.

Example

This example creates a program, written in BASIC, to control the MG3633A using the PACKET computer (Anritsu) with the configurations shown below.



Store 100 to 200 MHz frequencies in 0 to 400 frequency-memory addresses in 250 kHz steps, and sweep the frequency memory in a 1 second step.

```
100 DIM INT I,S ·································· Define variables as integer type.
110 WRITE @103:"SP70,SP78"        ·········· Release sweep end SRQ mask.
120 !
130 WRITE @103:"FR100MHZ"         ·········· Set frequency to 100 MHz.
140 WRITE @103:"FIS250KHZ"        ·········· Set incremental (step)  frequency to 250 kHz.
150 !
160 FOR I = 0 TO 400    ·························· Store frequencies in 0 to 400 frequency-memory
                                             addresses.
170 WRITE @103:"FQ",STR$(I),"ST"  ····· Store in frequency memory.
180 WRITE @103:"UFR"    ······················ Step-up frequency by 250 kHz.
190 NEXT I
200 !
210 WRITE @103:"FRM0..400PT"  ·········· Set frequency-memory sweep address range to 0
                                             to 400 addresses.
220 WRITE @103:"SWT1SEC"  ················ Set sweep time to 1 second.
230 WRITE @103:"SR2"    ······················ Start single sweep.
240 !
250 DO     ········································ Perform serial polling
260 STATUS @103:S    ························· Read STB.
270 EXIT IF BIT(6,S) = 1 AND BIT(2,S) = 1 ··· Exit from loop when both STB RQS (bit 6) and
                                             sweep end (bit 2) are 1.
280 LOOP
290 !
300 PRINTER IS @0 ······························ Specify output device at display.
310 PRINT "SWEEP END"   ······················ Output "SWEEP END" on display.
320 !
330 END
```

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APPENDIXES

TABLE OF CONTENTS

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APPENDIX A
DEVICE MASSAGE IN ALPHABETIC ORDER

Device Massage in Alphabetic Order (1/12)

Program code	Parameter	Classification
A0	AM OFF	MODULATION [AM]
A1	INT AM MODE ON	MODULATION [AM]
A2	EXT AC AM MODE ON	MODULATION [AM]
A3	EXT DC AM MODE ON	MODULATION [AM]
A4	INT/EXT AC AM MODE ON	MODULATION [AM]
A5	INT/EXT DC AM MODE ON	MODULATION [AM]
ABF	BINARY FREQ MEMORY ADDRESS SET	BINARY
ABU	BINARY FUNCTION MEMORY ADDRESS SET	BINARY
AD0	AM RESOLUTION 1st DIGIT	MODULATION [AM]
AD1	AM RESOLUTION 2nd DIGIT	MODULATION [AM]
AD2	AM RESOLUTION 3rd DIGIT	MODULATION [AM]
AD3	AM RESOLUTION RIGHT	MODULATION [AM]
AD4	AM RESOLUTION LEFT	MODULATION [AM]
AF	AF (AUDIO FREQUENCY)	AF OSC
AFOA	AF FREQUENCY request	Data request message (Hz)
AIS	AF INCREMENTAL STEP	AF OSC
AISOA	AF INCREMENTAL STEP request	Data request message (Hz)
ALG	AF SWEEP STEP LOG SIZE	SWEEP (AF OSC)
AM	AM (AMPLITUDE MODULATION)	MODULATION [AM]
AMOA	AM request	Data request message (%)
AP	OUTPUT LEVEL or AMPLITUDE	OUTPUT LEVEL
APOA	OUTPUT LEVEL request	Data request message (dBm, dBμ, V)
APDBM	OUTPUT LEVEL UNIT dBm or AMPLITUDE UNIT dBm	OUTPUT LEVEL
APDM	OUTPUT LEVEL UNIT dBm or AMPLITUDE UNIT dBm	OUTPUT LEVEL

Device Massage in Alphabetic Order (2/12)

Program code	Parameter	Classification
APDBU	OUTPUT LEVEL UNIT dBμ or AMPLITUDE UNIT dBμ	OUTPUT LEVEL
APDU	OUTPUT LEVEL UNIT dBμ or AMPLITUDE UNIT dBμ	OUTPUT LEVEL
APV	OUTPUT LEVEL UNIT V or AMPLITUDE UNIT V	OUTPUT LEVEL
AR0	AF RESOLUTION 0.1 Hz	AF OSC
AR1	AF RESOLUTION 1 Hz	AF OSC
AR2	AF RESOLUTION 10 Hz	AF OSC
AR3	AF RESOLUTION 100 Hz	AF OSC
AR4	AF RESOLUTION 1 kHz	AF OSC
AR5	AF RESOLUTION 10 kHz	AF OSC
ASA	AF SWEEP START	SWEEP (AF OSC)
ASAOA	AF SWEEP START request	Data request message (Hz)
ASB	AF SWEEP STOP	SWEEP (AF OSC)
ASBOA	AF SWEEP STOP request	Data request message (Hz)
ASL	AF RESOLUTION LEFT	AF OSC
ASN	AF SWEEP POINT	SWEEP (AF OSC)
ASNOA	AF SWEEP POINT request	Data request message (PT)
ASP	AF SWEEP SPAN	SWEEP (AF OSC)
ASPOA	AF SWEEP SPAN request	Data request message (Hz)
ASR	AF RESOLUTION RIGHT	AF OSC
ASZ	AF SWEEP STEP SIZE	SWEEP (AF OSC)
ASZOA	AF SWEEP STEP SIZE request	Data request message (Hz)
B1	BINARY FREQUENCY SET	BINARY
B2	BINARY FREQ MEMORY SET	BINARY
B3	BINARY PANEL SET	BINARY
B4	BINARY FUNCTION MEMORY SET	BINARY
B5	CENTER FREQUENCY request	Data request message (No unit)

