# MG3681A
# Digital Modulation Signal Generator
# Operation Manual

**13th 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-W1708AE-13.0

# 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

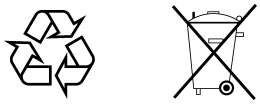
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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.

MG3681A
Digital Modulation Signal Generator
Operation Manual

17 April 2000 (First Edition)
1 February 2008 (13th Edition)

# For Safety

## DANGER ⚠


NEVER touch parts where the label shown on the left is attached. Such parts have high voltages of at least 1 kV and there is a risk of receiving a fatal electric shock.

## 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.

**LCD**

7. This instrument uses a Liquid Crystal Display (LCD). DO NOT subject the instrument to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak.
   This liquid is very caustic and poisonous.
   DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, 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.

   T6.3A indicates a time-lag fuse.

   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

**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.


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.

**Check Terminal**

4. Never input a signal of more than the indicated value between the measured terminal and ground. Input of an excessive signal may damage the equipment.

# For Safety

## CAUTION ⚠

**Replacing Memory Back-up Battery**

This equipment uses a Poly-carbomonofluoride lithium battery to backup the memory. This battery must be replaced by service personnel when it has reached the end of its useful life; contact the Anritsu sales section or your nearest representative.

Note: The battery used in this equipment has a maximum useful life of 7 years. It should be replaced before this period has elapsed.

**External Storage Media**

This equipment uses memory cards as external storage media for storing data and programs.

If this media is mishandled or becomes faulty, important data may be lost. To prevent this chance occurrence, all important data and programs should be backed-up.

Anritsu will not be held responsible for lost data.

Pay careful attention to the following points.

- Never remove the memory card from the pulse tester while it is being accessed.
- The memory card may be damaged by static electric charges.
- Anritsu has thoroughly tested all external storage media shipped with this instrument. Users should note that external storage media not shipped with this instrument may not have been tested by Anritsu, thus Anritsu cannot guarantee the performance or suitability of such media.

**Lifetime of Parts**

The life span of certain parts used in this instrument is determined by the operating time or the power-on time. Due consideration should be given to the life spans of these parts when performing continuous operation over an extended period. The safety of the instrument cannot be gauranteed if component parts are used beyond their life spans. These parts must be replaced at the customer's expense even if within the guaranteed period described in Warranty at the beginning of this manual.
For details on life-span, refer to the corresponding section in this manual.

Step attenuator: Refer to “5.3 Consumables.”
Cooling Fan: Refer to “5.3 Consumables.”
Back light of LCD: Refer to “5.3 Consumables.”

**Use in a residential environment**

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.

## Notice

The following actions are strictly prohibited for all of the software installed in this product or otherwise provided by Anritsu:

1. Copying, except for archival purposes.
2. Transferring to a third party separately from this product.
3. Analyzing the incorporated software including but not limited to modifying, decompiling, disassembling, and reverse engineering.
4. Using the software other than in connection with this product.

# 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**

CE

## 1. Product Model

| | |
|---|---|
| Model: | MG3681A Digital Modulation Signal Generator |
| | and |
| Plug-in Units: | MU368010A TDMA Modulation Unit |
| | MU368030A Universal Modulation Unit |
| | MU368040A CDMA Modulation Unit |
| | MU368060A AWGN Unit |
| | and |
| Software: | MX368011A PDC Software |
| | MX368012A GSM Device Test Software |
| | MX368031A Device Test Signal Generation Software |
| | MX368033A CDMA2000 1XEV-DO Signal Generation Software |
| | MX368034A PDC PACKET Software |
| | MX368035A PHS Signal Generation Software |
| | MX368037A RCR STD-39 π/4 DQPSK Signal Generation Software |
| | MX368037B ARIB STD-T61 π/4 DQPSK Signal Generation Software |
| | MX368037C ARIB STD-T79 π/4 DQPSK Signal Generation Software |
| | MX368041B W-CDMA Software |
| | MX368042A IS-95 Device Test Software |
| | and |
| Accessories: | MA2512A Band Pass Filter |

## 2. Applied Directive

EMC: Council Directive 2004/108/EC

LVD: Council Directive 2006/95/EC

## 3. Applied Standards

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

| | 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<br>European Quality Manager<br>ANRITSU S.A. France |
| Address, city: | 16/18 Avenue du Québec SILIC 720 Zone de Courtaboeuf<br>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**


## 1. Product Model

| | |
|---|---|
| Model: | MG3681A Digital Modulation Signal Generator |
| | and |
| Plug-in Units: | MU368010A TDMA Modulation Unit |
| | MU368030A Universal Modulation Unit |
| | MU368040A CDMA Modulation Unit |
| | MU368060A AWGN Unit |
| | and |
| Software: | MX368011A PDC Software |
| | MX368012A GSM Device Test Software |
| | MX368031A Device Test Signal Generation Software |
| | MX368033A CDMA2000 1XEV-DO Signal Generation Software |
| | MX368034A PDC PACKET Software |
| | MX368035A PHS Signal Generation Software |
| | MX368037A RCR STD-39 π/4 DQPSK Signal Generation Software |
| | MX368037B ARIB STD-T61 π/4 DQPSK Signal Generation Software |
| | MX368037C ARIB STD-T79 π/4 DQPSK Signal Generation Software |
| | MX368041B W-CDMA Software |
| | MX368042A IS-95 Device Test Software |
| | and |
| Accessories: | MA2512A Band Pass Filter |

## 2. Applied Standards

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

# Power Line Fuse Protection

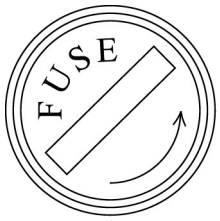
For safety, Anritsu products have either one or two fuses in the AC power lines as requested by the customer when ordering.

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.

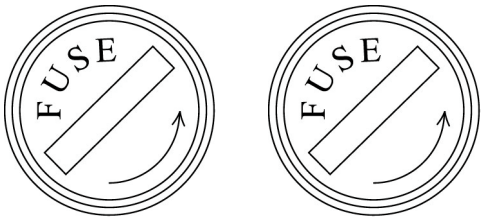
Example 1: An example of the single fuse is shown below:

**Fuse Holder**




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

**Fuse Holders**



# About This Manual

This manual (MG3681A Digital Modulation Signal Generator Main Frame Operation Manual) mainly describes operation, maintenance, and remote control of MG3681A Digital Modulation Signal Generator.
Basic functions and the outline of operation are described in Section 3 “Operation.”

 in this manual represents front panel keys.

In addition, the operation of Extended Unit to be installed in this equipment is explained in a separate volume of the manuals.

Use the operation manual along with this manual, according to the usage purpose.

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IV.

# Section 1 Outline

This section describes the outline and the composition of the product.


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# 1.1 Outline of the Product

The MG3681A is a standard digital modulation signal generator equipped with a wide-band quadrature modulator, capable of outputting complex and high-precision signals that are necessary in processes from development to mass-production of digital mobile communication equipment and of related devices.

MG3681A covers frequencies between 250 kHz and 3000 MHz, thus covering the main mobile communication frequency bands. Furthermore, since quadrature modulators show an excellent basic performance in terms of frequency characteristics, distortion characteristics, signal-to-noise ratio and so on, they can accurately perform sensitivity tests for receivers, adjacent channel leakage power characteristic tests for transmitters, for high baud-rate communication system.

The MG3681A incorporates a digital modulation unit for various digital communication systems, allowing test of radio equipment and other devices without preparing an external base band signal source.

# 1.2 Composition of the Product

## 1.2.1 Standard Composition

The table below shows the standard composition of the MG3681A. After opening the package, confirm if you have all the products described below. If anything is missing or damaged, contact our company or its agencies.

| Item | Model/No. | Product | Quantity | Remarks |
|---|---|---|---|---|
| Main unit | MG3681A | Digital modulation signal generator | 1 | |
| Accessory | | Power cord | 1 | |
| Accessory | B0325 | GPIB shield cap | 1 | |
| Accessory | F0014 | Fuse 6.3A | 2 | T6.3A250V |
| Accessory | W1708AE | Operation manual | 1 | |

## 1.2.2 Unit and Options

Shown in the table below are the extension units of the MG3681A. They are all sold separately.

| Model | Modulation unit | Remarks |
|---|---|---|
| MU368010A | TDMA modulation unit | Corresponding systems PDC, GSM, etc. |
| MG368030A | Universal Modulation unit | Depends on installed modulation software. |
| MU368040A | CDMA modulation unit | Corresponding systems W-CDMA, IS-95 |
| MU368060A | AWGN unit | Generate AWGN signal for W-CDMA |

Shown in the table below are some options for the MG3681A. They are all sold separately.

| Option No. | Product | Remarks |
|---|---|---|
| MG3681A-01 | Reference crystal oscillator | $\pm 5 \times 10^{-9}$/day |
| MG3681A-02 | Reference crystal oscillator | $\pm 5 \times 10^{-10}$/day |
| MG3681A-11 | Additional function of I/Q signal output | Level setting, offset setting, balanced output |
| MG3681A-21 | AF synthesizer | 0.01 Hz to 400 kHz, sine wave, triangular wave, rectangular wave, sawtooth wave |
| MG3681A-42 | Band Pass Filter | 1.9 to 2.3 GHz, 8 dB for W-CDMA |

## 1.2.3 Peripheral Equipment

The table below shows the peripheral equipment for the MG3681A. They are all sold separately.

| Model/No. | Product | Remarks |
|---|---|---|
| J0576B | Coaxial cord | Approx. 1 m long (N-P, 5D-2W, N-P) |
| J0576D | Coaxial cord | Approx. 2 m long (N-P, 5D-2W, N-P) |
| J0127C | Coaxial cord | Approx. 0.5 m long<br>(BNC-P, RG-58A/U, BNC-P) |
| J0127A | Coaxial cord | Approx. 1 m long<br>(BNC-P, RG-58A/U, BNC-P) |
| J0007 | GPIB connection cable | Approx. 1 m long (408JE-101) |
| J0008 | GPIB connection cable | Approx. 2 m long (408JE-102) |
| B0329C | Protect cover | 1MW4U |
| B0331C | Front handle kit | 2 pcs/set |
| B0332 | Joint plate | 4 pcs/set |
| B0333C | Rack mount kit | |
| B0334C | Carrying case | Hard type, equipped with protect cover and caster |
| MA2512A | Band Pass Filter | For W-CDMA,<br>Pass Band : 1.92 to 2.17 GHz |

# Section 2 For Using MG3681A Safely

This section describes items that you should know before using the MG3681A. As it also contains tips for safety and for avoiding failures during use, be sure to read it at least once.


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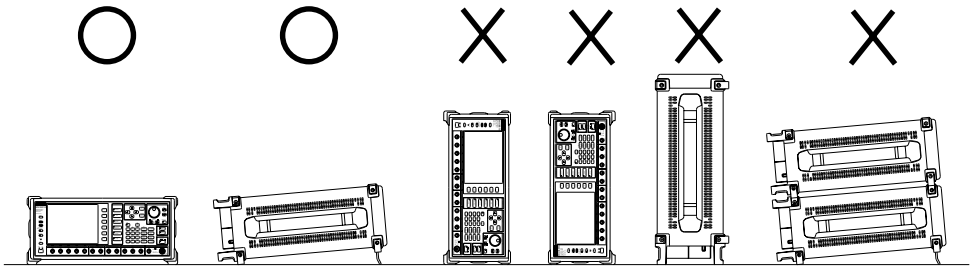
# 2.1 Installation

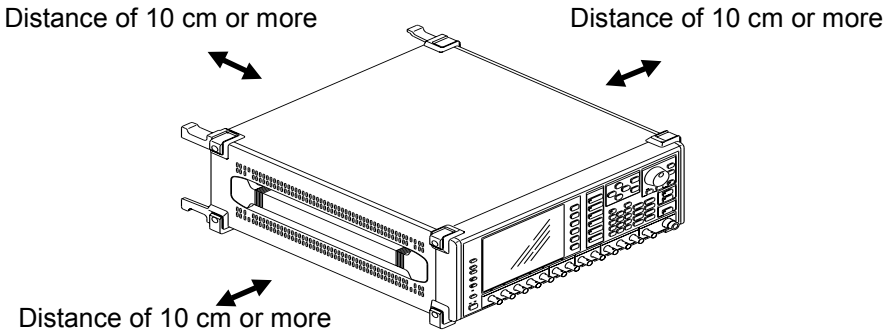
## 2.1.1 Installation place

Set the MG3681A either horizontally or at an angle using a tilt stand, as shown in the figure below. When it is tilted, do not put any object on the MG3681A.



## 2.1.2 Distance from the Fan

A fan is installed at the back of the MG3681A to prevent the internal temperature from rising. When installing the MG3681A, be sure to keep its rear and sides at a distance of 10 cm or more from surrounding obstacles such as walls and peripheral units, so that there is sufficient space around the fan.




## 2.1.3 Conditions of the Place Where MG3681A is to be Installed

While the MG3681A can operate normally in places with temperatures between 0 and 50 °C, however, do not use it in places described below to avoid failures.

- Places with a lot of vibration
- Places with a lot of moisture or dust
- Sunny places
- Places with possible penetration of active gases
- Places with large power voltage variations

# 2.2 Items to be Confirmed before Use

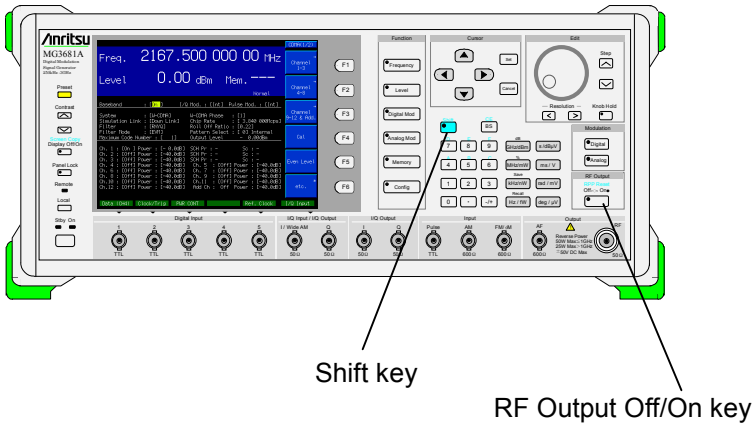
## 2.2.1 Safety Protection Labels

For safety, WARNING and CAUTION labels shown below are affixed on the back panel. Please observe the instructions on the labels.


## 2.2.2 Reverse-Power Protection Circuit

The RF power output connector of the MG3681A has a reverse-power protection circuit that automatically protects internal circuits when an external high-power signal is supplied by mistake. When the reverse-power protection circuit is in operation, the signal is cut off. To release this state, first stop the signal that caused the operation of the reverse-power protection circuit, and then press Shift and next RF Output RPP Reset Off/On.

The maximum value of power for which the reverse-power protection circuit of the MG3681A is effective is DC±50 VDC, 25 W(≤1 GHz), and 50 W(> 1 GHz).




**CAUTION**

**The reverse-power protection circuit uses a mechanical switch. Do not impress reverse power frequently or the contact erosion is unavoidable. Also, make sure not to release the reverse-power protection circuit while reverse power is being impressed; it may damage the reverse-power protection circuit.**

**The reverse-power protection circuit is applicable to the maximum DC ±50 V, 50 W (up to 1000 MHz), or 25 W (1000 to 3000 MHz). For powers above the limit, the function may not operate correctly. When the reverse-power protection circuit is in operation, impedance of RF Output Connector is in the status of open circuit; make sure not to damage other instrument such as transmitter.**

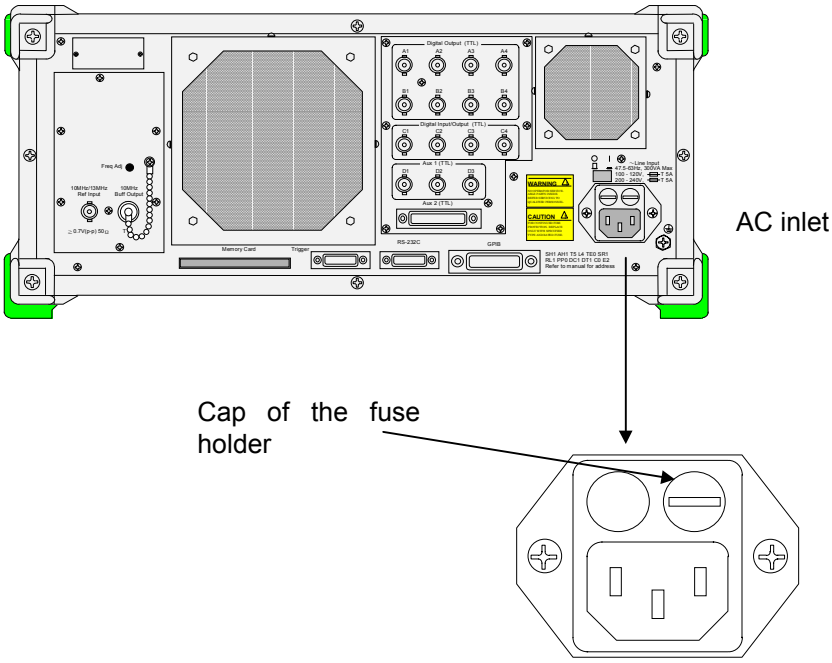
## 2.2.3 Fuse

Confirm if the T6.3A250V fuse is placed inside. When the fuse blows, first eliminate the cause, and then replace the fuse by the following procedure. The accessories package contains two T6.3A250V fuses.

### Procedure for replacing the fuse

<1> Turn off the power-supplies on the front and back panels, and disconnect the power cord from the socket.

<2> Turn the cap of the fuse holder on the back panel counterclockwise with a screwdriver to separate the cap and the fuse of the holder as a single unit from the AC inlet.




<3> Remove the blown fuse from the fuse holder and replace it with a new one.

<4> Put the fuse holder back into its original position and turn it clockwise with a screwdriver until it cannot be turned any further.

## CAUTION ⚠

**When replacing the fuse, first disconnect the power cord from the socket, and then replace the fuse. If you replace the fuse without disconnecting the power cord, you may receive an electric shock. Note that the new fuse to be replaced must have the same rate and characteristics as the T6.3A250V fuse. If you use a fuse of different rate and characteristics, you may receive an electric shock. Moreover, such a fuse may not blow out in some cases, causing fire and damage to the equipment.**

# 2.3 Power Connection

This section describes the procedures for supplying power.

## 2.3.1 Power Requirements

For normal operation of the instrument, observe the power voltage range described below.

| Power source | Voltage range | Frequency |
|---|---|---|
| 100 Vac system | 100 to 120 V | 47.5 to 63 Hz |
| 200 Vac system | 200 to 240 V | 47.5 to 63 Hz |

Changeover between 100 and 200 V systems is made automatically.

**CAUTION** ⚠

**Supplying power exceeding the above range may result in electrical shock, fire, failure, or malfunction.**

## 2.3.2 Connecting the Power Cord

Check that the OI switch on the rear panel is turned off (switched to the (O) side). 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 OI switch on the rear panel (switch to the (O) side), 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 OI 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 panel of the instrument is a standby switch, and cannot be used to cut the main power.**

# Section 3 Operation

This section describes the names of the parts of the MG3681A, the method to set its basic parameters, its operation method for modulation and its convenient functions that you should know in order to actually operate the unit. Keys displayed with [ ] are panel keys.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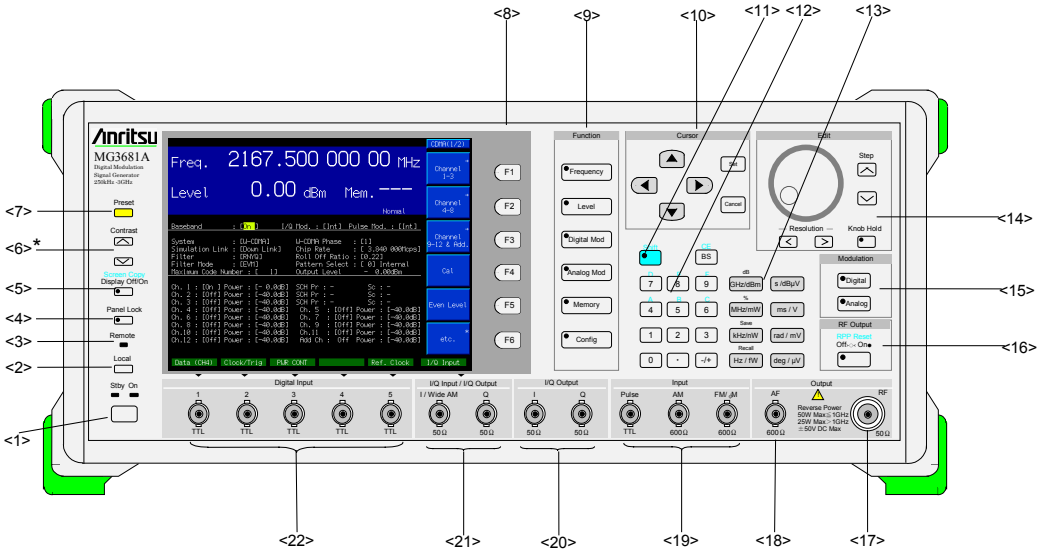
# 3.1 Names of Parts and Turning the Power-Supply On/Off

## 3.1.1 Names of the Parts

### Names on the front panel

The keys and connectors on the front panel are described here.




*: When the LCD screen consists of TFT, the contrast key is not provided.

<1> Stby On

### Power Switch

Switches between the Stand-by state and the On state. The "Stby" lamp (green) or the "On" lamp (orange) lights up for the Stand-by state or the On state respectively. Press the power switch for a reasonably long duration (for about 1 second).