Device Massage in Alphabetic Order (3/12)

Program code	Parameter	Classification
B6	FREQ MEMORY DATA request	Data request message (No unit)
B7	PANEL SET CONDITION request	Data request message (No unit)
B8	FUNCTION MEMORY DATA request	Data request message (No unit)
CAL	FREQ CAL	MODULATION [FM]
CBF	BINARY FREQ MEMORY DATA CHECK	BINARY
CBU	BINARY FUNCTION MEMORY DATA CHECK	BINARY
CF	FREQUENCY or CENTER FREQUENCY	FREQUENCY
CFOA	FREQUENCY request	Data request message (Hz)
DAF	INCREMENTAL STEP DOWN AF	AF OSC
DAM	INCREMENTAL STEP DOWN AM	MODULATION [AM]
DB	dB	UNIT
DBM	dBm	UNIT
DM	dBm	UNIT
DBU	dBμ	UNIT
DEG	degree	UNIT
DG	degree	UNIT
DFM	INCREMENTAL STEPDOWN FM	MODULATION [FM]
DFR	INCREMENTAL STEP DOWN FREQ	FREQUENCY
DOL	INCREMENTAL STEP DOWN OUTPUT LEVEL	OUTPUT LEVEL
DPH	INCREMENTAL STEP DOWN ØM	MODULATION [ØM]
DU	dBμ	UNIT
EAF	KNOB DOWN AF	AF OSC
EAM	KNOB DOWN AM	MODULATION [AM]
EFM	KNOB DOWN FM	MODULATION [FM]
EFR	KNOB DOWN FREQ	FREQUENCY
EOL	KNOB DOWN OUTPUT LEVEL	OUTPUT LEVEL
EPH	KNOB DOWN ØM	MODULATION [ØM]
EXD	EXT DEVIATION FIX	MODULATION [FM/ØM]

Device Massage in Alphabetic Order (4/12)

Program code	Parameter	Classification
EXDOA	FM/ØM EXT DEVIATION FIX request	Data request message (Hz, rad, deg)
F0	FM OFF	MODULATION [FM]
F1	INT FM MODE ON	MODULATION [FM]
F2	EXT AC FM MODE ON	MODULATION [FM]
F3	EXT DC FM MODE ON	MODULATION [FM]
F4	INT/EXT AC FM MODE ON	MODULATION [FM]
F5	INT/EXT DC FM MODE ON	MODULATION [FM]
FC	FREQUENCY or CENTER FREQUENCY	FREQUENCY
FCOA	FREQUENCY request	Data request message (Hz)
FD0	FM RESOLUTION 1st DIGIT	MODULATION [FM]
FD1	FM RESOLUTION 2nd DIGIT	MODULATION [FM]
FD2	FM RESOLUTION 3rd DIGIT	MODULATION [FM]
FD3	FM RESOLUTION RIGHT	MODULATION [FM]
FD4	FM RESOLUTION LEFT	MODULATION [FM]
FF	FREQ RELATIVE OFF	FREQUENCY
FIS	FREQUENCY INCREMENTAL STEP	FREQUENCY
FISOA	FREQUENCY INCREMENTAL STEP request	Data request message (Hz)
FLG	FREQ SWEEP STEP LOG SIZE	SWEEP (FREQ)
FM	FM (FREQUENCY MODULATION)	MODULATION [FM]
FMOA	FM request	Data request message (Hz)
FN	FUNCTION	MEMORY
FO	FREQ RELATIVE ON	FREQUENCY
FOS	FREQ OFFSET	FREQUENCY
FOSOA	FREQ OFFSET request	Data request message (Hz)
FQ	FREQ	MEMORY
FR	FREQUENCY or CENTER FREQUENCY	FREQUENCY
FRM	FREQ MEMORY SWEEP ADDRESS	SWEEP (FREQ MEMORY)
FRMOA	FREQ MEMORY SWEEP ADDRESS request	Data request message (PT)

Device Massage in Alphabetic Order (5/12)

Program code	Parameter	Classification
FRNOA	FREQ MEMORY SWEEP POINT request	Data request message (PT)
FROA	FREQUENCY request	Data request message (Hz)
FSA	FREQ SWEEP START	SWEEP (FREQ)
FSAOA	FREQ SWEEP START request	Data request message (Hz)
FSB	FREQ SWEEP STOP	SWEEP (FREQ)
FSBOA	FREQ SWEEP STOP request	Data request message (Hz)
FSL	FREQ RESOLUTION LEFT	FREQUENCY
FSN	FREQ SWEEP POINT	SWEEP (FREQ)
FSNOA	FREQ SWEEP POINT request	Data request message (PT)
FSP	FREQ SWEEP SPAN	SWEEP (FREQ)
FSPOA	FREQ SWEEP SPAN request	Data request message (Hz)
FSR	FREQ RESOLUTION RIGHT	FREQUENCY
FSZ	FREQ SWEEP STEP SIZE	SWEEP (FREQ)
FSZOA	FREQ SWEEP STEP SIZE request	Data request message (Hz)
FT	FUNCTION MEMORY SWEEP TIME	SWEEP TIME
FTOA	FUNCTION MEMORY SWEEP TIME request	Data request message (sec)
FUM	FUNCTION MEMORY SWEEP ADDRESS	SWEEP (FUNCTION MEMORY)
FUMOA	FUNCTION MEMORY SWEEP ADDRESS request	Data request message (PT)
FUNOA	FUNCTION MEMORY SWEEP POINT request	Data request message (PT)
GHZ	GHz	UNIT
GZ	GHz	UNIT
HZ	Hz	UNIT
IND	FM/ØM INT DEVIATION FIX	MODULATION [FM/ØM]
INDOA	FM/ØM INT DEVIATION FIX request	Data request message (Hz, rad, deg)
KHZ	kHz	UNIT
KZ	kHz	UNIT
L0	OUTPUT LEVEL RESOLUTION 0.1 dB	OUTPUT LEVEL

Device Massage in Alphabetic Order (6/12)

Program code	Parameter	Classification
L1	OUTPUT LEVEL RESOLUTION 1 dB	OUTPUT LEVEL
L2	OUTPUT LEVEL RESOLUTION 10 dB	OUTPUT LEVEL
LC	OUTPUT LEVEL CONTINUOUS MODE SET	OUTPUT LEVEL
LF	OUTPUT LEVEL RELATIVE OFF	OUTPUT LEVEL
LN	OUTPUT LEVEL NORMAL MODE SET	OUTPUT LEVEL
LO	OUTPUT LEVEL RELATIVE ON	OUTPUT LEVEL
M0	INT MOD FREQ OUTPUT AF OSC	AF OSC
M1	INT MOD FREQ OUTPUT 1kHz	AF OSC
M2	INT MOD FREQ OUTPUT 400 Hz	AF OSC
MHZ	MHz	UNIT
MS	milli second	UNIT
MV	mV	UNIT
MZ	MHz	UNIT
OIS	OUTPUT LEVEL INCREMENTAL STEP	OUTPUT LEVEL
OISOA	OUTPUT LEVEL INCREMENTAL STEP request	Data request message (dB)
OL	OUTPUT LEVEL or AMPLITUDE	OUTPUT LEVEL
OLOA	OUTPUT LEVEL request	Data request message (dBm, dBμ, V)
OLDBM	OUTPUT LEVEL UNIT dBm or AMPLITUDE UNIT dBm	OUTPUT LEVEL
OLDM	OUTPUT LEVEL UNIT dBm or AMPLITUDE UNIT dBm	OUTPUT LEVEL
OLDBU	OUTPUT LEVEL UNIT dBμ or AMPLITUDE UNIT dBμ	OUTPUT LEVEL
OLDU	OUTPUT LEVEL UNIT dBμ or AMPLITUDE UNIT dBμ	OUTPUT LEVEL
OLM	OUTPUT LEVEL LIMIT	OUTPUT LEVEL
OLMOA	OUTPUT LEVEL LIMIT request	Data request message (dBm, dBμ, V)
OLV	OUTPUT LEVEL UNIT V or AMPLITUDE UNIT V	OUTPUT LEVEL
OOS	OUTPUT LEVEL OFFSET	OUTPUT LEVEL

Device Massage in Alphabetic Order (7/12)