<2> Local

### Local Key

Recovers the local state from the remote state caused by GPIB, RS-232C, etc. and makes the panel setting effective.

<3> Remote

### Remote Lamp

Lights up when the equipment is in a remote state controlled by GPIB or RS-232C.

<4> Panel Lock

### Panel Lock Key

Makes all key operations invalid except for the power switch, the Local key, the Panel Lock key and the Contrast key. The lamp on this key lights up in red under a panel lock state.

<5> Screen Copy Display Off/On

## Display Off/On Key

Sets the display On or Off. The lamp on the key lights up in red under an Off state.

If this key is pressed after Shift is pressed, the display state of the current screen can be copied to a memory card in a bit-mapped format.

<6> Contrast

## Contrast Keys

Adjusts the contrast (darkness and brightness) of the screen.
The screen becomes brighter when ∧ is pressed, and darker when ∨ is pressed.

***Note:***

When the LCD screen consists of TFT, the contrast key is not provided.

<7> Preset

## Preset Key

Recovers the initial parameter-setting state.

<8> F1 F2 F3 F4 F5 F6

## Soft Function Keys

Used for executing the menus displayed on the right side of the screen. (Contents of the menus displayed on the screen change every time the screen is switched using a soft function key or a main function key.)

<9> Frequency Level Digital Mod Analog Mod Memory Config

## Main Function Keys

Used to set or execute the main functions of the MG3681A.

When Frequency is pressed, the frequency parameter setting screen appears.

When Level is pressed, the output level parameter setting screen appears.

When Digital Mod is pressed, digital modulation parameter setting screen appears.

When Analog Mod is pressed, the analog modulation parameter setting screen appears.

When Memory is pressed, the memory parameter setting screen appears.

When Config is pressed, the environment setting parameter setting screen appears.

Each parameter setting screen belongs to one of the above six main functions.

<10> ▲ ▼ ◀ ▶ Set Cancel

## Cursor Moving Keys and Control Keys

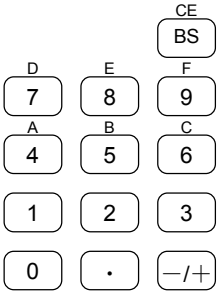
The reverse-cursor displayed on the screen can be moved by pressing ▲ ▼ ◀ or ▶. When Set is pressed, the input or selected data is established. When Cancel is pressed, the input or selected data becomes invalid.

<11>


## Shift Key

When operating any key to work a function described in blue characters shown above the key, first press this key, and then, after its lamp is illuminated, press the target key.

<12>



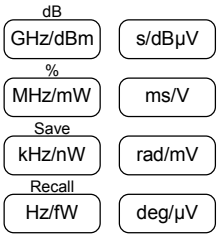

## Numeric Keypad

Used to input numbers on each parameter setting screen. When CE BS is pressed, the last input numeric character is deleted.

Hexadecimal "A" to "F" can be input by pressing A 4 to F 9 after Shift.

When CE BS is pressed after Shift, all the numbers being input are deleted and a reinput state is displayed.

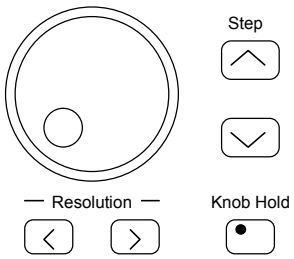
<13>




## Unit Keys

Used to establish numbers and units after numbers are input.

<14>




## Edit Keys

The values can be increased or decreased by either turning the rotary knob or by pressing the step keys ( ).

If Knob Hold is pressed and the lamp on the key is illuminated, the values can no longer be increased or decreased. The resolution digits can be set by moving the cursor on the screen using and .

<15>

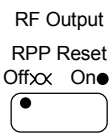

## Modulation Control Keys

Keys to batch process the modulation On and Off states.

By pressing Digital, the digital modulation (vector modulation) can be turned on/off.

By pressing Analog, the analog modulation (AM, FM, ϕM, pulse) can be turned on/off. The lamp on each key lights up when the modulation is on.

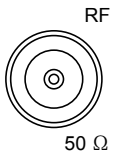
<16>




## RF Output Control Key

The RF signal output from the RF output connector can be turned on/off.
The lamp on the key lights up in red under the RF Off state.

<17>




## RF Output Connector

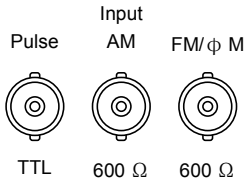
Outputs RF signal.

<18>


## AF Output Connector

Outputs AF signals. The AF synthesizer of Option 21 needs to be mounted in order to use the AF signals.

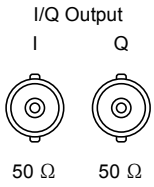
<19>




## Modulation Signal Input Connectors

Used to input modulation signals when analog modulation is carried out with external signals. Input connectors for amplitude modulation (AM), frequency modulation/phase modulation (FM/ϕM), and pulse modulation (Pulse) are provided.

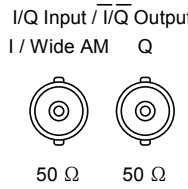
<20>




## I/Q Output Connectors

Used to output base band signals In-Phase component and Quadrature phase component that are generated by the digital modulation unit.

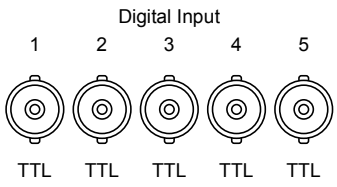
<21>




## I/Q Input (Wide AM Input, I/Q Invert Output) Connectors

Used to input In-Phase component and Quadrature phase component signals when vector modulation is carried out with external base band signals. Also, can be used as modulation signal input connectors when Wide AM modulation is carried out.
Can be used as connectors for reverse-outputting I-component and Q-component signals when the mode of the I/Q signal output is set at balanced output mode. To use the balanced output mode, it is necessary to mount an additional function of I/Q signal output which is Option 11.
Current connector functions are displayed on the screen right above the connectors.

<22>

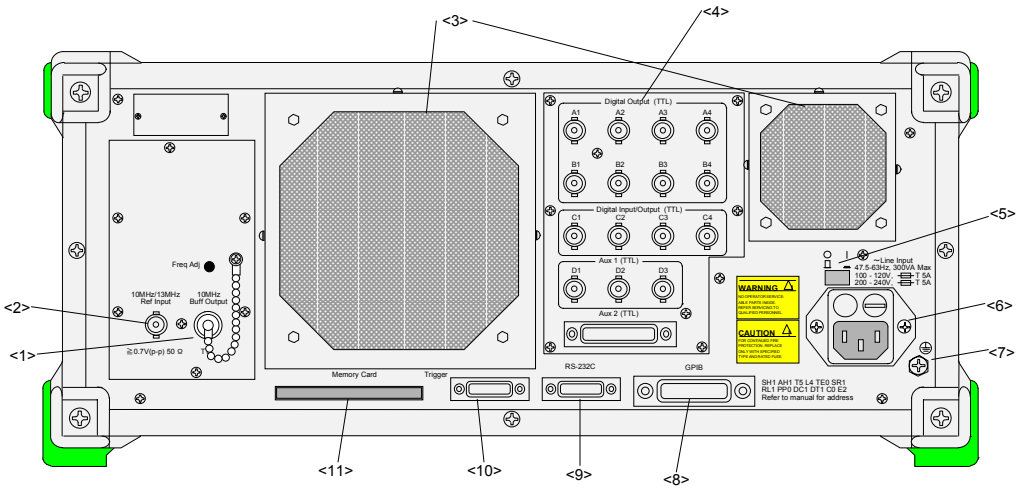



## Digital Signal Input Connectors

Auxiliary input connectors for the digital modulation units.
The connector functions vary with each system. Current functions of each connector are displayed on the screen right above the connector.

## Names on the back panel

Names of keys and connectors on the back panel are described here.




<1> 10MHz Buff Output

TTL

### Reference Frequency Signal Output Connector

Outputs the reference frequency signal (10 MHz) that is inside the MG3681A. Used for synchronizing the MG3681A with other equipment by referring to its reference frequency signal.

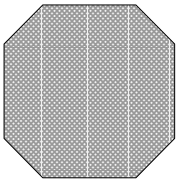
<2> 10MHz/13MHz Ref Input

≧0.7V(p-p) 50 Ω

### Reference Frequency Signal Input Connector

Inputs an external reference frequency signal (either 10 MHz or 13 MHz). Used for inputting reference frequency signal with accuracy higher than those inside the MG3681A, or for synchronizing reference frequency signal of the MG3681A with that of other equipment. Switching between 10 MHz and 13 MHz is automatically performed.

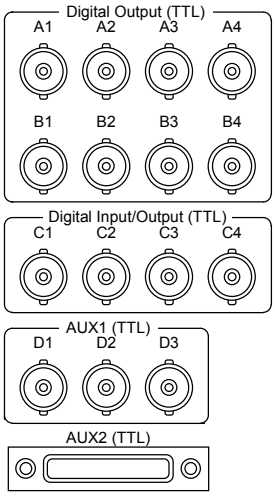
<3>



### Air Cooling Fan

An air cooling fan used for preventing the rise in the internal temperature of the MG3681A.

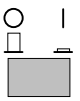
<4>




### Digital Signal Input/Output Connectors

Auxiliary input connectors of the digital modulation unit.
The connector functions vary with each system.

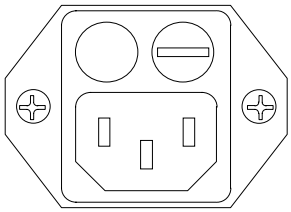
<5>



### OI Switch

Main power switch of MG3681A.

<6>



### AC Inlet

Inlet for supplying power.

<7>

### Protective Grounding Terminal

A protective grounding terminal. Connect this terminal to the ground potential if the power cord can not be grounded.

<8>


### GPIB Connector

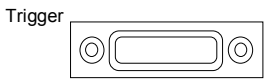
For external control using GPIB.

<9>


### RS-232C Connector

For external control using RS-232C.

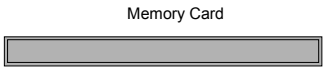
<10>




### Trigger Input Connector

For external control using trigger signals.

<11>




### PC Card Slot

Slot where a memory card is to be inserted.

## 3.1.2 Turning the Power-Supply On/Off

### Turning power on

The procedure for turning the power on is described below.

<1> Switch the OI switch on the back panel to O (Off).

<2> Plug in the jack-side of the power cord into the AC power inlet on the back panel. Make sure that it is securely plugged deep into the inlet.

<3> Plug in the plug-side of the power cord into the AC power outlet.

<4> Switch the OI switch on the back panel to I (On). The MG3681A goes into the power stand-by state, the stby lamp of the power switch lights up and warm up begins.

<5> Press the power switch on the front panel for about one second to turn it on.

### Turning power off

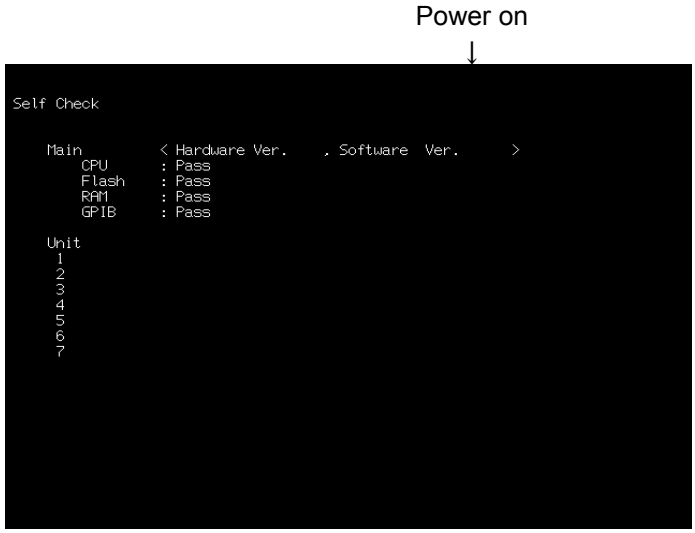
The procedure for turning the power off is described below.

<1> Press the power switch on the front panel for about one second to go into the Stby state.

<2> Switch the OI switch on the back panel to O (Off).

## Initial Screen

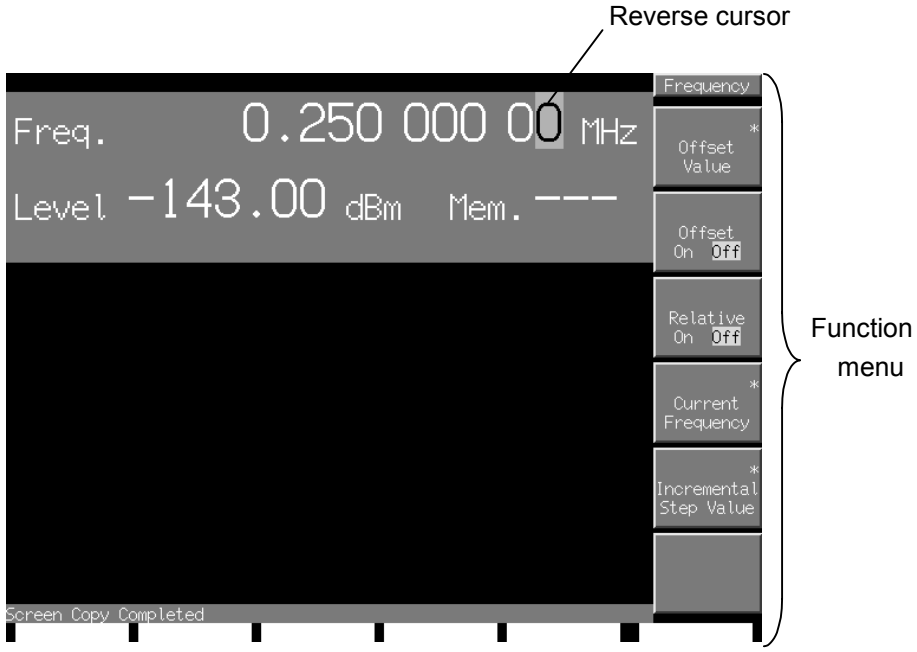
Turning on the power switch allows all the lamps to turn on, and self-checks of the instrument (Main) and Digital Modulation Units (Unit) to begin. The results of the self-checks are indicated as “Pass” (passed) or “Fail” (failed) on the Self Check screen.




If a self-check fails, “Fail” appears and the Self Check screen remains open. Since a failure may have occurred in this case, contact your nearest regional office, branch, sales office or agent.

If all the self-checks succeed, “Pass” appears and the initial screen (shown below) is displayed for one second.

After the initial screen is displayed for one second, a frequency setup screen (shown below) appears.




### Reverse Cursor

The reverse cursor appears onscreen in reverse video. The reverse cursor does not appear in a remote control state. The reverse video points to the resolution digit of the rotary knob while a frequency or output level is being set. Use ⟨ ⟩ to move the resolution digit position.

While a frequency or output level is not being set, the reverse cursor points to the item that can be set (which is enclosed in [ ]). Use ▲ ▼ ◀ ▶ to change the item in focus.

### Function Menu

A function menu appears on the right side of each parameter setting screen. Each function menu contains screen-specific function names.

When "→" is displayed within a function menu, it indicates that the entire screen may update. When "*" is displayed, it means that the screen has lower-level screens.

## 3.1.3 Common Setup Operations

This section describes the basic operation common for all screens, before introducing the setting of detailed parameters.

### Set Parameters Directly

Main function parameters, such as frequency and output level, depth of analog modulation, and certain other parameters can be directly set on the displayed screen without having to open a window. Select a main function by pressing the main function key or point the reverse cursor to the parameter enclosed in [ ] by using ▲ ▼ ◀ ▶ to set that parameter.

#### Entering a numeric value

When a numeric value is entered with the numeric keypad, a window opens containing the value recently entered. After the entry, press a unit key or Set to accept that numeric value and close the window. Pressing Cancel closes the window by discarding the numeric value entered.

#### Increasing/Decreasing a numeric value with the rotary knob

After selecting a resolution digit (appearing in reverse video) with < >, turn the rotary knob one click clockwise to increment the numeric value at that digit position by 1; or turn the knob one click counterclockwise to decrement the numeric value by 1.

The rotary knob allows numeric values to be set in real-time.

#### Increasing/Decreasing a numeric value with the step keys

Use ^ v to change a numeric value. The step in which a numeric value is updated each time a step key is pressed varies with each parameter.

The step keys allow numeric values to be set in real-time.

## Open a Setup Window to Set the Parameters

Point the reverse cursor to the parameter enclosed in [ ] to see an additional item that requires opening another setup window to set it. To open the window, press Set, or turn the rotary knob by one click or press either ∧ ∨ once.
The window displays help regarding the keys that can be used to set the parameter (numeric keypad, step keys, and the rotary knob).


### Entering a numeric value

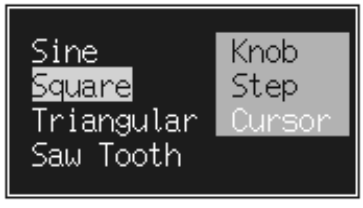
A window is opened with the current numeric value setting when it has been set for numeric entry. When a numeric value is entered with the numeric keypad, it is displayed in the window. After the entry, press a unit key or Set to accept the numeric value and the unit, and close the window. Pressing Cancel closes the window by discarding the numeric value entered.

### Changing a numeric value

A window is opened with the current numeric value setting, with the resolution digit appearing in reverse video, when it has been set for numeric entry. Using < >, move the resolution digit position. After selecting a resolution digit, turn the rotary knob one click clockwise or press ∧ once to increment the numeric value at that digit position by 1; or turn the knob one click counterclockwise or press ∨ once to decrement the numeric value by 1. After the entry, press Set to accept the numeric value and close the window. Pressing Cancel closes the window by discarding the numeric value entered.

### Selecting an item

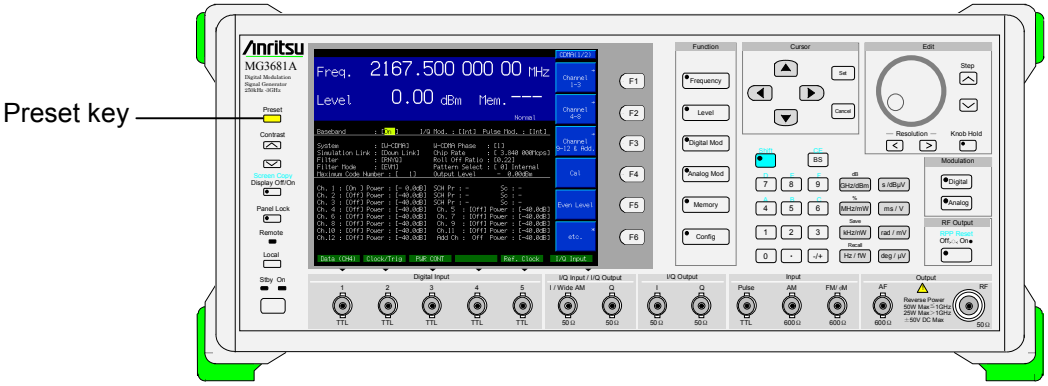
A window is opened with items arranged in a vertical row when it has been set for numeric entry. Among them, the item of current choice appears in reverse video. Turn the rotary knob one click counter clockwise or press ∧ once to move up the reverse cursor; or turn the knob one click clockwise or press ∨ once to move down the reverse cursor. After the selection, press Set to accept the value and close the window. Pressing Cancel closes the window by discarding the entered choice.



# 3.2 Setting the Key Parameters

## 3.2.1 Presetting

This instrument can be initialized to its default settings listed in Appendix C by pressing Preset.




To initialize the entire instrument to the status in which it has been purchased, turn the power on by holding down Preset while the power is off. Continue pressing Preset until all the lamps are turned on. Note that this operation will erase all the data that has been saved in the memories (BPM, APM).

## 3.2.2 Setting the frequency

Press front-panel main function key [Frequency] to open the frequency setup screen, with the onscreen cursor appearing at any digit position in the frequency reading. The key lamp will also light up.

Unless otherwise noted in this section, it is assumed that the frequency setup screen is open with [Frequency] being pressed.


Use one of these methods to set a frequency:

- Use the numeric keypad.
- Use the rotary knob.
- Use the step keys.

Instructions for setting a frequency by these methods are described on the pages that follow.

### Frequency setup range and minimum resolution setting

Frequency setup range: 0 Hz to 3000 MHz

Minimum frequency resolution setting: 0.01 Hz

If a frequency exceeds the upper limit (3000 MHz) or falls below the lower limit (0 Hz), it cannot be either set or accepted and an error indication appears on the screen.

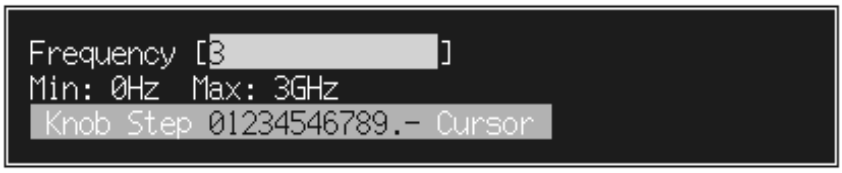
A frequency setting of less than 250 kHz would cause “Uncal” to be displayed, making successful performance unpredictable.

## Using the Numeric Keypad to Set Frequency

Follow these steps to use the numeric keypad to set frequency:

Sample operation: Set a frequency of 360.3 MHz.

<1> Press any key of the numeric keypad (in this example, [3] first) to open the frequency setup window. "3" is displayed in the window.




<2> Proceed to type [6] [0] [·] [3] to display "360.3" in the window.