Program code	Parameter	Classification
OOSOA	OUTPUT LEVEL OFFSET request	Data request message (dB)
OPTOA	OPTION request	Data request message (No unit)
OSA	OUTPUT LEVEL SWEEP START	SWEEP (OUTPUT LEVEL)
OSAOA	OUTPUT LEVEL SWEEP START request	Data request message (dBm, dBμ, V)
OSB	OUTPUT LEVEL SWEEP STOP	SWEEP (OUTPUT LEVEL)
OSBOA	OUTPUT LEVEL SWEEP STOP request	Data request message (dBm, dBμ, V)
OSL	OUTPUT LEVEL RESOLUTION LEFT	OUTPUT LEVEL
OSNOA	OUTPUT LEVEL POINT request	Data request message (PT)
OSP	OUTPUT LEVEL SWEEP SPAN	SWEEP (OUTPUT LEVEL)
OSPOA	OUTPUT LEVEL SWEEP SPAN request	Data request message (dB)
OSR	OUTPUT LEVEL RESOLUTION RIGHT	OUTPUT LEVEL
PC	%	UNIT
PD0	ØM RESOLUTION 1st DIGIT	MODULATION [ØM]
PD1	ØM RESOLUTION 2nd DIGIT	MODULATION [ØM]
PD2	ØM RESOLUTION 3rd DIGIT	MODULATION [ØM]
PD3	ØM RESOLUTION RIGHT	MODULATION [ØM]
PD4	ØM RESOLUTION LEFT	MODULATION [ØM]
PH0	ØM OFF	MODULATION [ØM]
PH1	INT ØM MODE ON	MODULATION [ØM]
PH2	EXT AC ØM MODE ON	MODULATION [ØM]
PH3	EXT DC ØM MODE ON	MODULATION [ØM]
PH4	INT/EXT AC ØM MODE ON	MODULATION [ØM]
PH5	INT/EXT DC ØM MODE ON	MODULATION [ØM]
PHM	ØM (PHASE MODULATION)	MODULATION [ØM]
PHMOA	ØM request	Data request message (rad, deg)
PHMDEG	ØM UNIT degree	MODULATION [ØM]
PHMDG	ØM UNIT degree	MODULATION [ØM]
PHMRAD	ØM UNIT radian	MODULATION [ØM]
PHMRD	ØM UNIT radian	MODULATION [ØM]

Device Massage in Alphabetic Order (8/12)

Program code	Parameter	Classification
PT	point	UNIT
R0	FREQ RESOLUTION 0.01 Hz	FREQUENCY
R1	FREQ RESOLUTION 0.1 Hz	FREQUENCY
R2	FREQ RESOLUTION 1 Hz	FREQUENCY
R3	FREQ RESOLUTION 10 Hz	FREQUENCY
R4	FREQ RESOLUTION 100 Hz	FREQUENCY
R5	FREQ RESOLUTION 1 kHz	FREQUENCY
R6	FREQ RESOLUTION 10 kHz	FREQUENCY
R7	FREQ RESOLUTION 100 kHz	FREQUENCY
R8	FREQ RESOLUTION 1 MHz	FREQUENCY
R9	FREQ RESOLUTION 10 MHz	FREQUENCY
RAD	radian	UNIT
RD	radian	UNIT
RAFOA	REFERENCE AF FREQUENCY request	Data request message (Hz)
RAMOA	REFERENCE AM MODULATION FACTOR request	Data request message (%)
RC	RECALL	MEMORY
REFOA	REFERENCE FREQUENCY request	Data request message (Hz)
REOOA	REFERENCE OUTPUT LEVEL request	Data request message (dBm, dBμ)
RFMOA	REFERENCE FM request	Data request message (Hz)
RPHOA	REFERENCE ∅M request	Data request message (rad, deg)
RLFOA	RELATIVE FREQUENCY request	Data request message (Hz)
RLOOA	RELATIVE OUTPUT LEVEL request	Data request message (dB)
RF	OUTPUT LEVEL OFF	OUTPUT LEVEL
RO	OUTPUT LEVEL ON	OUTPUT LEVEL
RS	RPP RESET	OUTPUT LEVEL
SA0	AF SWEEP OFF	SWEEP (AF OSC)
SA1	AF SWEEP AUTO	SWEEP (AF OSC)
SA2	AF SWEEP SINGLE	SWEEP (AF OSC)
SA3	AF SWEEP MANUAL	SWEEP (AF OSC)

Device Massage in Alphabetic Order (9/12)