<3> Press [MHz/mW] to accept the numeric value and the unit, and the frequency setup window closes. Then, the frequency in the frequency setup screen will appear as "360.300 000 00 MHz."

All the following key-in sequences will set the same frequency of 360.3 MHz:

- [0] [·] [3] [6] [0] [3] [GHz/dBm]
- [3] [6] [0] [3] [0] [0] [kHz/nW]
- [3] [6] [0] [3] [0] [0] [0] [0] [0] [Hz/fW]

After entering the numeric value, press [Set] instead of [GHz/dBm] [MHz/mW] [kHz/nW] [Hz/fW], and the numeric value entered in Hz will be accepted.

Fractions of 0.01 Hz or less are discarded.

## Use the Rotary Knob to Set Frequency

Use of the rotary knob makes it possible to increment or decrement the numeric value at the resolution digit position (pointed to by the reverse cursor) selected with < > . To use the rotary knob to set a frequency, follow these steps:

Resolution digit (reverse cursor) default: 0.01 Hz digit

Sample operation: Vary a frequency from 360.3 MHz to 360.7 MHz in steps of 10 kHz.

<1> Using < >, move the reverse cursor to the 10 kHz digit position. (Press < six times to move to the 10 kHz digit position.)


<2> Turn the rotary knob one click clockwise to increment the frequency by 10 kHz; turn the knob one click counterclockwise to decrement the frequency by 10 kHz. In this way, turn the rotary knob 40 clicks clockwise to set a frequency of 360.7 MHz.

## Using the Step Keys to Set Frequency

Use [^] [v] to vary a frequency in steps of a preset frequency. To use the step keys to set a frequency, follow these steps:

Frequency step default: 1 MHz

Sample operation: Set a frequency of 360.3 MHz, varying it in steps of 12.5 kHz.

<1> Type [3] [6] [0] [.] [3] [MHz/mW] to set a frequency of 360.3 MHz.

<2> Press [F5] (Incremental Step Value) to open the frequency step setup window.


<3> Type [1] [2] [.] [5] [kHz/nW] to set a frequency step of 12.5 kHz. The window closes when the setup completes.

<4> In the frequency setup screen, press [^] once to increment the frequency by 12.5 kHz to 360.3125 MHz. Next, press [v] once to decrement the frequency by 12.5 kHz to 360.3 MHz. The frequency can be varied in steps of 12.5 kHz by using [^] [v] in this way.

## Set a Frequency Offset

Frequency offset setting is a feature whereby the frequency that is set from the panel or under external control is shifted by a certain offset frequency for output.
This feature addresses the need to set a converted frequency as in a converter test.

[Actual output frequency] = [Set and displayed frequency] – [Offset]

Offset frequency setup range: –3 to +3 GHz
Offset frequency setting minimum resolution: 0.01 Hz

To set an offset frequency, follow these steps:

Sample operation: Set an offset frequency to output a frequency of 460.3 MHz from a panel setting of 360.3 MHz.

<1> Press F1 (Offset Value) to open the offset frequency setup window.


<2> Type +/– 1 0 0 MHz/mW to set an offset frequency of –100 MHz. The window closes when the setup completes.

<3> Press F2 (Offset On/Off) to turn on offset mode. (There is no need to press F2 if the reverse cursor is already at On.) "Offset" appears under the frequency reading onscreen, indicating that the instrument is now in an offset setting state.

<4> Type 3 6 0 . 3 MHz/mW to set a frequency of 360.3 MHz. Although 360.3 MHz is displayed onscreen, a frequency of 460.3 MHz is actually outputted.


To identify the actual output frequency, press F4 (Current Frequency). The output frequency will be displayed for about one second.

The output frequency may also be set using the rotary knob or step keys.

## Display a Relative Frequency

Relative frequency display is a feature whereby a frequency is displayed in relation to a base frequency of 0 Hz.

[Set and displayed frequency] = [Actual output frequency] – [Frequency displayed as a relative frequency]

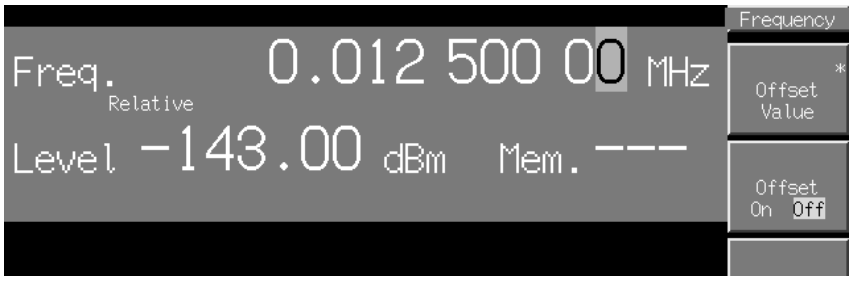
To set a relative frequency, follow these steps:

Sample operation: Display an output frequency in relation to a base frequency of 360.3 MHz, incrementing it by 12.5 kHz.

<1> Type [3] [6] [0] [.] [3] [MHz/mW] to set a frequency of 360.3 MHz.

<2> Press [F3] (Relative On Off) to turn on relative frequency display mode, in which a frequency is displayed in relation to the base frequency, or current frequency of 360.3 MHz. The frequency reading will then change from 360.3 MHz to 0 Hz. Further, "Relative" appears under the frequency reading onscreen, indicating that a relative frequency is now displayed.

<3> Turn the rotary knob clockwise to set a relative frequency of 12.5 kHz. Although 12.5 kHz is also displayed, a frequency of 360.3 MHz +12.5 kHz, or 360.3125 MHz, is actually outputted.



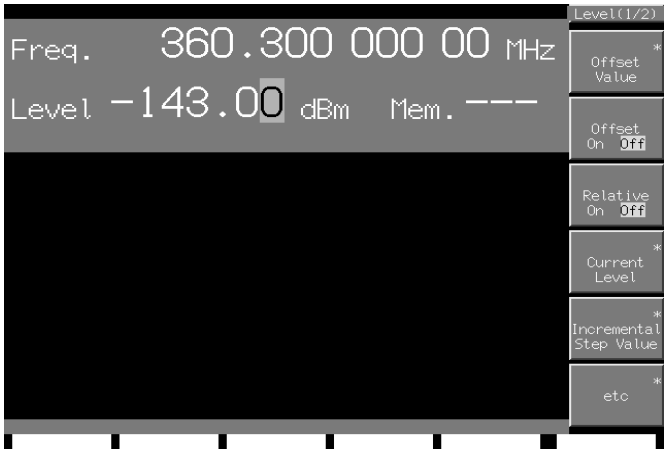

To identify the actual output frequency, press [F4] (Current Frequency). The output frequency will be displayed for about one second.

The output frequency, as well as the relative frequency in relative frequency display mode, may also be set using the numeric keypad or step keys.

## 3.2.3 Setting output level

Press the front-panel main function key [Level] to open the output level setup screen, with the onscreen cursor appearing at any digit position in the output level reading. The key lamp will also light up.

Unless otherwise noted in this section, it is assumed that an output level setup screen is now open with [Level] being pressed.




Use one of these methods to set an output level:

- Use the numeric keypad.
- Use the step keys.
- Use the rotary knob.

Instructions for setting an output level by these methods are described on the pages that follow.

### Output level setup ranges and minimum resolution settings

Output level setup ranges:

–143 to +17 dBm (power, in dBm)
5.01 aW to 50.1 mW (power, in W)
–36.01 to +123.99 dBμV (terminating voltage, in dBμV)
–29.99 to +130.01 dBμV (emf voltage, in dBμV)
0.016 μV to 1.58 V (terminating voltage, in V)
0.032 μV to 3.17 V (emf voltage, in V)

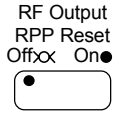
Minimum output level resolution settings:

0.01 dB (in dB units)
3 digits (in V or W units)

If an output level exceeds the upper limit (+17 dBm) or falls below the lower limit (–143 dBm), it cannot be either set or accepted, with an error indication appearing onscreen.

An invalid output level setting (dependent on the modulation condition; +13.01 dBm or more in CW mode) would cause "Uncal" to be displayed, making successful performance unpredictable.

## Turn RF Output On/Off

Press 

on the front panel to toggle RF Output between on and off. The key lamp will glow red when RF output is turned off.

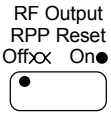
RF output, when set to On, enables preset signal output.

***Note:***

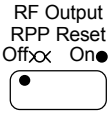
It is recommended that the setting of parameters of this instrument be completed with RF output off before RF Output is turned on, to avoid possible damage to the device under test connected to the RF output.

To turn RF output on or off, follow these steps:

Sample operation: Turn RF output off, then on.

<1> Press 

to turn off RF output. (The lamp will light).

<2> Press 

again to turn on RF output and the signal is outputted at the output level indicated.

## Use the Numeric Key Pad to Set Output Level

To use the numeric keypad to set output levels, follow these steps:

Sample operation: Set an output level of –47 dBm.

<1> Press [Level] to open the output level setup window.

<2> Press any key of the numeric keypad (in this example, [–/+] first) to open the frequency setup window. "–" is displayed in the window at the same time. (pressing [–/+] toggles the display between "+" and "–". If "+" is displayed, press [–/+] once again.)


<3> Proceed to type [4] [7] to display "–47" in the window.

<4> Press [GHz/dBm] to accept the numeric value and the unit, and the output level set-up window closes. Then, the output level in the output level setup screen will appear as "–47.00 dBm".

Output levels can be set and displayed in the power units of dBm and W and in the voltage units of V and dBμV.

- [2] [0] [kHz/nW] ..... Set 20 nW
- [6] [6] [·] [0] [1] [s/dBμV] ..... Set 66.01 dBμV
- [9] [9] [9] [deg/μV] ..... Set 999μV

The voltage units (V, dBμV) are selectable from release voltage and terminating voltage display modes.

The power units are displayed as aW, fW, pW, nW, μW or mW. However, since only three unit keys (fW, nW, mW) are available, type 1000 fW or 0.001nW to set 1 pW.

If a unit key is pressed alone, without entering a numeric value, the output level is displayed in the units that are represented by the key just pressed. Repeated unit conversions may result in a slight change in the reading due to computational errors.

After entering a numeric value, press [Set] instead of a unit key and the numeric value is confirmed in the units then on display.

Fractions of 0.01 dB are discarded.

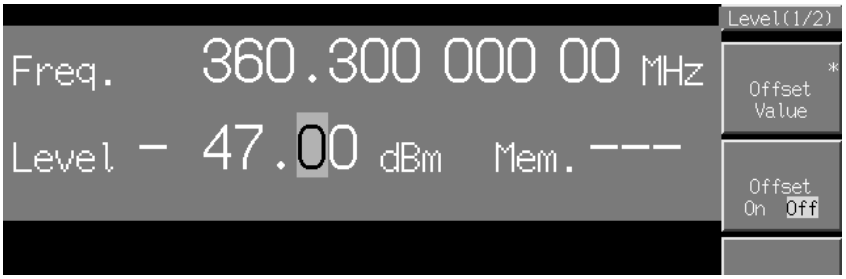
## Use the Rotary Knob to Change Output Level

Using the rotary knob, it is possible to increment or decrement the numeric value at the resolution digit position (pointed to by the reverse cursor) selected with the Resolution key. Follow these steps to use the rotary knob to set output levels:

Resolution digit (reverse cursor) default: 0.01 dB digit

Sample operation: Vary an output level from the current setting –47 dBm to –37 dBm in steps of 0.1 dB.

<1> Using [<] [>], move the reverse cursor to the 0.1 dB digit position. (Press [<] once to move to the 0.1 dB digit position.)




<2> Turn the rotary knob one click clockwise to increment the output level by 0.1 dB; turn the knob one click counterclockwise to decrement the output level by 0.1 dB. In this way, turn the rotary knob 100 clicks clockwise to set an output level of –37 dBm.

## Use the Step Keys to Change Output Level

Use [^] [v] to vary an output level in steps of a preset value. To use the step keys to set an output level, follow these steps:

Output level step default: 1 dB

Sample operation: Set an output level of –47 dBm, varying it in steps of 6 dB.

<1> Type [–/+] [4] [7] [GHz/dBm] to set an output level of –47 dBm.

<2> Press [F5] (Incremental Step Value) to open the output level step setup window.


<3> Type [6] [dB / GHz/dBm] to set an output level step of 6 dB. The window closes when the setup completes.

<4> In the output level setup parameter screen, press [^] once to increment the output level by 6 dB to –41 dBm. Next, press [v] once to decrement the output level by 6 dB to –47 dBm. The output level can be varied in steps of 6 dB by using [^] [v] in this way.

## Set an Output Level Offset

Output level offset setting is a feature whereby the output level that is set from the panel or under external control is shifted by a certain offset.
This feature addresses the need to correct the attenuation in a cable connected to an output.

[Actual output level] = [Set and displayed output level] – [Offset level]

Offset output level setup range: –50 to + 50 dB
Offset level setting minimum resolution: 0.01 dB

To set an output level offset, follow these steps:

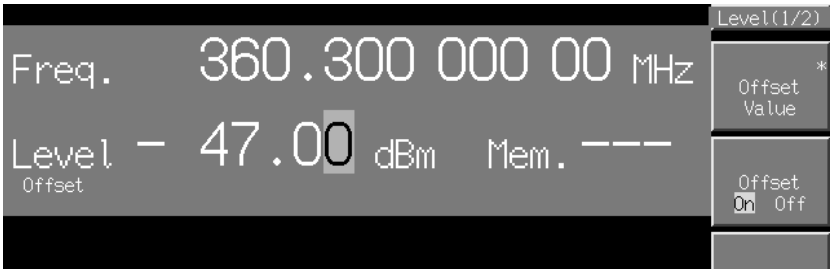
Sample operation: Set an offset to generate an output level of –45.3 dBm from a panel setting of –47 dBm.

<1> Press F1 (Offset Value) to open the offset setup window.


<2> Type −/+ 1 · 7 dB GHz/dBm to set an offset of –1.7 dB. The window closes when the setup completes.

<3> Press F2 (Offset On/Off) to turn on offset mode. (There is no need to press F2 if the reverse cursor is already at On.) "Offset" appears under the output level reading onscreen, indicating that the instrument is now in an offset setting state.

<4> Type −/+ 4 7 GHz/dBm to set an output level of –47 dBm. Although –47.00 dBm is displayed onscreen, an output level of –45.3 dBm is output actually.




To identify the actual output level, press F4 (Current Level). The output level will be displayed for about one second.

The output level may also be set using the rotary knob or step keys.

The offset setting feature works only if the output level unit of dB (dBm or dBμV) is selected.

## Display a Relative Level

Relative output level display is a feature whereby an output level is displayed in relation to a base output level of 0 dB.

[Set and displayed output level] =
[Actual output level] – [Output level displayed as a relative output level]

To set a relative output level, follow these steps:

Sample operation: Display an output level in relation to a base output level of 47 dBm, incrementing it by 7.5 dB.

<1> Type (–/+) (4) (7) (GHz/dBm) to set an output level of –47 dBm.

<2> Press (F3) (Relative On/Off) to turn on relative output level display mode, in which an output level is displayed in relation to the base output level, or current output level of –47 dBm. The output level reading will then change from –47 dBm to 0 dB. Further, "Relative" appears under the output level reading onscreen, indicating that a relative output level is now displayed.

<3> Turn the rotary knob counterclockwise to set a relative output level of 7.5 dB. Although 7.5 dB is also displayed, an output level of –47 dBm + 7.5 dB, or –39.5 dBm, is output actually.


To identify the actual output level, press (F4) (Current Frequency). The output level will be displayed for about one second.

The output level, as well as the relative output level in relative output level display mode, may also be set using the rotary knob or step keys.

Relative output level display mode works only when the output level unit of dB (dBm or dBμV) is selected.

## Select a Voltage Display Mode

The voltage units (V, dBμV) are selectable from EMF (Electro Motive Fource) voltage and terminating voltage display modes.

To set either release voltage mode or terminating voltage display mode, follow these steps:

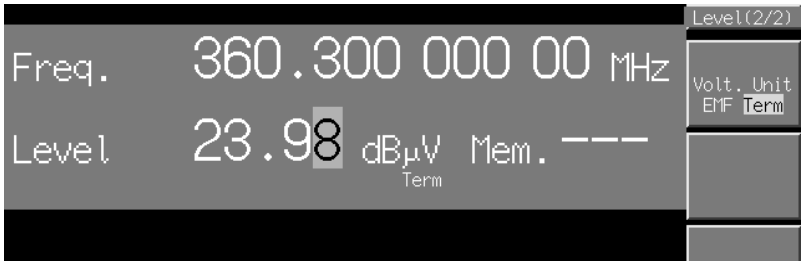
Voltage display mode default: emf voltage display

Sample operation: Set an output level of 30 dBμV in emf voltage display mode and then switch it to display in terminating voltage display mode.

<1> Type [3] [0] [s/dBμV] to set an output level of 30 dBμV. "EMF" (Electro Motive Force) appears under the output level reading onscreen, indicating that release voltage display mode is now effective.


<2> Press [F6] (etc) to switch to Level (2/2). Then, press [F1] (Volt. Unit EMF Term) to move the reverse cursor from EMF voltage display mode (EMF) to terminating voltage display mode (Term).

<3> The output level reading will change to 23.98 dBμV in terminating voltage display mode. "Term" appears under the output level reading onscreen, indicating that terminating voltage display mode is in effect.



## Use Continuous Mode

This instrument uses a mechanical attenuator to vary the output level. The mechanical attenuator is susceptible to momentary signal interruptions or spike noises. Choose Continuous mode when such momentary signal interruptions or spike noises pose a concern during measurement tasks. In Continuous mode, the action of the mechanical attenuator is locked, so that the output level can be continuously varied within a range of ±10 dB using the high-resolution setup electronic attenuator alone. To set Continuous mode, follow these steps:

Sample operation: Vary the output level between –57 and –37 dBm in Continuous mode.

<1> Type [–/+] [4] [7] [GHz/dBm] to set an output level of –47 dBm.

<2> Press [F6] (etc) to switch to Level (2/2). Then, press [F4] (Continuous On Off) to turn on Continuous mode. "Continuous" appears under the output level reading onscreen, indicating that Continuous mode is now effective.


<3> Turn the rotary knob clockwise to raise the output level to –37 dBm or counterclockwise to reduce it to –57 dBm.

In Continuous mode, an output level can be varied only within a range of ±10 dB from the level when continuous made by turning the rotary knob, using the numeric keypad, or by using the step keys.

Continuous mode works only if the output level unit of dB (dBm or dBμV) is selected.

In Continuous mode, the variable range of output levels may be restricted by the settings of vector modulation by a digital modulation Unit. For more information, refer to the user's guide pertaining to the type of digital modulation Unit used.

## Use Safety Mode

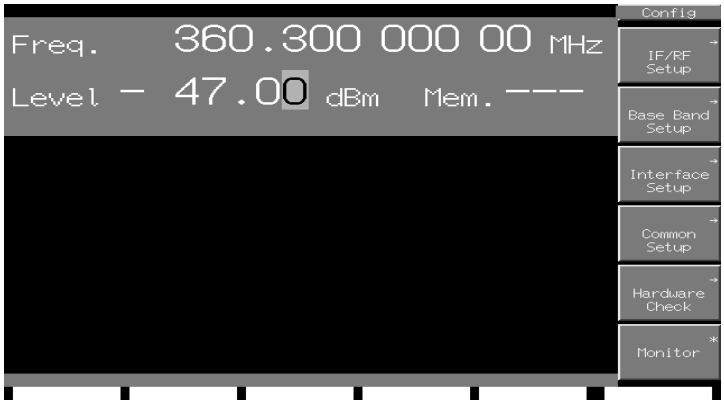
When modifications are made to parameters of this instrument, a large signal larger than the output level setting may be outputted depending on the setup procedure used.

Safety mode is used if it is feared that such excessive-level signal output may damage the device under test.

In Safety mode, when a parameter that is likely to produce excessive-level signal output is set, the output is withheld until the setup completes, to prevent excessive-level signal output. Note, however, that Safety mode adds to the time needed to set parameters, such as the output level.

To set Safety mode, follow these steps:

<1> Press Config to open the configuration parameter setup screen.



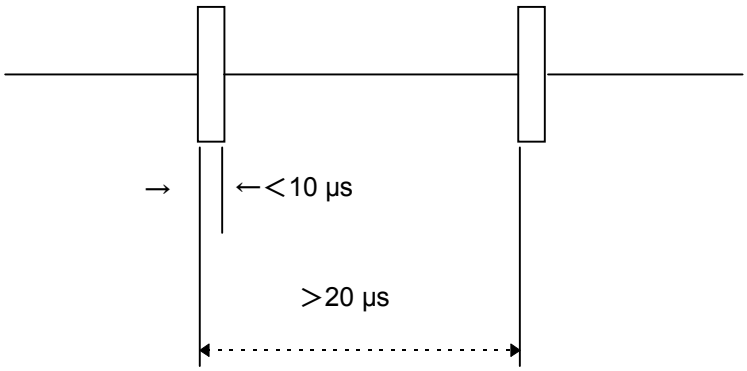

<2> Press F1 (IF/RF Setup) to open the IF/RF Setup screen.


<3> Move the reverse cursor to Level Safety Mode to open the setup window.

<4> After selecting On, press Set. "Safety" appears under the output level reading onscreen, indicating that Safety mode is now in effect.

## Using the ALC (Automatic Level Control) Off Mode

MG3681A normally outputs a level-stabilized signal using the ALC loop circuit. However, the ALC loop circuit does not operate normally when it performs modulation for a pulse that has a short RF output time and a long loop interval. Thus, MG3681A sometimes does not output a stable signal.