Program code	Parameter	Classification
SA4	AF SWEEP MARKER OFF	SWEEP (AF OSC)
SA5	AF SWEEP MARKER ON	SWEEP (AF OSC)
SA6	AF SWEEP BREAK	SWEEP (AF OSC)
SA7	AF SWEEP CONTINUE	SWEEP (AF OSC)
SA8	AF SWEEP STEPUP	SWEEP (AF OSC)
SA9	AF SWEEP STEP DOWN	SWEEP (AF OSC)
SAA	AF SWEEP START PRESET	SWEEP (AF OSC)
SAB	AF SWEEP STOP PRESET	SWEEP (AF OSC)
SC	second	UNIT
SEC	second	UNIT
SF0	FREQ SWEEP OFF	SWEEP (FREQ)
SF1	FREQ SWEEP AUTO	SWEEP (FREQ)
SF2	FREQ SWEEP SINGLE	SWEEP (FREQ)
SF3	FREQ SWEEP MANUAL	SWEEP (FREQ)
SF4	FREQ SWEEP MARKER OFF	SWEEP (FREQ)
SF5	FREQ SWEEP MARKER ON	SWEEP (FREQ)
SF6	FREQ SWEEP BREAK	SWEEP (FREQ)
SF7	FREQ SWEEP CONTINUE	SWEEP (FREQ)
SF8	FREQ SWEEP STEP UP	SWEEP (FREQ)
SF9	FREQ SWEEP STEP DOWN	SWEEP (FREQ)
SFA	FREQ SWEEP START PRESET	SWEEP (FREQ)
SFB	FREQ SWEEP STOP PRESET	SWEEP (FREQ)
SO0	OUTPUT LEVEL SWEEP OFF	SWEEP (OUTPUT LEVEL)
SO1	OUTPUT LEVEL SWEEP AUTO	SWEEP (OUTPUT LEVEL)
SO2	OUTPUT LEVEL SWEEP SINGLE	SWEEP (OUTPUT LEVEL)
SO3	OUTPUT LEVEL SWEEP MANUAL	SWEEP (OUTPUT LEVEL)
SO4	OUTPUT LEVEL SWEEP MARKER OFF	SWEEP (OUTPUT LEVEL)
SO5	OUTPUT LEVEL SWEEP MARKER ON	SWEEP (OUTPUT LEVEL)
SO6	OUTPUT LEVEL SWEEP BREAK	SWEEP (OUTPUT LEVEL)

Device Massage in Alphabetic Order (10/12)

Program code	Parameter	Classification
SO7	OUTPUT LEVEL SWEEP CONTINUE	SWEEP (OUTPUT LEVEL)
SO8	OUTPUT LEVEL SWEEP STEP UP	SWEEP (OUTPUT LEVEL)
SO9	OUTPUT LEVEL SWEEP STEP DOWN	SWEEP (OUTPUT LEVEL)
SOA	OUTPUT LEVEL SWEEP START PRESET	SWEEP (OUTPUT LEVEL)
SOB	OUTPUT LEVEL SWEEP STOP PRESET	SWEEP (OUTPUT LEVEL)
SP	SPECIAL FUNCTION	SPECIAL
SPAOA	SPECIAL FUNCTION request (01~20)	Data request message (No unit)
SPBOA	SPECIAL FUNCTION request (21~40)	Data request message (No unit)
SPCOA	SPECIAL FUNCTION request (41~60)	Data request message (No unit)
SPDOA	SPECIAL FUNCTION request (61~80)	Data request message (No unit)
SPEOA	SPECIAL FUNCTION request (81~99)	Data request message (No unit)
SR0	FREQ MEMORY SWEEP OFF	SWEEP (FREQ MEMORY)
SR1	FREQ MEMORY SWEEP AUTO	SWEEP (FREQ MEMORY)
SR2	FREQ MEMORY SWEEP SINGLE	SWEEP (FREQ MEMORY)
SR3	FREQ MEMORY SWEEP MANUAL	SWEEP (FREQ MEMORY)
SR4	FREQ MEMORY SWEEP MARKER OFF	SWEEP (FREQ MEMORY)
SR5	FREQ MEMORY SWEEP MARKER ON	SWEEP (FREQ MEMORY)
SR6	FREQ MEMORY SWEEP BREAK	SWEEP (FREQ MEMORY)
SR7	FREQ MEMORY SWEEP CONTINUE	SWEEP (FREQ MEMORY)
SR8	FREQ MEMORY SWEEP STEP UP	SWEEP (FREQ MEMORY)
SR9	FREQ MEMORY SWEEP STEP DOWN	SWEEP (FREQ MEMORY)
SRA	FREQ MEMORY SWEEP START PRESET	SWEEP (FREQ MEMORY)
SRB	FREQ MEMORY SWEEP STOP PRESET	SWEEP (FREQ MEMORY)
ST	STORE	MEMORY
STSOA	ERROR STATUS request	Data request message (No unit)
SU0	FUNCTION MEMORY SWEEP OFF	SWEEP (FUNCTION MEMORY)
SU1	FUNCTION MEMORY SWEEP AUTO	SWEEP (FUNCTION MEMORY)
SU2	FUNCTION MEMORY SWEEP SINGLE	SWEEP (FUNCTION MEMORY)
SU3	FUNCTION MEMORY SWEEP MANUAL	SWEEP (FUNCTION MEMORY)

Device Massage in Alphabetic Order (11/12)