Use the ALC Off mode when using such a modulation signal. In the ALC Off mode, the pulse modulation signal is directly modulated. In this case, level calibration is required because the ALC loop circuit is released in the ALC Off mode.

Level calibration is performed automatically when the ALC Off mode is set, and when frequency and output level settings are changed.

The procedure to set the ALC Off mode is shown below:

<1> Press (F6) (etc) to open the Level (2/2) window, then press (F3) (ALC On Off) (On is the default).


<2> Select “Off” to execute the ALC Off mode. Level calibration is then automatically performed.

In the ALC Off mode, the Continuous mode cannot be used and amplitude modulation cannot be performed.

## Changing the ALC Time Constant

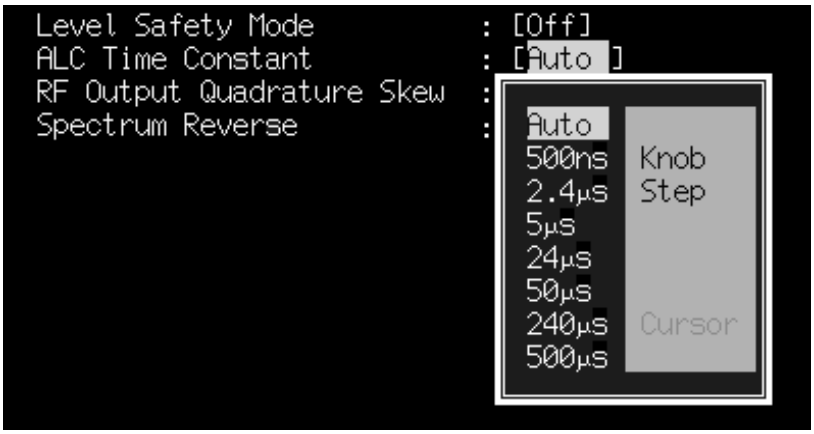
In the ALC On mode, you can set a desired ALC time constant.
Normally, set the ALC time constant to “Auto”.
When performing external digital modulation (vector modulation), wide-band amplitude modulation (Wide AM), or pulse modulation, change the ALC time constant as required. Generally, setting an ALC time constant greater than the modulation rate reduces the level fluctuation and the influence of modulation upon the modulation accuracy, but it affects the output level switching time and the frequency characteristic of amplitude modulation.

Sample operation: Setting the ALC time constant to 5 μs.

<1> Press [Config] to open the Configuration Setting screen.


<2> Press [F1] (IF/RF Setup) to display the IF/RF Setup screen.

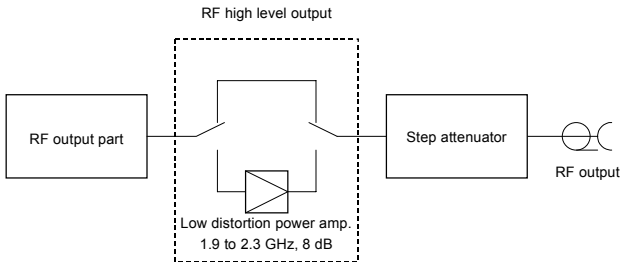
<3> Move the reverse cursor to ALC Time Constant to open the setting window.




<4> Select "5 µs," then press Set to accept it as the ALC time constant.

## Using the RF High Level Output Mode

Installing Option 42, RF High Level Output, enables the low-distortion power-amplifier for W-CDMA band to be inserted at the end of RF circuit.




The maximum RF level of W-CDMA modulated wave within the range of 1.9 to 2.3 GHz can be increased 8 dB by turning on the RF High Level Output mode. Also, it is possible to gain the RF Output Signal, which is 8 dB higher, without encouraging the adjacent-channel leakage-power.

| W-CDMA Multiplex nos. | RF level upper limit | |
|---|---|---|
| | Normal | RF high level (Output mode: on) |
| 1 to 7 | +5 dBm | +13 dBm |
| 8 to 12 | +4 dBm | +12 dBm |
| 13 to 15 | +3 dBm | +11 dBm |
| 16 to 19 | +2.14 dBm | +10.14 dBm |
| 20 to 31 | +2 dBm | +10 dBm |
| 32 to 50 | +1 dBm | +9 dBm |
| 51 or more | 0 dBm | +8 dBm |

To output the W-CDMA modulated wave, MU368040A CDMA Modulation Unit and MX368041A W-CDMA Software are required.

Example: Turning on the RF High Level Output Mode

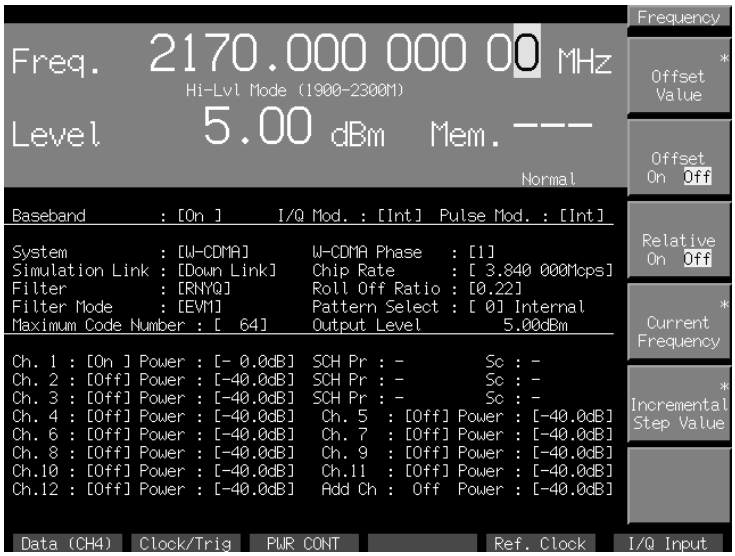
<1> Press Config to display the environment setting screen.

<2> Press F1 (IF/RF Setup) to display the IF/RF Setup screen.

<3> Move the cursor to "RF High level Output." The setting window appears.

<4> Select "On" and press Set .

When the RF High Level Output mode is turned on, "Hi-Lvl Mode (1900-2300M)" appears above the display of output level. It indicates that the RF High Level Output mode is being turned on with the available frequency range displayed.




The performance of the RF High Level Output mode is assured only in the range of 1.9 to 2.3 GHz. When the set frequency is out of the range, "Uncal" appears.

Turning on the RF High Level Output mode while the unit of output level is set to either V or W sets dBm as a unit of output level. In the RF High Level Output mode, note that you cannot change the unit to V or W.

The RF High Level Output mode is unavailable when output level is set to less than –135 dBm. In the RF High Level Output mode with the output level set to higher than +17 dBm, turning off the RF High Level mode automatically causes the output level to be +17 dBm.

Switching the RF High Level Output mode invalidates the continuous mode, the output-level offset-mode and the relative-level display mode that have been set.

## 3.2.4 Using Memory Functions

With its memory functions, this instrument enables the user to save, recall, and delete parameters, such as frequency, output level, and modulation.

The following memory modes are supported:

1. Save and recall frequencies and output levels (up to 512 sets)
2. Save and recall all parameters (up to 100 sets)

The memory to which frequency and output level settings are saved is called “basic parameter memory (BPM)”. The memory to which all parameters are saved is called “all-parameter memory (APM)”. When parameters are saved to APM, each memory location can be assigned a title (consisting of a string of eight or fewer alphanumeric characters and symbols).

## BPM (Basic Parameter Memory)

BPM stores up to 512 sets of hardware settings of frequencies and output levels. It allows either frequency or output level settings or both to be recalled selectively, as well as by memory location number or by sweep.

## BPM: Save to Memory

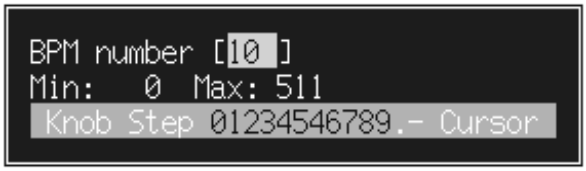
To save data to BPM, press front-panel main function key [Memory] to enable the memory facility and then type a memory location number and [Save kHz/nW]. Data can be saved up to 512 pairs of memory locations.

Sample operation: Save the frequency and output level currently on display to memory location number 10.

***Note:***

The current settings are saved. Set the relevant parameters before proceeding to save them.

<1> Press [Memory] and any key of the numeric keypad to enter the memory location number (0 to 511).




<2> Press [Save kHz/nW] to save the current frequency and output level settings to memory. If the same memory location number already exists, a Yes/No window opens asking if the user wants to overwrite the existing settings.


<3> Select Yes and press [Set] to close the window after saving the frequency and output level settings to memory location number 10.

## BPM: Recall from Memory

To recall stored data from BPM, press front-panel main function key [Memory] to enable the memory facility. Then, enter a memory location number and press [Recall Hz/fW]; or turn the rotary knob; or press the step keys.

Sample operation: Recall the frequency and output level settings stored at memory location number 10.

<1> Press [Memory] and then any key of the numeric keypad to enter the memory location number (0 to 511).

<2> Press [Recall Hz/fW] to read and set the current frequency and output level settings from memory location number 10.

Stored data can also be recalled from memory locations by continuously addressing them with the rotary knob or step keys. With continuous addressing, those memory locations that have step mode set to On are skipped.

While two parameters, frequency and output level, are stored in BPM, there are three different ways to recall their settings: recall frequencies only, recall output levels only, and recall both frequencies and output levels.

Instructions on setting skip mode and recall patterns are explained in “Edit Memory Attributes.

The unit of the output level is converted into “dBm”, independent of the state when BPM was stored.

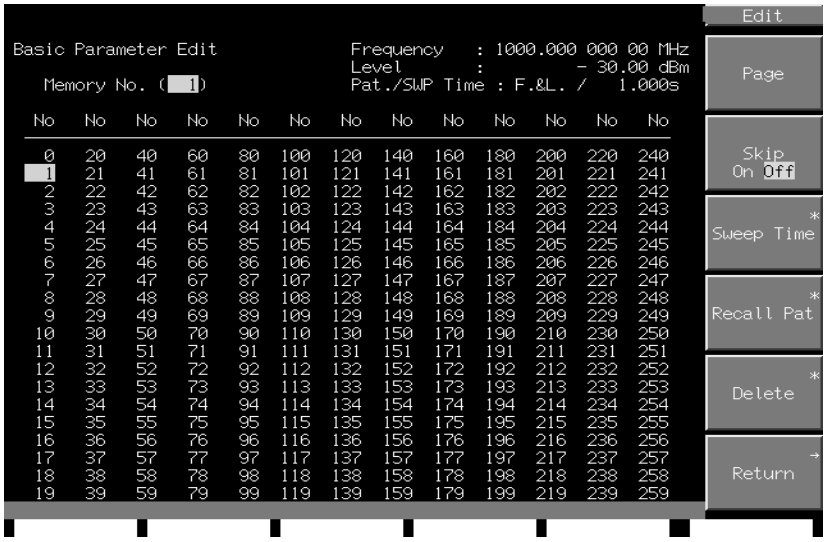
## BPM: Edit Memory Attributes

The following two attributes can be set on BPM for each memory location number:

1 Recall pattern (parameters to be recalled)
2 Skip mode (disable recall with the rotary knob or step keys)

These two attributes can be set in the Basic Parameter Edit screen that is invoked by the memory facility.

<1> Press [Memory], then [F2] (Basic Parameter Edit) to open the Basic Parameter Edit screen. The current frequency and output level settings stored in BPM are displayed in the upper right corner of the screen. (The frequency and output level fields will appear blank if no data is saved.)




<2> Using the cursor keys, move the reverse cursor to memory location number 1, and then Memory No. in the upper left of the screen will also change to 1.

<3> Press function keys on the Edit screen to set the individual attributes.

The reverse cursor may also be moved using the rotary knob or step keys.
And the BPM number can also be set by using the numeric keypad. In this case, press [Set] after the window appering in order to accept the BPM number.

## BPM: Select a Recall Pattern

There are three different ways to recall stored data from basic parameter memory: frequencies only, recall output levels only, and recall both frequencies and output levels. Edit BPM attributes on the Basic Parameter Edit screen to select a recall pattern. To select a recall pattern, follow these steps:

Sample operation: Recall both the frequency and output level settings stored at memory location number 10.

<1> Press [Memory], then [F2] (Basic Parameter Edit) to open the Basic Parameter Edit screen.

<2> Using the cursor keys, move the reverse cursor to memory location number 10, and then Memory No. in the upper left of the screen will also change to 10.

<3> Press [F4] (Recall Pat) to open the Recalling Pattern setup window. Using the rotary knob or step keys, move the reverse cursor in the window to "Freq & Level".


<4> Press [Set] to accept "Freq & Level" and close the window.

## BPM: Set Skip Mode

When BPM skip mode is turned on for a given memory location, that location can be skipped from the scope of recall by the rotary knob or step keys. The selected memory location can also be hidden from the scope of a sweep and also from the scope of triggering under external control. To set skip mode, follow these steps:

Sample operation: Turn on skip mode for memory location number 10.

<1> Press [Memory], then [F2] (Basic Parameter Edit) to open the Basic Parameter Edit screen.

<2> Using the cursor keys or rotary knob, move the reverse cursor to memory location number 10, and then Memory No. in the upper left of the screen will also change to 10.

<3> Press [F2] (Skip On Off) to turn on skip mode. (There is no need to press [F2] if the reverse cursor is already at On.)

## BPM: Delete Memory

To delete BPM, follow these steps:

Sample operation: Delete stored data from memory location 10.

<1> Press [Memory], then [F2] (Basic Parameter Edit) to open the Basic Parameter Edit screen.

<2> Using the cursor keys, move the reverse cursor in the memory location number field to memory location number 10, and then Memory No. in the upper left corner of the screen will also change to 10.

<3> Press [F5] (Delete) and a Yes/No window opens asking if the user wants to delete the stored settings.


<4> After selecting "Yes", press [Set] to close the window after deleting the stored settings from memory location number 10.

The reverse cursor in the memory location number field can also be moved using the rotary knob or step keys. The memory location number can also be set by using the numeric keypad. In this case, press [Set] after the window appearing in order to accept the memory location number.

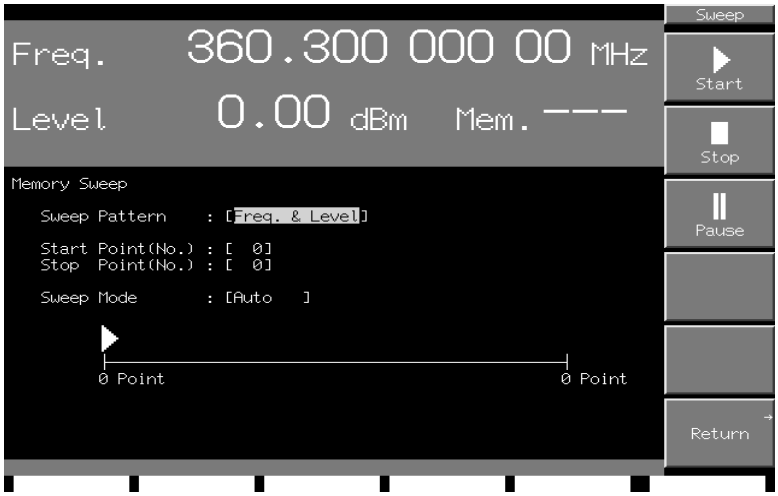
## BPM: Sweeping

You can sweep frequencies and/or output levels stored in BPMs.
Frequencies and/or output levels are swept between the specified start point and the specified end point in the order of memory numbers. The sweep time is the same to the sweep times specified set for each BPM.

Sample operation: Sweeping only frequencies stored in memories No.5 to No.10 of the BPM shown below, repeatedly

| | | | | |
|---|---|---|---|---|
| BPM No.1 | : | 500 MHz | , 0 dBm | , 50 ms |
| BPM No.2 | : | 600 MHz | , –30 dBm | , 50 ms |
| BPM No.3 | : | 700 MHz | , –30 dBm | , 10 ms |
| BPM No.4 | : | 1000 MHz | , +5 dBm | , 10 ms |
| BPM No.5 | : | 1010 MHz | , +5 dBm | , 100 ms |
| BPM No.6 | : | 1050 MHz | , –47 dBm | , 200 ms |
| BPM No.7 | : | 520 MHz | , –37 dBm | , 200 ms |
| BPM No.8 | : | 800 MHz | , 0 dBm | , 10 ms |
| BPM No.9 | : | 2000 MHz | , –20 dBm | , 10 ms |
| BPM No.10 | : | 10 MHz | , –20 dBm | , 50 ms |

<1> Press [• Memory], then press [F3] (Sweep) to open the Sweep screen.




<2> Move the reverse cursor to the Sweep Pattern parameter.

<3> Select “Frequency” using the step key or rotary knob, then press [Set] to determine it.

<4> Move the reverse cursor to Start Point (No.).

<5> Enter “5” using a numeric key, then press [Set] to determine it.

<6> Move the reverse cursor to Stop Point (No.).

<7> Enter “10” using numeric keys, then press Set to determine it.

<8> Move the reverse cursor to Sweep Mode.

<9> Select “Auto” using the step key or rotary knob, then press Set to determine it.

<10> Pressing F1 (▶ Start) starts sweeping.

## APM (All-Parameter Memory)

With up to 100 memory locations, APM has enough capacity to store all parameters that can be set from the instrument panel (except for memory parameters and remote control parameters). These parameters include the settings of the digital modulation units. To recall a stored parameter from APM, select its memory location number on the All Parameter Recall screen. A function is also available for listing data stored in APM.

## APM: Save to Memory

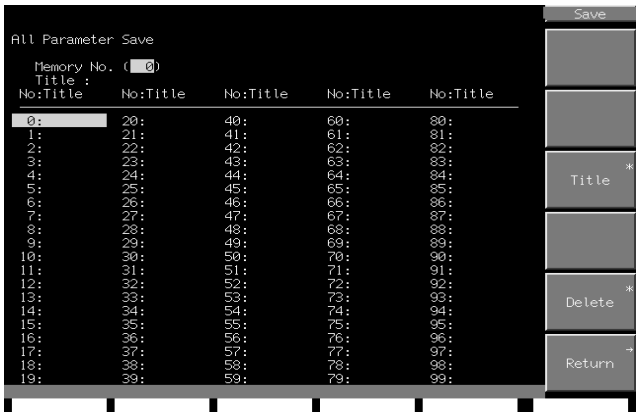
The task of saving all parameter settings to memory can be set in the All Parameter Save screen that is invoked by the memory facility.

Sample operation: Save the parameter currently on display to memory location number 10 under the title name “ABCDEF.”

***Note:***

The current setting is saved. Set the relevant parameters before proceeding to save it.

<1> Press [Memory] and then [F4] (All PRM Save) to open the All Parameter Save screen.




<2> Using the cursor keys, move the reverse cursor in the memory location number field to memory location number 10, and then Memory No. in the upper left corner of the screen will also change to 10.

<3> Press [F3] (Title) to open the title entry screen.


<4> Using the cursor keys, move the reverse cursor in the character set to “A”. “A” will appear at the reverse cursor in Entry.

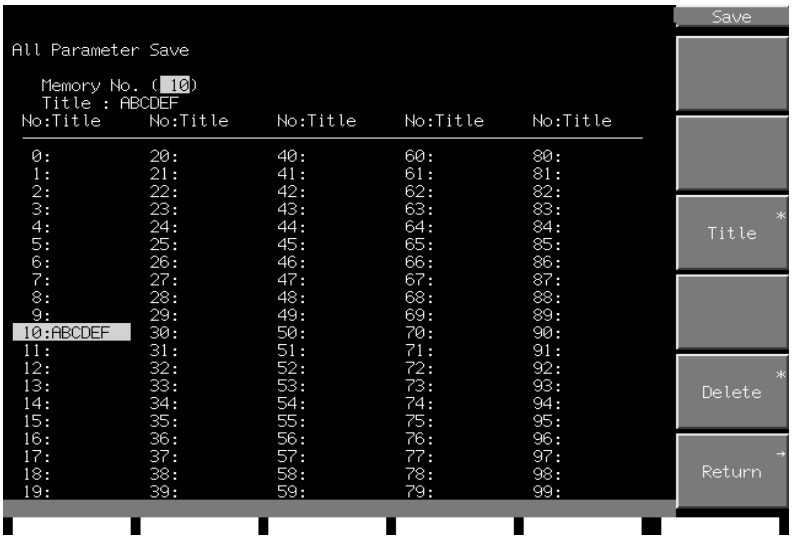
<5> Press [F2] (▷) to move the reverse cursor in Entry to right. Next, move the reverse cursor in the character set to “B” and “B” also appears at the reverse cursor in Entry.

<6> Repeat step <5> until character string "ABCDEF" is displayed in Entry, and then press Set. The title name of memory location number 10 is set to "ABCDEF".

<7> Pressing Set once, The parameter is saved to memory location number 10 at the same time.

***Note:***

Step <6> is registration of title only, it can't save the Parameter.