Program code	Parameter	Classification
SU6	FUNCTION MEMORY SWEEP BREAK	SWEEP (FUNCTION MEMORY)
SU7	FUNCTION MEMORY SWEEP CONTINUE	SWEEP (FUNCTION MEMORY)
SU8	FUNCTION MEMORY SWEEP STEP UP	SWEEP (FUNCTION MEMORY)
SU9	FUNCTION MEMORY SWEEP STEP DOWN	SWEEP (FUNCTION MEMORY)
SUA	FUNCTION MEMORY SWEEP START PRESET	SWEEP (FUNCTION MEMORY)
SUB	FUNCTION MEMORY SWEEP STOP PRESET	SWEEP (FUNCTION MEMORY)
SWT	SWEEP TIME	SWEEP TIME
SWTOA	SWEEP TIME request	Data request message (sec)
TAF	KNOB UP AF	AF OSC
TAM	KNOB UP AM	MODULATION [AM]
TFM	KNOB UP FM	MODULATION [FM]
TFR	KNOB UP FREQ	FREQUENCY
TOL	KNOB UP OUTPUT LEVEL	OUTPUT LEVEL
TPH	KNOB UP ØM	MODULATION [ØM]
TRG	TRIGGER PROGRAM SET	TRIGGER
TRGOA	TRIGGER PROGRAM SET request	Data request message (No unit)
UAF	INCREMENTAL STEPUP AF	AF OSC
UAM	INCREMENTAL STEPUP AM	MODULATION [AM]
UFM	INCREMENTAL STEP UP FM	MODULATION [FM]
UFR	INCREMENTAL STEPUP FREQ	FREQUENCY
UOL	INCREMENTAL STEPUP OUTPUT LEVEL	OUTPUT LEVEL
UPH	INCREMENTAL STEP UP ØM	MODULATION [ØM]

Device Massage in Alphabetic Order (12/12)

Program code	Parameter	Classification
UV	μV	UNIT
V	V	UNIT
ZAF	RESET TUNABLE AF	AF OSC
ZAM	RESET TUNABLE AM	MODULATION [AM]
ZFM	RESET TUNABLE FM	MODULATION[FM]
ZFR	RESET TUNABLE FREQ	FREQUENCY
ZOL	RESET TUNABLE OUTPUT LEVEL	OUTPUT LEVEL
ZPH	RESET TUNABLE ∅M	MODULATION [∅M]
0~9	NUMERAL 0~9	DATA
•	DECIMAL POINT	DATA
–	MINUS	DATA

APPENDIX B
SPECIAL FUNCTION IN NUMERICAL ORDER

Special Function in Numerical Order (1/3)

Program code	Parameter	Classification
SP00	Initial setting	INITIAL
SP01 SP02	Bell OFF Bell ON *	BELL
SP03 SP04	Output level open voltage display (EMF) * Output level terminating voltage display	LEVEL DISPLAY
SP05 SP06	Output level limiter OFF Output level limiter ON	LIMITER
SP07 SP08 SP11 SP12	Output level offset mode OFF * Output level offset mode ON Frequency offset mode OFF * Frequency offset mode ON	OFFSET
SP13 SP14 SP15 SP16	Frequency memory protect OFF* Frequency memory protect ON Function memory protect OFF* Function memory protect ON	MEMORY PROTECT
SP17 SP18 SP19 SP20 SP21 SP22 SP23 SP24 SP25 SP26 SP27	FM OSC auto swtiching * FM OSC MIDDLE fixed FM OSC WIDE fixed ØM OSC auto switching * ØM OSC MIDDLE fixed ØM OSC WIDE fixed FM/ØM POLARITY NORMAL * FM/ØM POLARITY INVERT FM/ØM INT/EXT deviation release * FM/ØM INT deviation fixed FM/ØM EXT deviation fixed	MODULATION

* : Set at initialization by SP00.

Special Function in Numerical Order (2/3)

Program code	Parameter	Classification
SP30 SP31 SP32 SP33 SP35 SP36 SP37 SP38	INT MOD NORMAL * INT MOD + DC applied INT MOD − DC applied INT MOD ± DC external control MOD OUTPUT auto switching * MOD OUTPUT INT fixed MOD OUTPUT AM EXT fixed MOD OUTPUT FM/ØM EXT fixed	INT MOD FREQ
SP43 SP44 SP45 SP46	SWEEP BLANKING output positive logic * SWEEP BLANKING output negative logic Function memory sweep SWEEP OUTPUT pattern 1* Function memory sweep SWEEP OUTPUT pattern 2	SWEEP
SP56 SP57 SP58	Trigger program setting Trigger program clear Trigger program start	TRIGGER
SP60 SP61 SP63	GP-IB TALKER DATA with header * GP-IB TALKER DATA with no header GP-IB address display	GP-IB
SP70 SP71 SP72 SP73 SP74 SP75 SP76 SP77 SP78 SP79 SP80	SRQ ALL MASK * SRQ ERROR MASK OFF SRQ BUSY/READY MASK OFF SRQ MALFUNCTION MASK OFF SRQ SELF TEST MASK OFF SRQ SUSPENSION MASK OFF SRQ DATA ERROR MASK OFF SRQ TRIGGER PROGRAM MASK OFF SRQ SWEEP END MASK OFF SRQ MARKER POSITION MASK OFF SRQ STRINGS END MASK OFF	SRQ
SP81 SP82	Frequency memory clear Function memory clear	MEMORY CLEAR
SP83	Option display	OPTION

* : Set at initialization by SP00.