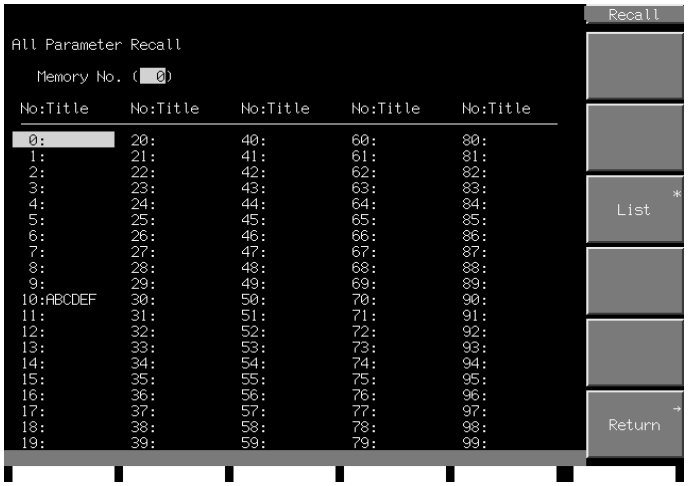

The reverse cursor in the memory location number field and that in the character set can also be moved using the rotary knob or step keys. The digits (0 to 9) and certain letters (A to F) can be entered using the numeric keypad as well. If the numeric keypad is used, the reverse cursor in Entry moves to right without F2 being pressed.

## APM: Recall from Memory

To recall data that has been saved to APM on the All Parameter Save screen, follow these steps:

Sample operation: Recall title name “ABCDEF” of memory location number 10 at which parameters are stored.

<1> Press [Memory] and then [F5] (Al Parameter Recall) to open the All Parameter Recall screen.




<2> Using the cursor keys, move the reverse cursor in the memory location number field to memory location number 10, and then Memory No. in the upper left of the screen will also change to 10.

<3> Press [Set] to recall the data stored at memory location number 10.

The reverse cursor in the memory location number field can also be moved using the rotary knob or step keys.

Then the window opens, and pressing [Set] , the memory location number can be set.

To view data stored in APM, specify a memory location number on the All Parameter Recall screen and press [F3] (List). Then, an itemized list of the data stored at the specified memory location is displayed in a window. (The list is displayed as Frequency. To change the view, press [F1] (Previous) or [F2] (Next). When the viewing is finished, press [F6] (Close) to close the window.

## APM: Delete Memory

To delete data that has been saved on the All Parameter Save screen, follow these steps:

Sample operation: Delete stored data from memory location 10.

<1> Press [Memory], then [F4] (All PRM Save) to open the Basic Parameter Edit screen.

<2> Using the cursor keys, move the reverse cursor in the memory location number field to memory location number 10, and then Memory No. in the upper left corner of the screen will also change to 10.

<3> Press [F5] (Delete) and a Yes/No window opens asking if the user wants to delete the stored settings.


<4> After selecting Yes, press [Set] to close the window after deleting the stored settings from memory location number 10.

The reverse cursor in the memory location number field can also be moved using the rotary knob or step keys. The reverse cursor in the memory location number field can also be moved using the rotary knob or step keys. And the memory location number can also be set by pressing Ten key. then the Window opens, and pressing [Set], the memory location number can be set.

When the contents stored in APM involve the system data related to the digital modulation, and if the system data is deleted; all the contents of the APM memory number is also deleted at the same time.

***Example:***

When the MX368041A W-CDMA Modulation Software is installed, and the APM memory No. 20 stores the condition of the Pattern 10 of system data; all the contents of the APM memory No. 20 are also deleted in addition to the Pattern 10, if the Download Data Clear is executed.

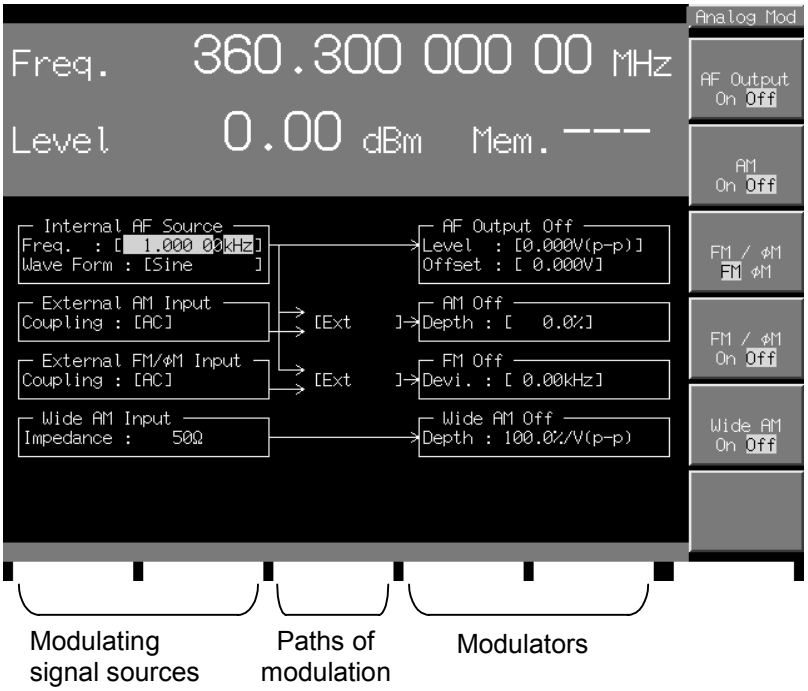
# 3.3 Setting the Modulation Function

## 3.3.1 Analog modulation

Press the front-panel main function key [Analog Mod] to open the analog modulation setup screen, with the key lamp illuminated.

Set analog modulation on this screen.

Unless otherwise noted in this section,it is assumed that the analog modulation setup screen is now open with [Analog Mod] being pressed.




The analog modulation setup screen shows the flow of signals from the modulating signal sources to analog modulation.

The modulating signal sources at the leftmost end of the screen indicate the frequency and waveform for the internal modulating signal source (Internal AF Source) and the coupling, input impedance, etc. for external modulation input.

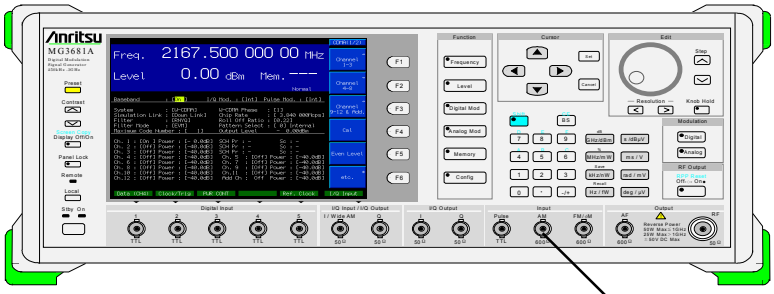
The paths of modulation in the middle of the screen use arrow marks to designate the flow of signals from the modulating signal sources to the modulators.

The modulators at the rightmost end of the screen indicate the on/off states, depth of modulation and other parameters of the modulators. The settings that can be modified are enclosed in brackets [ ]. These settings can be modified by moving the reverse cursor on them with the cursor keys.

## Carry Out Amplitude Modulation (AM) with an External Modulating Signal

To set amplitude modulation (AM) with external signal input, follow these steps:

Connecting an external modulating signal



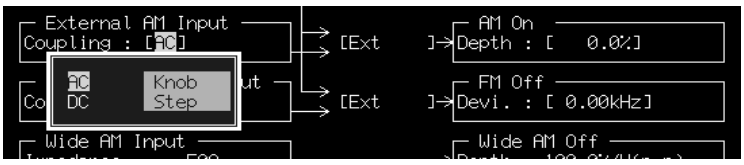

The amplitude modulation input connector is internally terminated at 600Ω. Input a 2V (p-p) signal in the 600Ω termination state.

Sample operation: Carry out amplitude modulation with the external AM input coupling set to AC and the depth of AM modulation set to 50%.

<1> Press F2 (AM On/Off) to turn on AM modulation. (There is no need to press F2 if the reverse cursor is already at On.)

<2> Using the cursor keys, move the reverse cursor to the Coupling parameter in External AM Input.

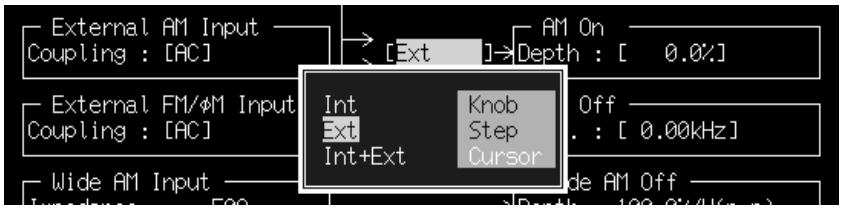
<3> Using the step keys or the rotary knob, open the window and move the reverse cursor in the window to AC.




<4> Press Set to accept AC and close the window.

<5> Using the cursor keys, move the reverse cursor to the path of amplitude modulation.

<6> Using the step keys or the rotary knob, open the window and move the reverse cursor to Ext.




<7> Press [Set] to accept Ext and close the window.

<8> Using the cursor keys, move the reverse cursor to the AM Depth setup parameter.

<9> Using the numeric keypad, enter a value of 50.


<10> Press [%/MHz/mW] to accept the numeric value and the units and close the window.

<11> Press [Analog] to start amplitude modulation with the key lamp turned on.

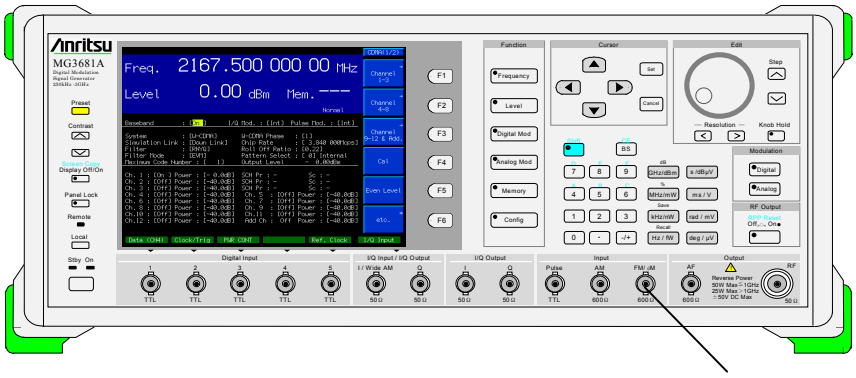
The depth of modulation may also be varied using the rotary knob or step keys.

The polarity of the modulating signal reverses when a negative value is entered for the depth of modulation.

## Carry Out Frequency Modulation (FM) with an External Modulating Signal

To set frequency modulation (FM) with external signal input, follow these steps:

Connecting an external modulating signal




The frequency modulation input connector is internally terminated at 600Ω. Input a 2V (p-p) signal in the 600Ω termination state.

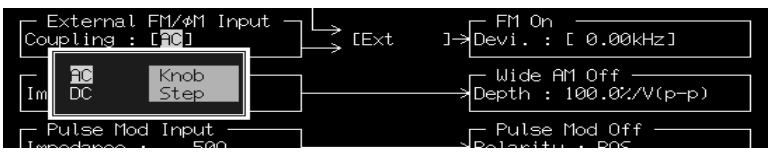
Sample operation: Carry out frequency modulation with the external FM/ϕM input set to AC and FM Deviation set to 500 kHz.

<1> Press F3 (FM/ϕM) to select FM. (There is no need to press F3 if the reverse cursor is already at FM.)

<2> Press F4 (FM/ϕM On Off) to carry on FM modulation. (There is no need to press F4 if the reverse cursor is already at FM.)

<3> Using the cursor keys, move the reverse cursor to the Coupling parameter in External FM Input.

<4> Using the step keys or the rotary knob, open the window and move the reverse cursor in the window to AC.




<5> Press Set to accept AC and close the window.

<6> Using the cursor keys, move the reverse cursor to the path of frequency modulation.

<7> Using the step keys or the rotary knob, open the window and move the reverse cursor to Ext.


<8> Press [Set] to accept Ext and close the window.

<9> Using the cursor keys, move the reverse cursor to the FM Deviation setup parameter.

<10> Using the numeric keypad, enter a value of 500.


<11> Press [Save / kHz/nW] to accept the numeric value and the unit and close the window.

<12> Press [Analog] to start frequency modulation with the key lamp turned on.

The frequency deviation may also be varied using the rotary knob or step keys.

Although frequency deviations of up to 2000 kHz can be set irrespective of the output frequency, actual frequency deviations are limited to 1000 kHz with an output frequency of 1010 MHz or lower. In this case, “Uncal” is displayed onscreen.

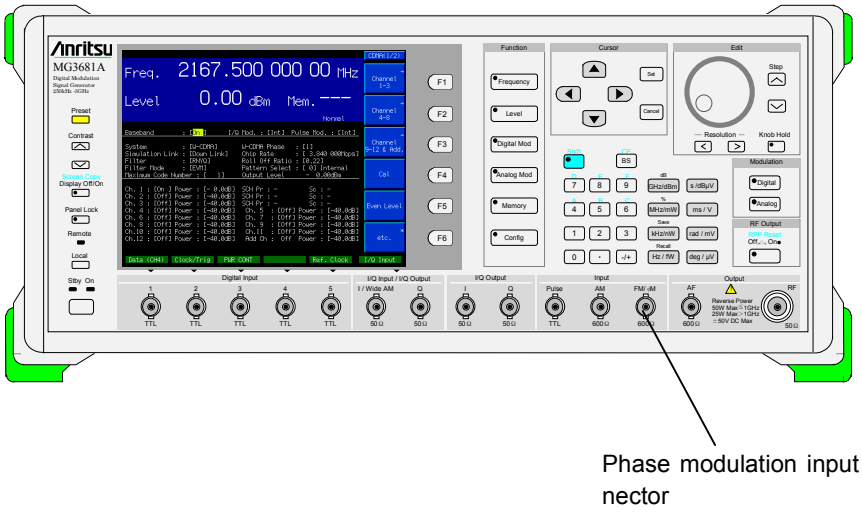
The polarity of the modulating signal reverses when a negative value is entered for the frequency deviation.

Frequency modulation cannot be carried out concurrently with phase modulation.

## Carry Out Phase Modulation (ϕM) with an External Modulating Signal

To set phase modulation (ϕM) with external signal input, follow these steps:

Connecting an external modulating signal




The phase modulation input connector is internally terminated at 600Ω. Input a 2V (p-p) signal in the 600Ω termination state.

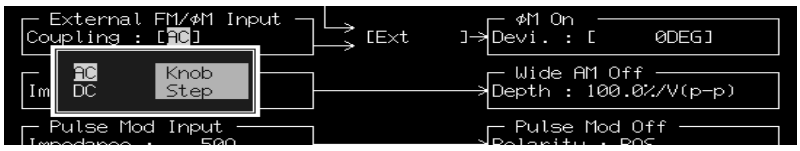
Sample operation: Carry out phase modulation with the external FM/ϕM input set to AC.

<1> Press F3 (FM/ϕM) to select ϕM. (There is no need to press F3 if the reverse cursor is already at ϕM.)

<2> Press F4 (FM/ϕM On/Off) to turn on ϕM modulation. (There is no need to press F4 if the reverse cursor is already at On.)

<3> Using the cursor keys, move the reverse cursor to the Coupling parameter in External FM/ϕM Input.

<4> Using the step keys or the rotary knob, open the window and move the reverse cursor in the window to AC.




<5> Press Set to accept AC and close the window.

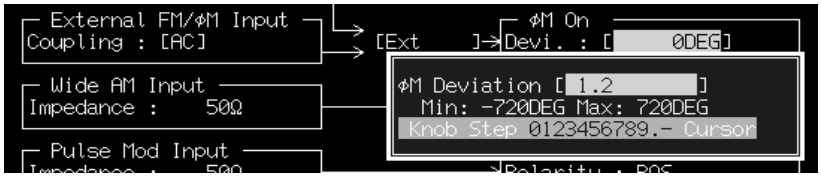
<6> Using the cursor keys, move the reverse cursor to the path of phase modulation.

<7> Using the step keys or the rotary knob, open the window and move the reverse cursor to Ext.


<8> Press [Set] to accept Ext and close the window.

<9> Using the cursor keys, move the reverse cursor to the ϕM Deviation setup parameter.

<10> Using the numeric keypad, set a value of 1.2.




<11> Press [rad/mV] to accept the numeric value and the units and close the window.

<12> Press [Analog] to start phase modulation with the key lamp turned on.

The phase deviation may also be varied using the rotary knob or step keys.

Although phase deviations up to 12.56 rad can be set irrespective of the output frequency, actual phase deviations are limited to 6.28 rad with an output frequency of 1010 MHz or lower. In this case, “Uncal” is displayed onscreen.

The polarity of the modulating signal reverses when a negative value is entered for the phase deviation.

Phase modulation cannot be carried out concurrently with frequency modulation.

## Carry Out Analog Modulation (AM, FM, ϕM) with an Internal Modulating Signal

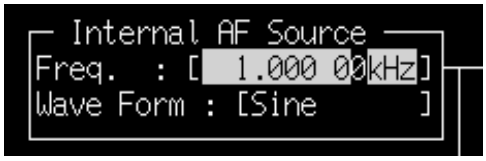
An AF synthesizer (option 21) is a prerequisite for carrying out modulation with an internal modulating signal. Remember also to set a frequency and waveform as Internal AF Source setup parameters. Further, it is necessary to set the path of modulation to "Int". Other operation of AM, FM, ϕM modulation performed by internal modulating signals are the same as those of modulations performed by external signals.

### Setting Internal AF Source setting items

#### <Frequency>

<1> Move the reverse cursor to the Internal AF Source Frequency setup parameter.

<2> Using the numeric keypad, set an optional numeric value. (A numeric value may also be set using the rotary knob or step keys.)

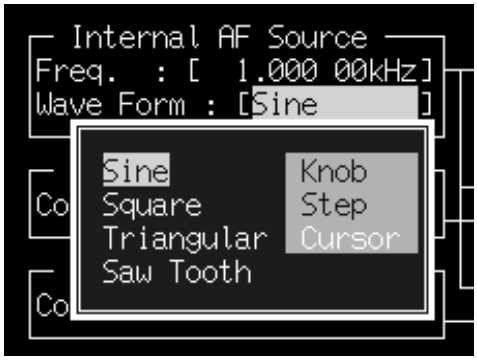



<3> Press a unit key or [Set] to accept the numeric value and the unit. The numeric value is accepted in the units Hz when [Set] is pressed.

#### <Waveform>

<1> Move the reverse cursor to the Internal AF Source Waveform setup parameter.

<2> Using the step keys, open the Waveform setup window.




<3> Select an optional waveform from the item window and press [Set] to accept the wave for and then close the window.

<Waveform patterns>

- Sine: Sine wave
- Square: Square wave
- Triangular: Triangular wave
- Saw Tooth: Sawtooth wave

<Path of modulation>

<1> Move the reverse cursor to the path of modulation.

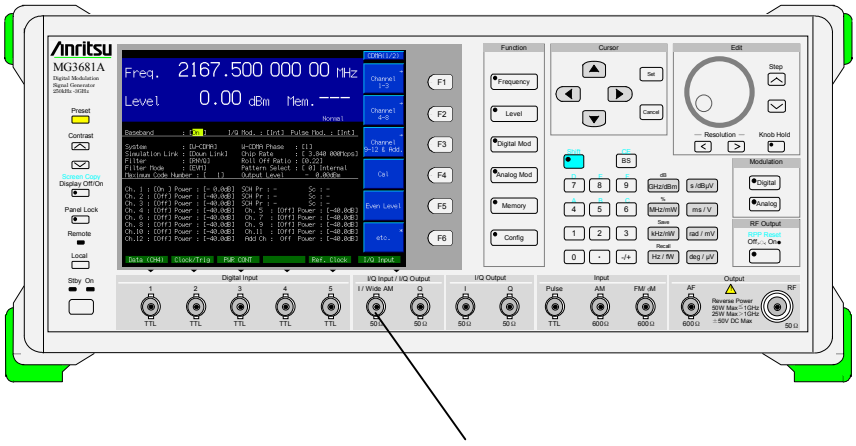
<2> Using the rotary knob or step keys, open the window and move the reverse cursor in the window to “Int”.

<3> Press [Set] to accept “Int” and close the window.

## Carry Out Wide-band Amplitude Modulation (Wide AM) with an External Modulating Signal

To set wide-band amplitude modulation (wide AM) with external signal input, follow these steps:

Connecting an external modulating signal




<1> Press F5 (Wide AM On Off) to turn on wide AM. (There is no need to press F5 if the reverse cursor is already at On.)

<2> Press Analog to start wide-band amplitude modulation with the key lamp illuminated.

The external input impedance is fixed at 50Ω.

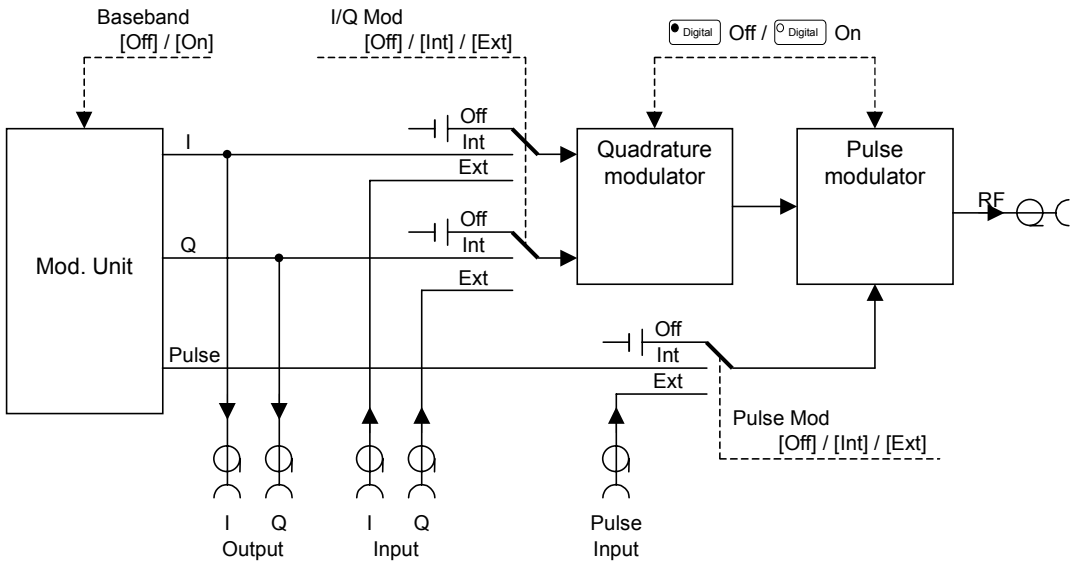
The modulation sensitivity is fixed at 100%/1 V (p-p). To adjust the depth of modulation, change the amplitude of the external input signal.

Wide range amplitude modulation can not be used when vector modulation is set to On.

## 3.3.2 Digital modulation

Press the front-panel main function key [Digital Mod] to open the digital modulation setup screen, with the key lamp turned on.
Set digital modulation on this screen.
Unless otherwise noted in this section, it is assumed that the digital modulation setup screen is now open with [Digital Mod] being pressed.


The settings (by Baseband, I/Q Mod., and Pulse Mod. on the digital modulation setup screen, and by front-panel key [Digital] ) depend on the switch selection in the below diagram, which shows the modulation signal flow.
The I/Q signal outputs and digital modulation status at each setting are shown on the table below.

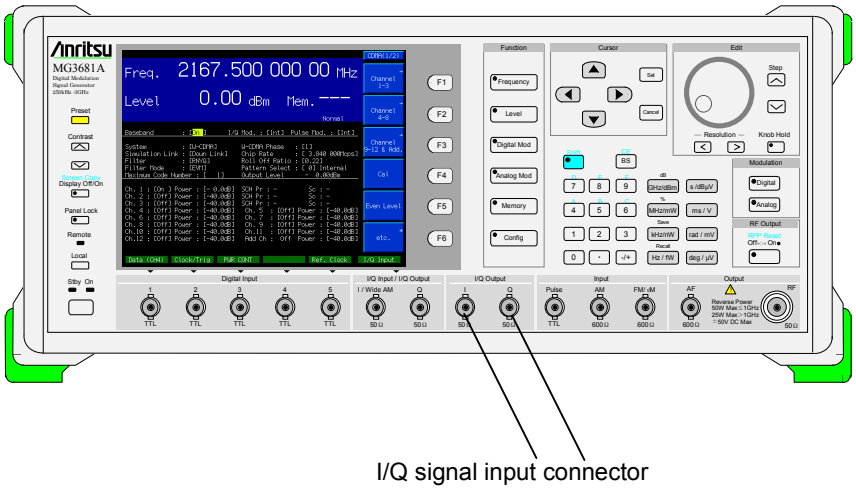


**I/Q signal outputs and digital modulation status at each setting**

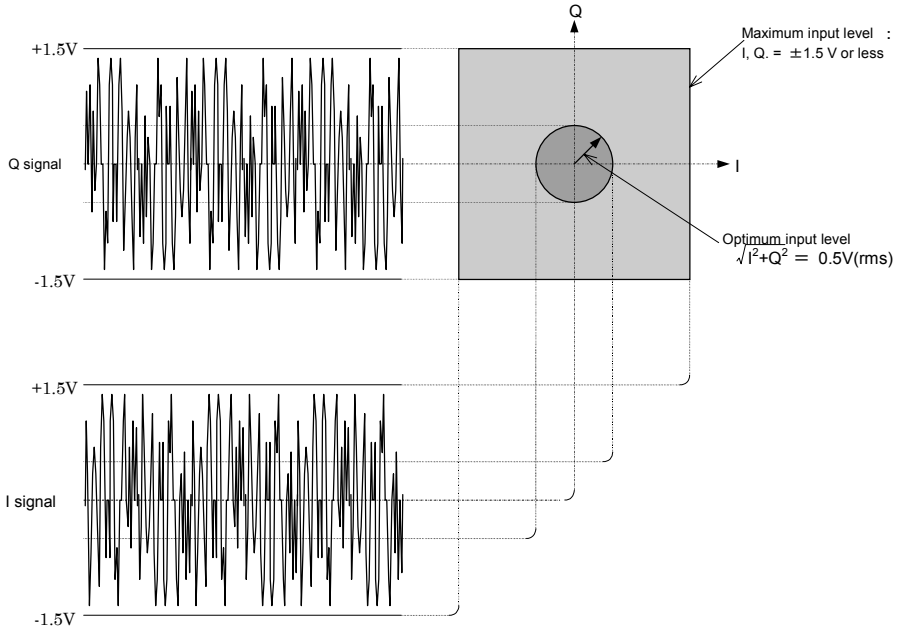
| Setting | | | | Output signal | |
|---|---|---|---|---|---|
| **Baseband** | **I/Q Mod.** | **Pulse Mod.** | **Digital** | **I/Q Output** | **RF Output** |
| [Off] | [Off], [Int], [Ext] | [Off], [Int], [Ext] | ● Digital Off | Nothing are output. | CW |
| | [Off] | [Off] | ○ Digital On | | |
| | [Ext] | [Off] | | | External vector modulation |
| | [Off] | [Ext] | | | External pulse modulation |
| | [Ext] | [Ext] | | | Ext. vector mod. + Ext. pulse mod. |
| | [Int] | [Off], [Int], [Ext] | | | Un-definable |
| | [Off], [Int], [Ext] | [Int] | | | (Depends on stop state of mod. unit.) |
| [On] | [Off], [Int], [Ext] | [Off], [Int], [Ext] | ● Digital Off | Int. I/Q signals are output. | CW |
| | [Off] | [Off] | ○ Digital On | | CW |
| | [Int] | [Off] | | | Internal vector modulation |
| | [Ext] | [Off] | | | External vector modulation |
| | [Off] | [Int] | | | Internal pulse modulation |
| | [Off] | [Ext] | | | External pulse modulation |
| | [Int] | [Int] | | | Int. vector mod. + Int. pulse mod. |
| | [Ext] | [Ext] | | | Ext. vector mod. + Ext. pulse mod. |
| | [Ext] | [Int] | | | Ext. vector mod. + Int. pulse mod. |
| | [Int] | [Ext] | | | Int. vector mod. + Ext. pulse mod. |

## Carry out Vector Modulation with External I/Q Signals

To set digital (vector) modulation with external I/Q signal input, follow these steps:



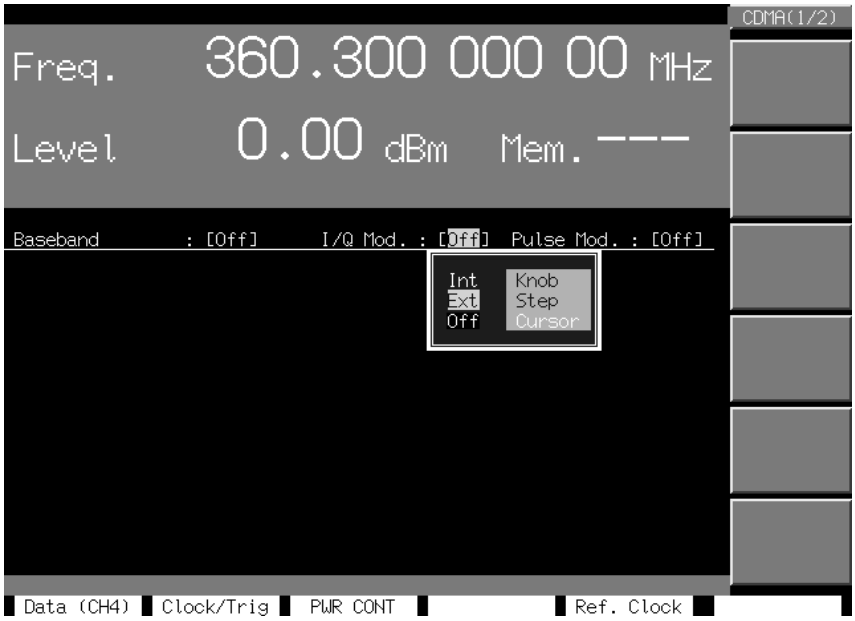

The I/Q signal input connectors are internally terminated at 50Ω. If the rms voltage of $\sqrt{(I^2 + Q^2)}$ is 0.5 V in the 50Ω termination state, an RF signal matching the output level setting is outputted. For carrying out vector modulation, input I/Q signals that make the rms voltage of $\sqrt{(I^2 + Q^2)}$ equal to 0.5 V. Also set the maximum values of the I/Q signals so that they do not exceed ±1.5 V.



Sample operation: Carry out digital (vector) modulation with external I/O signal input.

<1> Using the cursor keys, move the reverse cursor to the I/Q Mod setup parameter.

<2> Using the rotary knob or step keys, open the window and move the reverse cursor in the window to “Ext”.



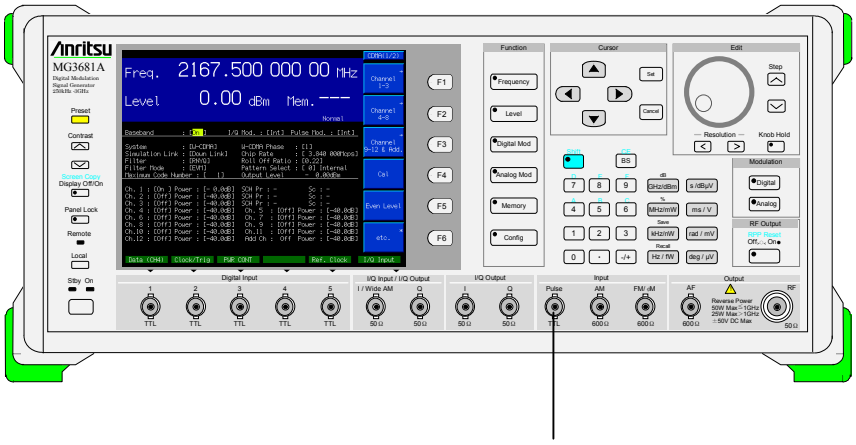

<3> Press Set to accept “Ext” and close the window.

<4> Press Digital to start digital (vector) modulation with the key lamp turned on.

## Carry Out Pulse Modulation with an External TTL Signal

To set pulse modulation with external signal input, follow these steps:

Connecting an external TTL signal

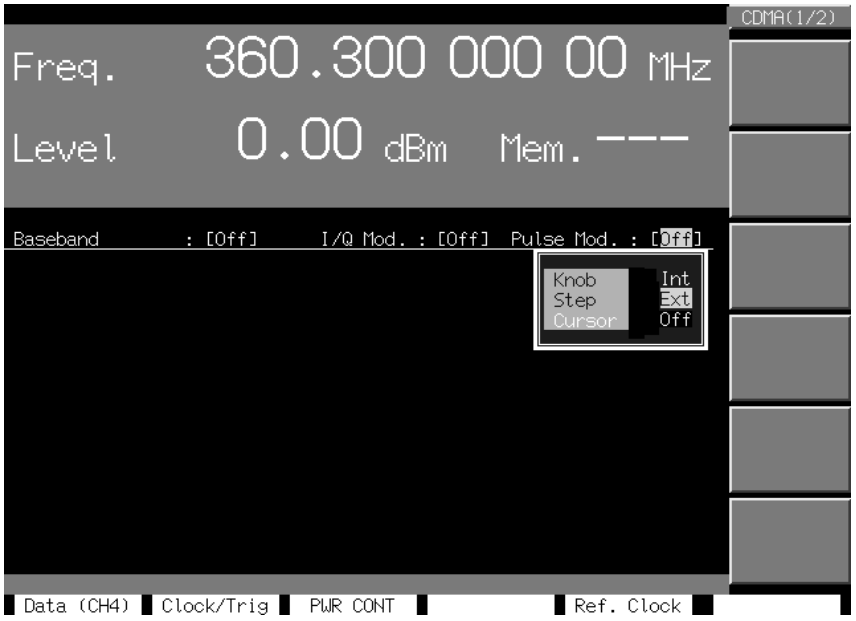



The external input impedance is fixed at 50Ω. The polarity of pulse modulation is fixed at "Positive". This means that an RF signal is output when the external modulating signal is logical high level but not when the external modulating signal is logical low level.

Sample operation: Carry out pulse modulation with external TTL signal input

<1> Using the cursor keys, move the reverse cursor to the setup parameter of Pulse Mod.

<2> Using the rotary knob or step keys, open the window and move the reverse cursor in the window to"Ext".



<3> Press [Set] to accept "Ext" and close the window.

<4> Press [Digital] to light the key lamp and then start the pulse modulation.

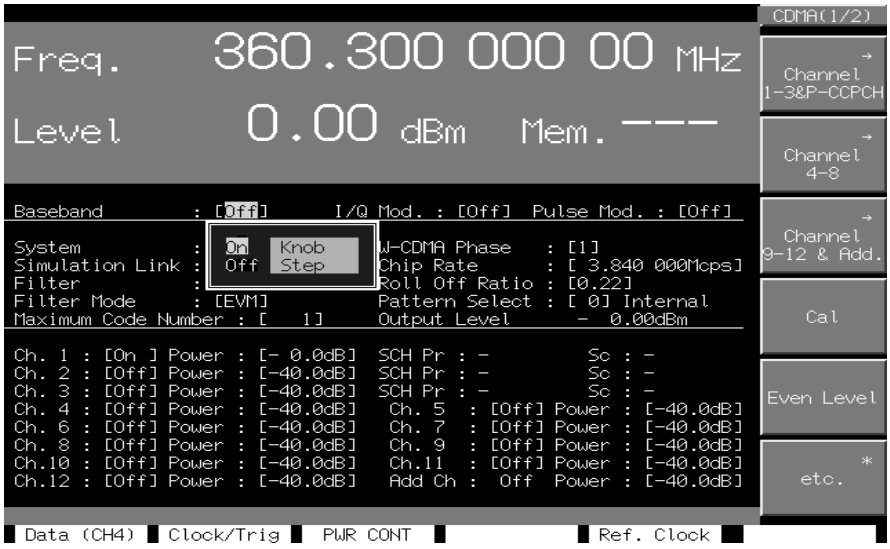
## Carry out Modulation with a Digital Modulation Unit

To set digital (vector) modulation with a built-in digital Modulation Unit, follow these steps:

Sample operation: Carry out digital (vector) modulation by using the built-in MU368040A CDMA digital modulation Unit and installed MX368041A W-CDMA software.

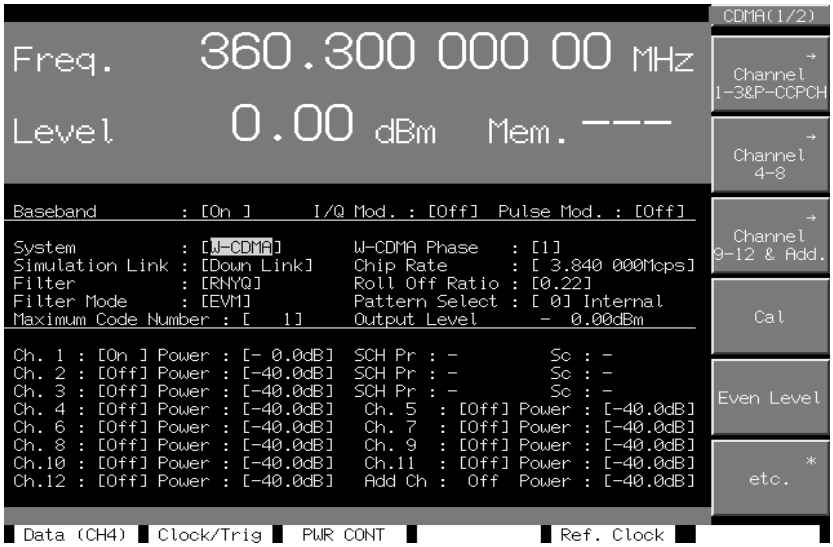
<1> Using the cursor keys, move the reverse cursor to the Baseband setup parameter.

<2> Using the rotary knob or step keys, open the window and move the reverse cursor in the window to “On”.



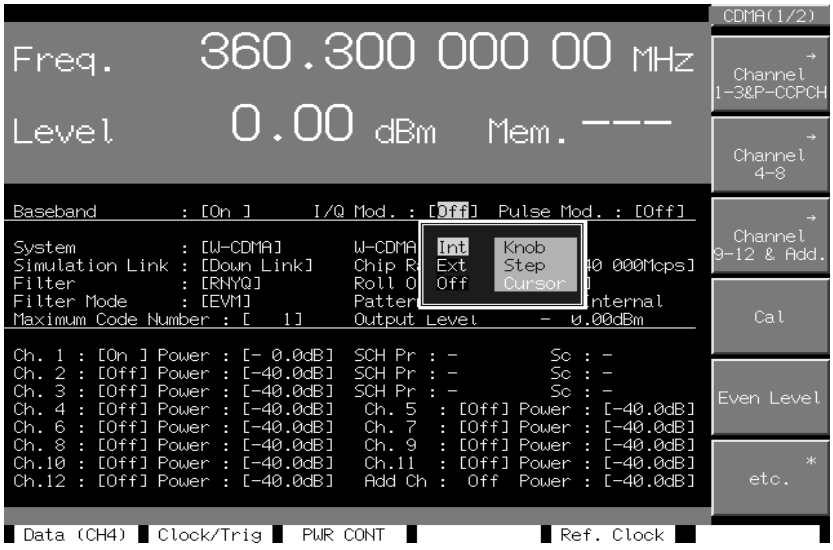

<3> Press Set to accept “Ext” and close the window.

<4> Move the reverse cursor to the setup parameters of modulation unit using the cursor keys and complete the setup. For more information, refer to the user’s guide pertaining to the digital modulation unit and each system software.




<5> Using the cursor keys, move the reverse cursor to the setup parameter of I/Q Mod.

<6> Using the rotary knob or step keys, open the window and move the reverse cursor in the window to"Int".




<7> Press Set to accept "Int" and close the window.

<8> Press Digital to start digital (vector) modulation with the key lamp turned on.

When the modulated signal of digital modulation unit is a burst wave, set the Pulse Mod. setup parameter to "Int".

## Changing Vector Quadurature Ratio

This section shows the procedure for changing the vector quadurature ratio during performing digital modulation using an external modulation signal and digital modulation unit.

Sample operation: Adjusting quadurature ratio to correct I and Q phases deviation when performing digital modulation using an external modulation signal

<1> Press Config to open the Configuration Setting screen.


<2> Press F1 (IF/RF Setup) to open the IF/RF Setup screen.


<3> Move the reverse cursor to RF Output Quadurature Skew.

<4> Adjust quadurature ratio using the step key or rotary knob.

Quadurature ratio settings are represented by unitless integers (–1000 to +1000). Quadurature ratio cannot be set with a quantitative value.

## Reversing the RF Spectrum

You can reverse the spectrum of the modulated RF signal by interchanging the I and Q signals.

Sample operation: Reversing the RF spectrum

<1> Press Config to open the Configuration Setting screen.


<2> Press F1 (IF/RF Setup) to open the IF/RF Setup screen.


<3> Move the reverse cursor to the RF Spectrum to open the setting window.

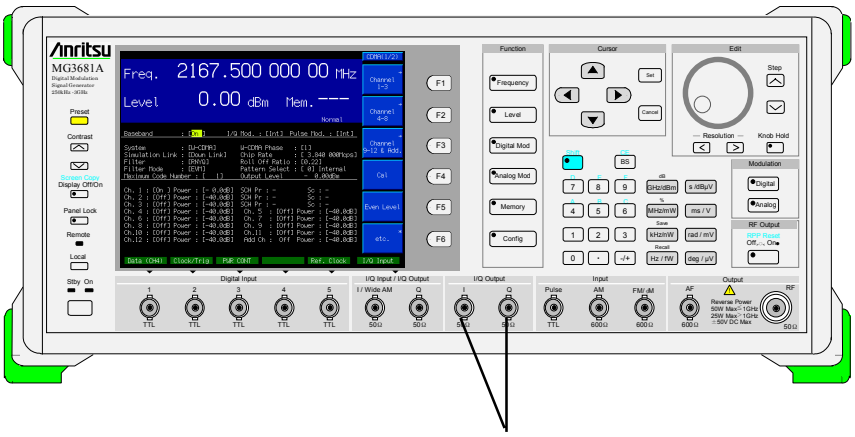
<4> Select “Reverse”, then press Set.

The I and Q signals for vector modulation will be interchanged and the RF signal spectrum will be reversed.

# 3.4 Setting the Baseband Signal Output

## 3.4.1 Outputting I/Q signals

I/Q signals generated by the digital modulation unit can be outputted from the I/Q signal connectors on the front panel.



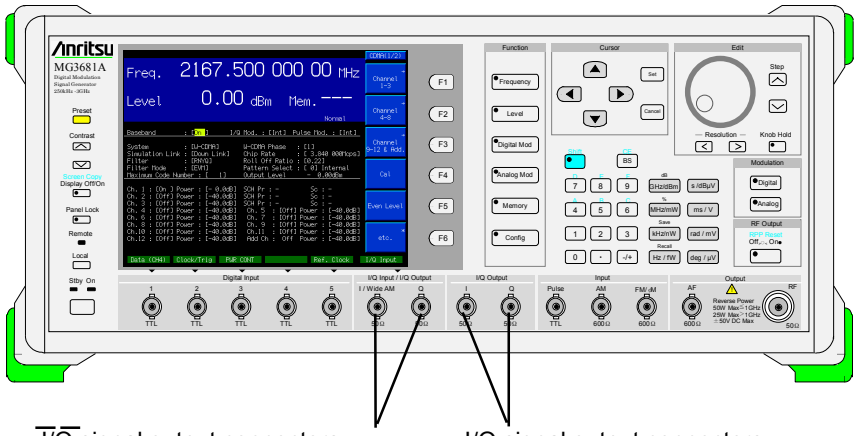

I/Q signal output connectors

The I/Q signal output connectors have an output impedance of 50Ω. Set a load impedance of 50Ω if the I/Q signal output connectors are used for I/Q signals.
The output signal level depends on the setting of the digital modulator. For more information, refer to the user's guide pertaining to the type of digital modulation unit and each system software used.