Special Function Numerical Order (3/3)

Program code	Parameter	Classification
SP86 SP87 SP88	Output level correction NORMAL * Output level correction (CAL DATA 1) (Option) Output level correction (CAL DATA 2) (Option)	OUTPUT LEVEL CORRECTION

* : Set at initialization by SP00.

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APPENDIX C

UNIVERSAL ASCII* CODE TABLE

B7 B6 B5 BITS B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0 NUL 0 0	20 DLE 10 16	40 SP 20 32	60 0 30 48	100 @ 40 64	120 P 50 80	140 ` 60 96	160 p 70 112
0 0 0 1	1 GTL SOH 1 1	21 LLO DC1 11 17	41 ! 21 33	61 1 31 49	101 A 41 65	121 Q 51 81	141 a 61 97	161 q 71 113
0 0 1 0	2 STX 2 2	22 DC2 12 18	42 " 22 34	62 2 32 50	102 B 42 66	122 R 52 82	142 b 62 98	162 r 72 114
0 0 1 1	3 ETX 3 3	23 DC3 13 19	43 # 23 35	63 3 33 51	103 C 43 67	123 S 53 83	143 c 63 99	163 s 73 115
0 1 0 0	4 SDC EOT 4 4	24 DCL DC4 14 20	44 S 24 36	64 4 34 52	104 D 44 68	124 T 54 84	144 d 64 100	164 t 74 116
0 1 0 1	5 PPC ENQ 5 5	25 PPU NAK 15 21	45 % 25 37	65 5 35 53	105 E 45 69	125 U 55 85	145 e 65 101	165 u 75 117
0 1 1 0	6 ACK 6 6	26 SYN 16 22	45 & 26 38	65 6 36 54	106 F 46 70	126 V 56 86	146 f 66 102	166 v 76 118
0 1 1 1	7 BEL 7 7	27 ETB 17 23	47 ' 27 39	67 7 37 55	107 G 47 71	127 W 57 87	147 g 67 103	167 w 77 119
1 0 0 0	10 GET BS 8 8	30 SPE CAN 18 24	50 (28 40	70 8 38 56	110 H 48 72	130 X 58 88	150 h 68 104	170 x 78 120
1 0 0 1	11 TCT HT 9 9	31 SPD EM 19 25	51) 29 41	71 9 39 57	111 I 49 73	131 Y 59 89	151 i 69 105	171 y 79 121
1 0 1 0	12 LF A 10	32 SUB 1A 26	52 * 2A 42	72 : 3A 58	112 J 4A 74	132 Z 5A 90	152 j 6A 106	172 z 7A 122
1 0 1 1	13 VT B 11	33 ESC 1B 27	53 ÷ 2B 43	73 ; 3B 59	113 K 4B 75	133 [5B 91	153 k 6B 107	173 { 7B 123
1 1 0 0	14 FF C 12	34 FS 1C 28	54 , 2C 44	74 < 3C 60	114 L 4C 76	134 \ 5C 92	154 l 6C 108	174 | 7C 124
1 1 0 1	15 CR D 13	35 GS 1D 29	55 – 2D 45	75 = 3D 61	115 M 4D 77	135] 5D 93	155 m 6D 109	175 } 7D 125
1 1 1 0	15 SO E 14	36 RS 1E 30	56 . 2E 46	76 > 3E 62	116 N 4E 78	136 ^ 5E 94	156 n 6E 110	176 ~ 7E 126
1 1 1 1	17 SI F 15	37 US 1F 31	57 / 2F 47	77 UNL ? 3F 63	117 O 4F 79	137 UNT — 5F 95	157 o 6F 111	177 RUBOUT (DEL) 7F 127
	Address command	Universal command	Listen address		Talk address		Secondary address or command	

KEY octal	25	PPU	GP-IB code
	NAK		ASCII character
hex	15	21	decimal

* U S A Standard Code for Information Interchange

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APPENDIX D
BIT ASSIGNMENT FOR CAUSES OF GP-IB INTERFACE INTERRUPT

Bit No.	Cause
0	Set to controller
1	EIO detected Interrupt generated when PACKET is controller, not when it is talker or listener
2	SRQ received
3	Remote/local state changed
4	MTA received
5	MLA received
6	GET received
7	Device clear received
8	IFC received
9	————
10	————
11	Parity error occurred during data reading
12	MLA/MTA released
13	————
14	————
15	————

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APPENDIX E
IEEE STANDARD ABBREVIATIONS INDEX

A

AC	Address Command
ACDS	Accept Date State
ACG	Addressed Command Group
ACRS	Accepter Ready State
AD	Address
AH	Accepter Handshake
AIDS	Accepter Idle State
ANRS	Accepter Not Ready State
APRS	Affirmative Poll Response State
ATN	Attention
AWNS	Accepter Wait for New cycle State