I/Q signals are outputted continuously when the Baseband setting is set to "On".

## Output Differential Signals I/Q

If the additional function of I/Q signal output option (option 11) is mounted, along with $\overline{I}/\overline{Q}$ signals, or I/Q signals can be outputted. The $\overline{I}/\overline{Q}$ signals are available from the front-panel $\overline{I}/\overline{Q}$ signal output connectors (which are also used as I/Q input connectors).

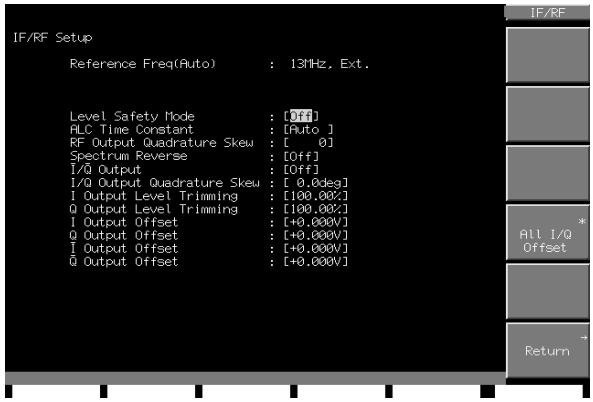



Sample operation: Output $\overline{I}/\overline{Q}$ signals .

<1> Press [Config] to open the configuration parameter setup screen.

<2> Press [F1] (IF/RF Setup) to open the IF/RF Setup screen.

<3> Move the reverse cursor to the $\overline{I}/\overline{Q}$ Output parameter.



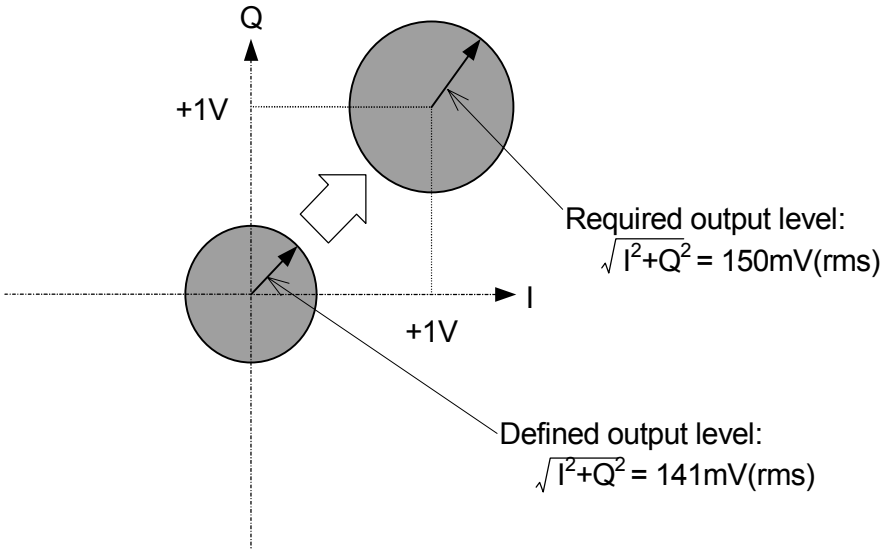

<4> Using the rotary knob or step keys, open the window and move the reverse cursor in the window to “On”.

<5> Press [Set] to accept “On” and close the window.

## Adjust I/Q Signal Output

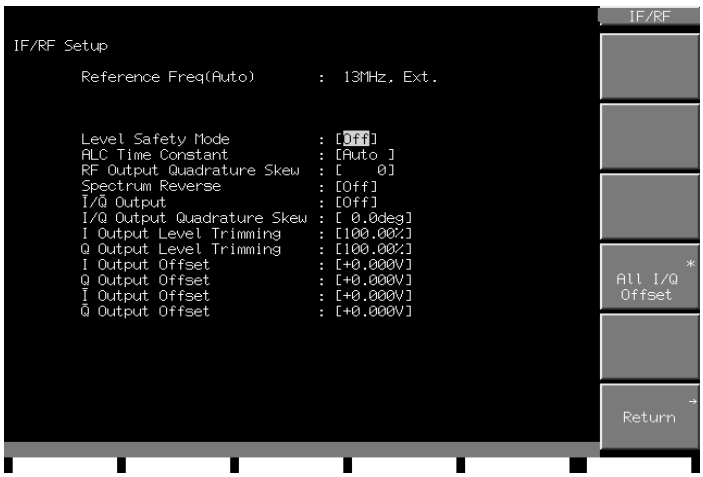
If the enhanced I/Q signal output option (option 11) is mounted, the output voltage, the DC offset, and guadrature of the I/Q and $\overline{I}$/$\overline{Q}$ signals can be varied.
The level is variable in a range of 80 to 120% of the output voltage defined by the setting of the digital modulation unit for the two sets of I, $\overline{I}$ and Q, $\overline{Q}$.
The DC offset is independently variable in a range of -0.5 to +1.5V of the output of I, $\overline{I}$ and Q, $\overline{Q}$.

Sample operation: Trim the guadrature of the I/Q signals after setting them to an output voltage of 150 mV (rms) and a DC offset of +1 V. (An output voltage of 141 mV (rms) defined by the setting of the digital modulation unit is assumed.)




<1> Press (Config) to open the configuration parameter setup screen.

<2> Press (F1) (IF/RF Setup) to open the IF/RF Setup screen.




<3> Move the reverse cursor to the I Output Level Trimming parameter.

<4> Using the numeric keypad, enter a numeric value of 106 (150 mV (rms)/141 mV (rms) × 100%).

<5> Press [%] [MHz/mW] to accept the numeric value and the units and close the window.

<6> Likewise, set the Q Output Level Trimming parameter to 106%.

<7> Move the reverse cursor to the I Output Offset parameter.

<8> Using the numeric keypad, enter a numeric value of 1.

<9> Press [ms/V] to accept the numeric value and the units and close the window.

<10> Likewise, set the Q Output Offset to 1 V.

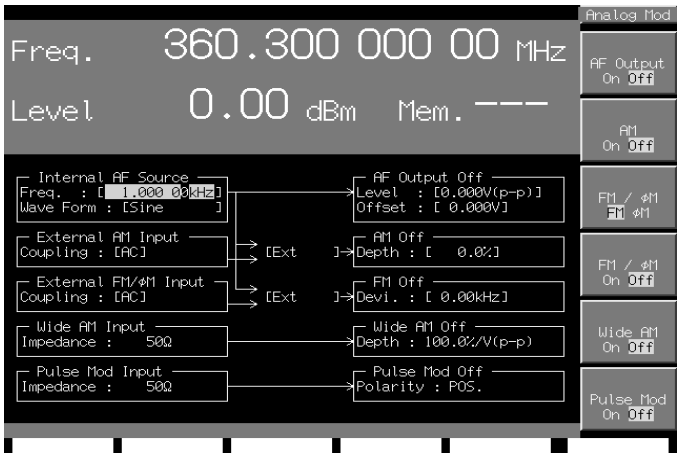
<11> Move the reverse cursor to the I/Q Quadrature Skew parameter.

<12> Using the rotary knob or step keys, vary the value of guadrature.

## 3.4.2 AF output

The AF output signal is output with an impedance of 600Ω. An AF synthesizer (option 21) is required to output the AF output signal.

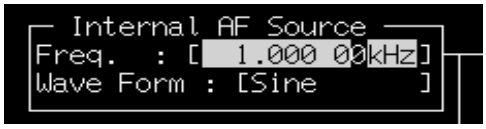
<1> Press [Analog Mod] to open the analog modulation setup screen.




<2> Press [F1] (AF Output On Off) to turn on the AF output signal. (There is no need to press [F1] if the reverse cursor is already at On.)

<3> Move the reverse cursor to the Internal Source Frequency setup parameter.

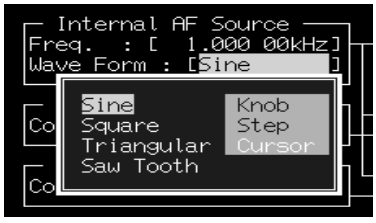
<4> Using the numeric keypad, set an optional numeric value. (A numeric value may also be set using the rotary knob or step keys.)




<5> Press a unit key or [Set] to accept the numeric value and the unit. The numeric values are accepted in the unit Hz when [Set] is pressed.

<6> Move the reverse cursor to the Internal AF Source Waveform setup parameter.

<7> Using the step keys, open the Waveform setup window.

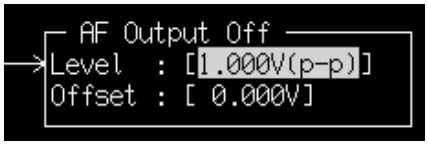


<8> Select an optional waveform from the item window and press Set to accept the waveform and then close the window.

<Waveform patterns>

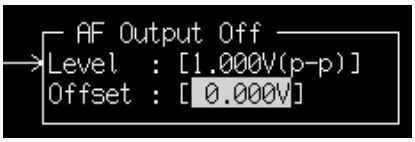
- Sine: Sine wave
- Square: Square wave
- Triangular: Triangular wave
- Saw Tooth: Sawtooth wave

<9> Move the reverse cursor to the AF Output On Level parameter.




<10> After entering an optional value with the numeric keypad, press a unit key or Set to accept the numeric value and the units.

<11> Move the reverse cursor to the AF Output On Offset parameter.




<12> After entering an optional value with the numeric keypad, press a unit key or Set to accept the numeric value and the units.

Numeric values may also be set using the rotary knob or step key.

# 3.5 Useful Features

## 3.5.1 Locking the panel

The panel lock feature disables all the keys, except for the front-panel power switch, the Local key, the Panel Lock key and the Contrast keys. With the panel locked, the user can perform measurement tasks with confidence, because the settings are protected against alteration due to inadvertent pressing of a key.

Press 

to lock the panel with the key lamp turned on.

If 

is pressed while a setup window is open, the screen is reset to the status it was in before the window was opened, and all the keys are disabled.

Press 

again to unlock the panel with the key lamp going off.

## 3.5.2 Backup feature

When the instrument is turned off, its current status is backed up in internal memory. When the instrument is turned on subsequently, the status in which the instrument was when it was turned off is recovered (except for data then being entered, remote state, data then being transferred by GPIB, RPP operating status, display transitions, and main function selection conditions).

## 3.5.3 Setting display features

### Display on/off feature

Press Display Off/On on the front panel to turn off the display so that electromagnetic radiation from the display surface can be reduced. When the display is off, all the keys are disabled, except for the power switch, the Local key, and the Contrast keys.

Press Display Off/On again to turn on the display.

### Contrast adjustment

The Contrast keys adjust the display contrast (brightness and darkness). Press ∧ to brighten the display or ∨ to darken it.

***Note:***

When the LCD screen consists of TFT, the contrast key is not provided.

### Screen saver

The screen saver launches when the instrument panel is left idle for a certain period of time, with the display being turned off. The backlight turns off at the same time. To set the screen saver, follow these steps:

Sample operation: Set the screen saver to be launched after 1 hour.

<1> Press Config to open the configuration parameter setup screen.

<2> Press F4 (Common Setup) to open the Common Setup screen.


<3> Using the rotary knob, move the reverse cursor to the Screen Saving Time setup parameter.

<4> Using the rotary knob, open the setup window.

<5> Using the rotary knob, move the reverse cursor to “1.0hour”.


<6> Press Set to accept the choice and close the setup window.

The setup window can also be opened and the reverse cursor can be moved by using the step keys.

## 3.5.4 Turning On/Off the Buzzer

You can turn on/off the buzzer that sounds to alert you to a wrong operation.

Sample operation: Turning off the buzzer

<1> Press Config to open Config Parameter Setting screen.

<2> Press F4 (Common Setup) to open the Common Setup screen.

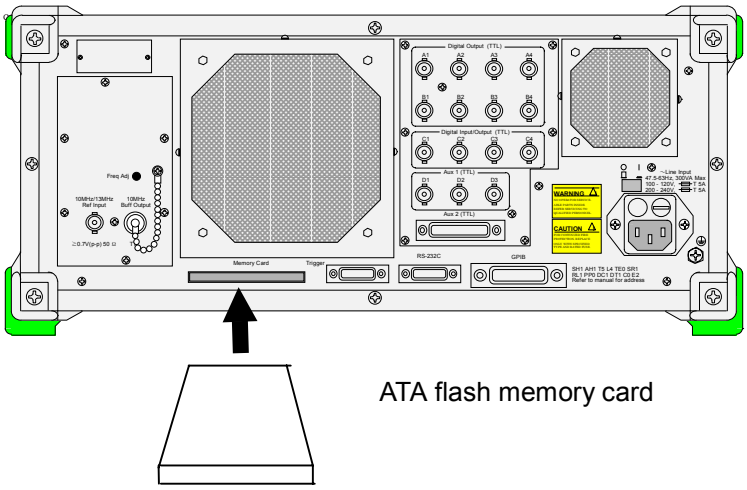

<3> Move the reverse cursor to the Buzzer Setup parameter.

<4> Move the reverse cursor to “Off” using the rotary knob or step key.

<5> Press Set to determine the setting and close the setting window.

## 3.5.5 Making a Hardcopy of the Screen

You can store the data displayed on the screen in the ATA flash memory card as a bitmap file. Insert the ATA flash memory card into the memory card slot in the rear panel of this unit.




With the target screen displayed, pressing Shift and then Screen Copy Display off/on stores the screen data in the root directory of the ATA flash memory card as a bitmap file. Bitmap file names are automatically assigned in the specified order:

SG00.bmp -> SG01.bmp -> SG02.bmp -> ...-> SG99.bmp.

After SG99.bmp is assigned to a bitmap file, SG00.bmp is assigned again to the next bitmap file.

When this unit is powered off and on again, the bitmap file names are assigned again starting with SG00.bmp and new bitmap files are overwritten the old ones.

Without an ATA flash memory card to be inserted in the memory card slot, the screen copy data is stored to the internal memory temporarily as a bit map data when Shift and Screen Copy Display off/on are pressed. After the ATA flash card is inserted, the bit map data stored in the internal memory can be saved to the ATA flash memory card by using the remote control. A device message “SCPEXP” is used.

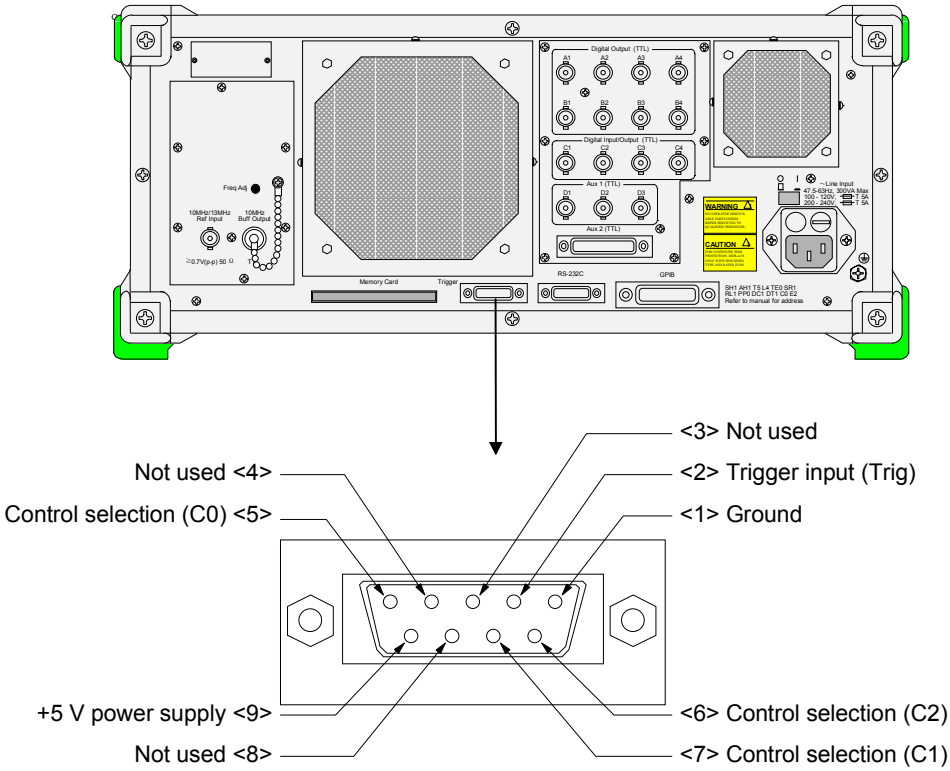
Refer to Section 4 for the details of the remote control and device messages.

In addition, the internally stored bit map data is erased if the next screen copy data is saved or this equipment is turned off.

## 3.5.6 Using a Trigger Function to Perform Remote Control

Using the trigger function, you can control the following eight operations with the TTL level signals input to the trigger connector on the rear panel of this unit.

- Frequency step down
- Output level step up
- Output level step down
- BPM recall address up
- RF recall address down
- RF output On
- RF output Off



Set the type of operation to be controlled by assigning to the control selection (C0 to C2) in advance as shown below, and the operation of the selected type is controlled at the falling edge of the trigger input (Trig).

| Input | | | | Operation |
|---|---|---|---|---|
| C2 | C1 | C0 | Trig | |
| L | L | L | ↓ | RF output Off |
| L | L | H | ↓ | RF output On |
| L | H | L | ↓ | Output level step down |
| L | H | H | ↓ | Output level step up |
| H | L | L | ↓ | Frequency step down |
| H | L | H | ↓ | Frequency step up |
| H | H | L | ↓ | BPM address down |
| H | H | H | ↓ | BPM address up |

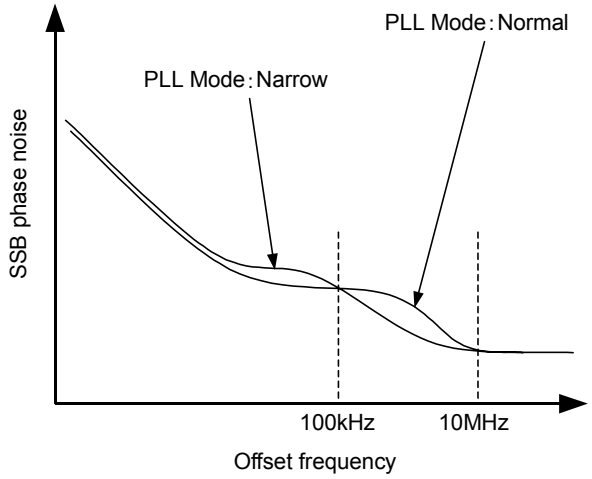
The +5 VDC power supplied from the trigger connector can be used as power for the external logic circuit and so on. The maximum current is 100 mA.

## 3.5.7 Changing the PLL mode

By changing the loop characteristics of the PLL synthesizer in the MG3681A, the SSB phase noise characteristics of the RF output can be changed.

PLL Mode Normal: The SSB phase noise characteristics at 100 kHz and near offset frequency is good.

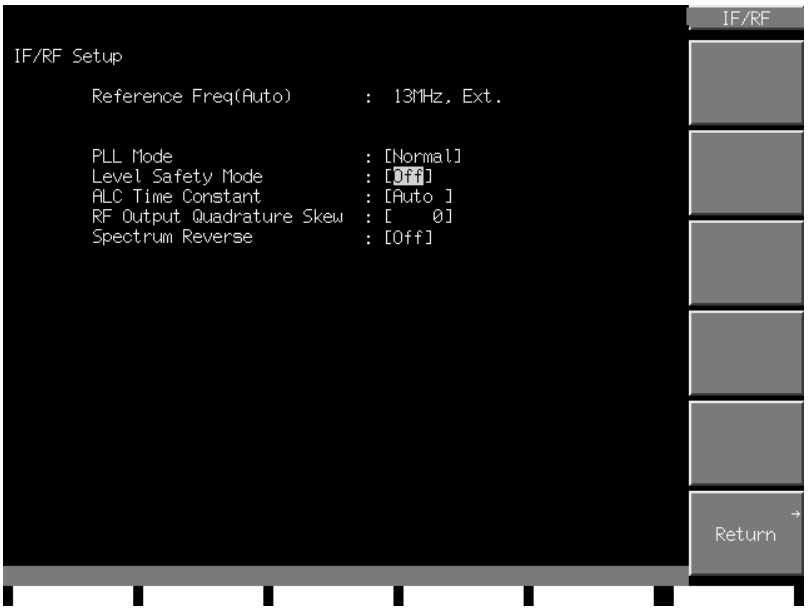
PLL Mode Narrow: The SSB phase noise characteristics at 100 kHz and far offset frequency is good.




Sample operation: Improves the SSB phase noise characteristics at far offset frequency in PLL Mode: Narrow.

<1> Press [Config] to open the Config. Parameter Setting screen.

<2> Press F1 (IF/RF Setup) to open IF/RF Setup screen.




<3> Move the reverse cursor at PLL Mode, then display the setup window.

<4> Select “Narrow”, and press Set .

The PLL Mode becomes Narrow, then the SSB phase noise at a few hundred kHz is improved.

## 3.5.8 Changing error message display mode in remote control

The MG3681A can select one of the following error-message display modes, as shown below.
See Section 4 for the remote control and error messages.