C

C	Controller
CACS	Controller Active State
CADS	Controller Addressed State
CAWS	Controller Active Wait State
CIDS	Controller Idle State
CPWS	Controller Parallel Poll Wait State
CSBS	Controller Standby State
CSNS	Controller Service not Requested State
CPPS	Controller Parallel Poll State
CSRS	Controller Service Requested State
CSWS	Controller Synchronous Wait State
CTRS	Controller Transfer State

D

DAB	Data Byte
DAC	Data Accepted
DAV	Data Valid
DC	Device Clear
DCAS	Device Clear Active State
DCIS	Device Clear Idle State
DCL	Device Clear
DD	Device Data
DIO	Data input/output
DT	Device Trigger
DTAS	Device Trigger Active State
DTIS	Device Trigger Idle State

E

END	End
EOI	End Or Identify
EOS	End of String

G

GET	Group execute Trigger
GTL	Go to Local
gts	go to standby

I

IDY	Identify
IFC	Interface Clear
ist	Individual Status

L

L	Listener
LACS	Listener Active State
LAD	Listener Address
LADS	Listener Addressed State
LAG	Listen Address Group
LE	Extended Listener
LIDS	Listener Idle State
LLO	Local Lock Out
LOCS	Local State
lon	Listen only
LPAS	Listener Primary Addressed State
lpe	Local Poll enabled
LPIS	Listener Primary Idle State
ltn	Listen
LWLS	Local with Lockout State
lun	Local unlisten

M

MLA ····· My Listen Address
MSA ····· My Secondary Address
MTA ····· My Talk Address

N

nba ····· new byte available
NDAC ····· Not Data Accepted
NPRS ····· Negative Poll Response State
NRFD ····· Not Ready For Data
NR ····· Numeric Representation
NUL ····· Null Byte

O

OSA ····· Other Secondary Address
OTA ····· Other Talk Address

P

PACS ····· Parallel Poll Addressed to Configure State
PCG ····· Primary Command Group
pof ····· Power-off
pon ····· Power-on
PP ····· Parallel Poll
PPAS ····· Parallel Poll Active State
PPC ····· Parallel Poll Configure
PPD ····· Parallel Poll Disable
PPE ····· Parallel Poll Enable
PPIS ····· Parallel Poll Idle State
$\text{PPR}_{1\sim 8}$ ···· Parallel Poll Response 1 ~ 8
PPSS ····· Parallel Poll Standby State
PPU ····· Parallel Poll Unconfigure
PUCS ····· Parallel Poll Unaddressed to Configure State

rdy ····· Ready for next message
REMS ····· Remote State
REN ····· Remote Enable
RFD ····· Ready For Data
RL ····· Remote Local
rPP ····· Request Parallel Poll
RQS ····· Request Service
rsc ····· Request system Control
rsv ····· Request service
rtl ····· Return to local
RWLS ····· Remote With Lockout state

S

SACS ····· System Control Active State
SCG ····· Secondary Command Group
SDC ····· Selected Device Clear
SDYS ····· Source Delay State
SE ····· Secondary Message
SGNS ····· Source Generate State
SH ····· Source Handshake
SIAS ····· System Control Interface Clear Active State
sic ····· Send interface clear
SIDS ····· Source Idle State
SIIS ····· System Control Interface Clear Idle State
SINS ····· System Control Interface Clear Not Active State
SIWS ····· Source Idle Wait State
SNAS ····· System Control Not Active State
SPAS ····· Serial Poll Active State
SPD ····· Serial Poll Disable
SPE ····· Serial Poll Enable
SPIS ····· Serial Poll Idle State
SPMS ····· Serial Poll Mode State
SR ····· Service Request
SRAS ····· System Control Remote Enable Active State
sre ····· Send remote enable
SRIS ····· System Control Remote Enable idle State
SRNS ····· System Control Remote Enable not active State
SRQ ····· Service Request
SRQS ····· Service Request State
ST ····· Status
STB ····· Status Byte
STRS ····· Source Transfer State DAV to Low
SWNS ····· Source Wait for New cycle State
SACS ····· System Control Active State

T	·····	Talker
TACS	·····	Talker Active State
TAD	·····	Talk Address
TADS	·····	Talker Addressed State
TAG	·····	Talker Addressed Group
tca	·····	Take Control asynchronously
tcs	·····	Take Control synchronously
TCT	·····	Take Control
TE	····	Extended Talker
TIDS	·····	Talker Idle State
ton	·····	Talk only
TPAS	·····	Talker Primary Addressed State
TPIS	·····	Talker Primary Idle State

U

U	·····	Uniline Message
UC	·····	Universal Command
UCG	·····	Universal Command Group
UNL	·····	Unlisten
UNT	·····	Untalk

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