Remote Error Mode Normal: Error message is erased when the next command is received from the controller or the message of status change is displayed.

Remote Error Mode Remain: Error message is not erased if the next command is received from the controller.
If the message of status change is displayed, the error message is erased.

Remote Error Mode Stop: When a error is occurred in remote control, the error message is displayed and the following remote commands are refused to receive.
This stop status continues until the Local key is pressed for Local status.

Sample operation: Sets the Remote Error Mode to Remain, and the error message is remained.

<1> Press [Config.] to open the Config. Parameter Setting screen.


<2> Press F4 (Common Setup) to open the Common Setup screen.


<3> Move the reverse cursor to Remote Error Mode setting parameter.

<4> Using the rotary knob or step keys, move the reverse cursor to “Remain”.

<5> Press Set to accept “Remain” and close the set window.

# Section 4 Remote Control

This section describes the concepts of the instrument's remote control.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# 4.1 Overview

This instrument supports a GPIB interface (IEEE Standard 488.2-1987) and RS-232C interface so it can team up with an external controller to automate measurement tasks.

The remote control facility of this instrument does the following:

- Controls all functions, except for the front-panel power switch, Local key, Contrast key, and Panel Lock key.
- Recalls all the status and settings, except for contrast adjustment.
- Allows the GPIB address to be set from the panel.
- Raises interrupts and launches serial polls (GPIB).
- Allows uses of the interface to be chosen from the panel.
- Works in conjunction with an external controller or any other measuring instrument to build an automatic measurement system.

# 4.2 System Atization

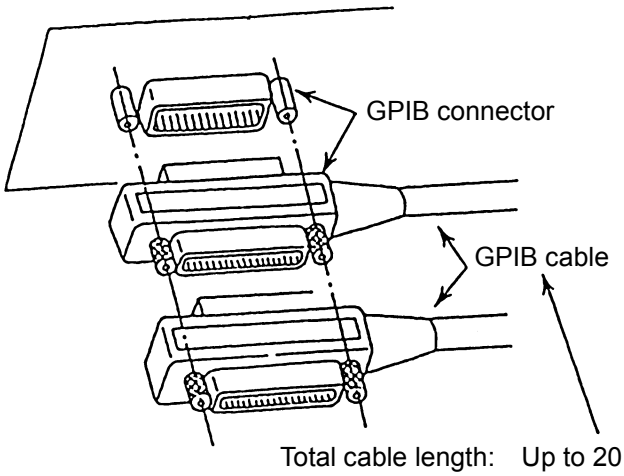
## 4.2.1 Connecting devices by a GPIB cable

Connect the GPIB connector on the rear panel of this equipment to the GPIB connector of an external device with a GIPB cable.

***Note:***

Be sure to connect the GPIB cable before turning the equipment power on.

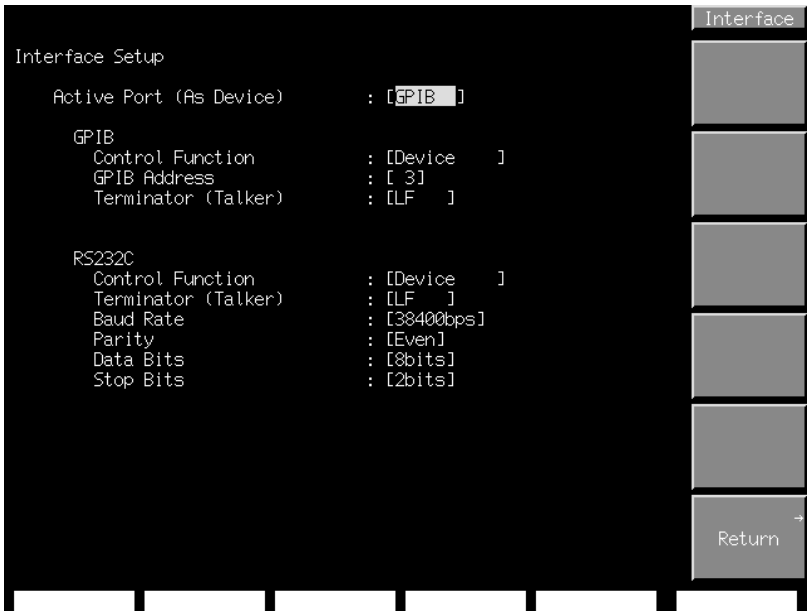
Up to 15 devices, including the controller, can be connected to one system. Connect devices as shown below.




Total cable length: Up to 20 m
Cable length between devices: Up to 4 m
Number of devices that can be connected: Up to15

## Set Up GPIB Interface Conditions

Press [Config], then [F3] (Interface Setup) to open the interface setup screen. GPIB interface conditions can be set up on this screen. To set up GPIB interface conditions, follow these steps:




<1> Active Port
Set “GPIB”.

<2> Control Function
Set “Device”.

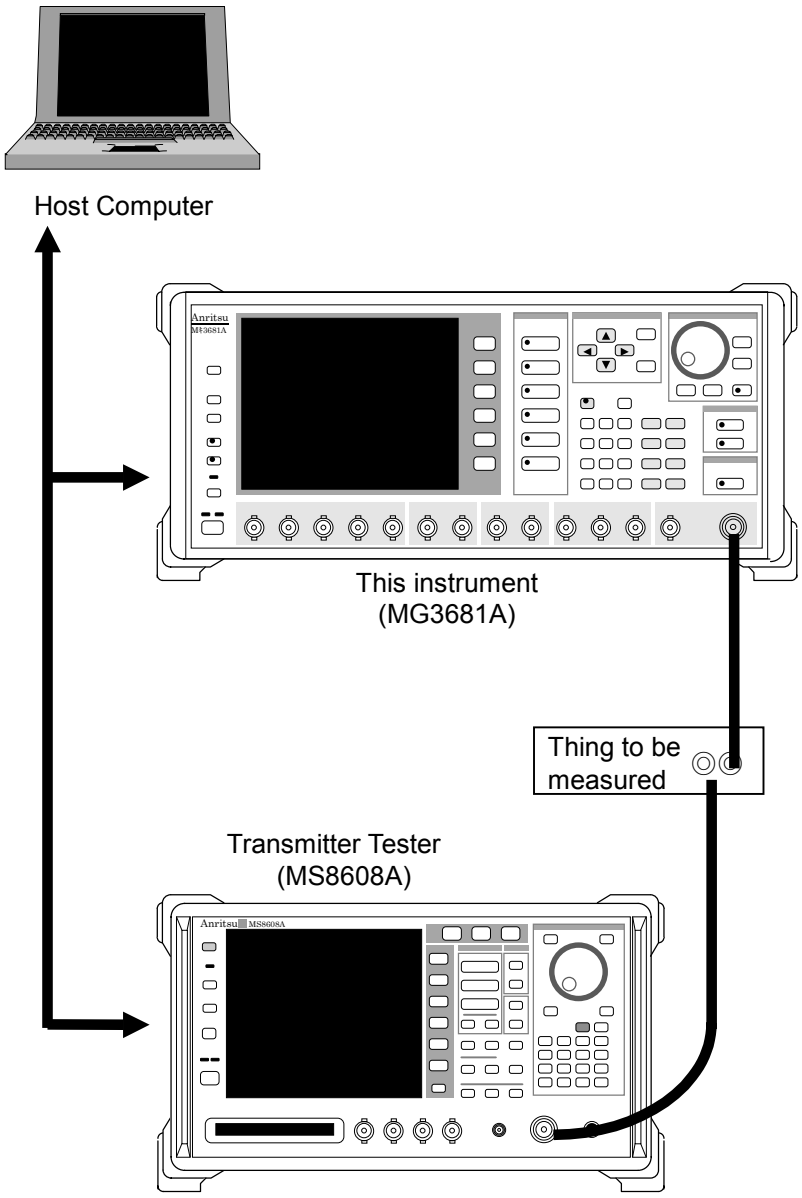
<3> GPIB Address
Set an optional address.
GPIB Address: 0 to 30

<4> Terminator (Talker)
Set a terminator as a talker.
Terminator: LF, CR/LF

## 4.2.2 Example of System Atization with GPIB

### Host computer control

When this instrument and the wave analyzer (e.g. MS8608A Digital Mobile Radio Transmitter Tester) are controlled from a host computer via GPIB, a performance test system can be configured.



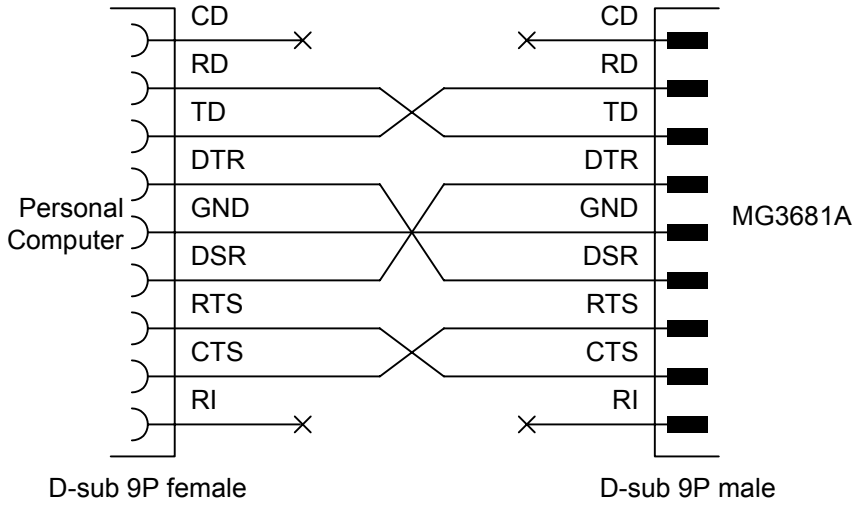
### 4.2.3 Connecting devices by a RS-232C cable

Connect the RS-232C connector at rear panel of the MG3681A to the RS-232C connector of the external device using a RS-232C cross cable.

***Note:***

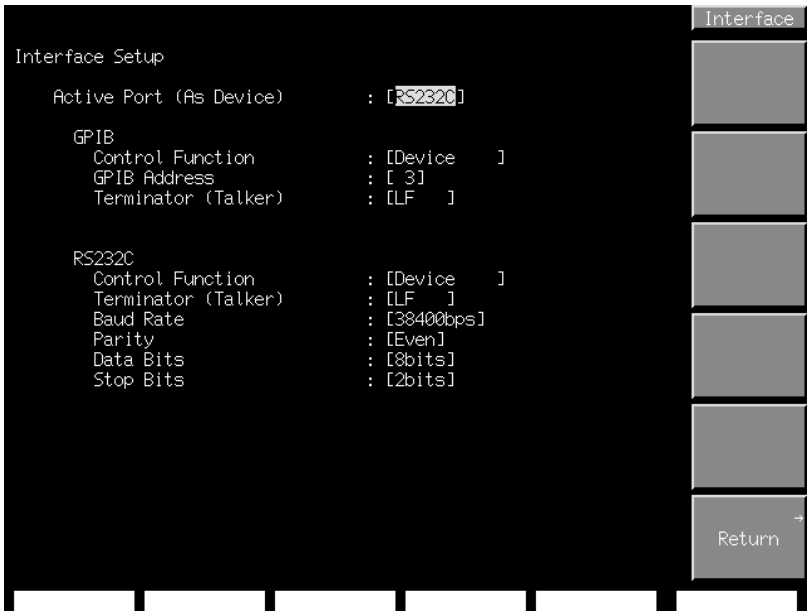
The connection of the RS-232C cable must be performed before turning on the power of the MG3681A.

- Connection to the IBM PC/AT compatible PC.



## Set Up RS-232C Interface Conditions

Press Config, then F3 (Interface Setup) to open the interface setup screen. RS-232C interface conditions can be set up on this screen. To set up RS-232C interface conditions, follow these steps:




<1> Active Port
Set “RS-232C”.

<2> Control Function
Set “Device”.

<3> Terminator (Talker)
Set a terminator as a talker.
Terminator: LF, CR/LF

<4> Baud Rate
Set a baud rate.
Baud Rate: 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps

<5> Parity
Set a parity bit.
Parity: Even, Odd, Off

<6> Data Bits
Set a data bit length.
Data bits: 7 bits, 8 bits

<7> Stop Bits
Set a stop bit.
Stop bits: 1 bit, 2 bits

# 4.3 Initialization

IEEE488.2 classifies the process of initializing a GPIB system into three levels and defines them as bus initialization, message exchange initialization, and device initialization. It also requires the devices to be initialized to predefined status when they are powered on. Details are given in the table below.

| Level | Kind of initialization | Summary | Level combination and sequence |
|---|---|---|---|
| 1 | Bus initialization | Initializes the interface functions of all the devices connected to the bus by issuing an IFC message from the controller. | Can be used with other levels, but level 1 initialization must be executed before level 2 initialization. |
| 2 | Message exchange initialization | Initializes message exchanges on all devices on the GPIB interface with GPIB bus command DCL (Device Clear) or on a selected device with GPIB bus command SDC (Sleeted Device Clear) and disables the function of reporting of the end of operations to the controller. | Can be used with other levels, but level 2 initialization must be executed before level 3 initialization. |
| 3 | Device initialization | ∗Resets a selected device on the GPIB interface to the status specific to that device, regardless of its past usage with the ∗RST command. | Can be used with other levels, but level 3 initialization must be executed before level 1 and 2 initializations. |

The discussions below focus on the commands used to execute level 1, 2, and 3 initializations and the resulting items initialized and the known status to which devices are initialized when powered on.

## 4.3.1 Initializing the bus with IFC commands

Explanation

IFC commands initialize the interface functions of all the devices connected to the GPIB bus line. Initialization of the interface functions is used for initializing the status (talker, listener, etc.) of the interface functions of the devices that have been configured by the controller. In the table below, the functions marked by ○ are initialized in their entirety; the functions marked by △ are initialized in part.

| No | Function | Symbol | IFC initialization |
|---|---|---|---|
| 1 | Source handshaking | SH | ○ |
| 2 | Acceptor handshaking | AH | ○ |
| 3 | Talker or extended talker | T or TE | ○ |
| 4 | Listener or extended listener | L or LT | ○ |
| 5 | Service request | SR | △ |
| 6 | Remote local | RL | |
| 7 | Parallel poll | PP | |
| 8 | Device clear | DC | |
| 9 | Device trigger | DT | |
| 10 | Controller | C | ○ |

The initialization of the device by IFC commands does not affect the operation status of the devices (such as frequency setting and lamp on/off states).

Use example

Use examples depend on the computer and the program being run. Refer to the relevant users documentation.

## 4.3.2 Initializing message exchanges with DCL and SDC bus commands

Explanation

Initializes message exchanges on all devices on the GPIB interface having a specified select code or on a selected device.

Items of message exchanges that are initialized

When this instrument receives DCL and SDC bus commands, it carries out the following functions:

<1> Input buffer and output queue: .....Cleared, along with the MAV bit.

<2> Parser, executive, and response generator ....Reset.

<3> Device commands containing ∗RST ....All commands that interfere with the execution of these commands are cleared.

<4> ∗OPC command processing .....Devices are put into the OCIS (Operation Complete Command Idle State) state. The Operation Complete bit cannot be set in the Standard Event Status register as a consequence.

<5> ∗OPC? query processing .....Devices are put into the OQIS (Operation Complete Query Idle State) state. The Operation Complete bit can be set to 1 in the output queue as a consequence.

<6> Device function .....All portions pertaining to message exchanges are kept idle. The device continues to wait for messages from the controller.

Use example

Use examples depend on the computer and the program being run. Refer to the relevant users documentation.

***Note:***

The execution of DCL and SDC bus commands does not affect the following:

- Current device settings and data that has been saved
- Front panel status
- Status of status bytes other than the MAV bit
- Ongoing operations of devices

## 4.3.3 Initializing devices with the ∗RST command

Format ∗RST

Explanation One of the IEEE488.2 common commands, the ∗RST (Reset) command gives Level 3 initialization to a device.
The ∗RST (Reset) command is used to initialize the device (this instrument) to a pre-defined status.

***Note:***

The execution of the ∗RST command does not affect the followings:

- IEEE4488.1 interface status
- Device address (this instrument's GPIB address)
- Output queue
- Service Request Enable register
- Standard Event Status Enable register
- Power-on-Status-Clear flag
- Calibration data affecting specifications of the device (this instrument).
- Setup parameters pertaining, for example, to the control of external equipment

Application example Use examples depend on the computer and the program being run. Refer to the relevant users documentation.

### 4.3.4 Status in which the device (this instrument) goes into when powered on

The device (this instrument), when powered on, goes into the following status:

<1> The device is set in the status in which it was when it was last turned off. The device, however, is reset to its defaults (see Appendix C) when it is turned on while holding down Preset on the front panel.

<2> The input buffer and output queue are cleared.

<3> The parser, executive, and response generator are reset.

<4> The device is put into the OCIS (Operation Complete Command Idle State) state.

<5> The device is put into the OQIS (Operation Complete Query Idle State) state.

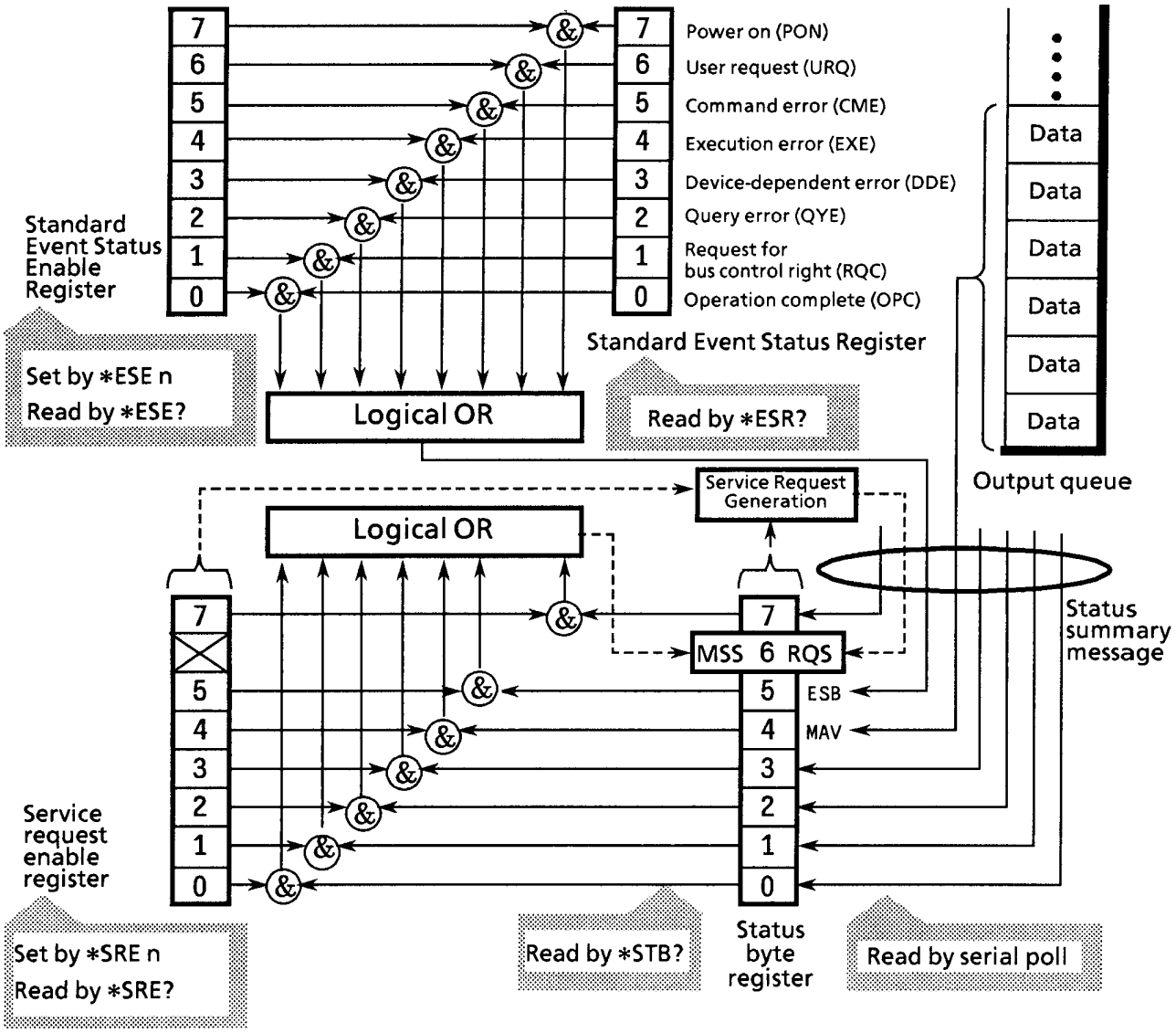
<6> The standard Event Status register and the Standard Event Status Enable register are cleared. Events are recorded after they are cleared.

# 4.4 Status Structure

The status byte (STB) that is transmitted to the controller is based on the specifications of IEEE488.1. Its component bits are called a "status summary message" and provide a summary description of the current data stored in the registers and queues.

## 4.4.1 IEEE488.2 standard status model

The standard model in the status structure defined by IEEE488.2 is shown below.



In the status model, an IEEE488.1 status byte is used as the lowest-level status, which consists of seven summary message bits that are supplied from an upper status structure. The status data structure is organized into a register model and a queue model to generate these summary message bits.

| Register model | Queue model |
|---|---|
| A set of registers used to keep a record of the events and conditions that have been encountered in the device. Its structure is built of an Event Status register and an Event Status Enable register. If their AND operation results in non-zero, the corresponding bit of the status byte is set to 1; otherwise, it is set to 0. If their OR operation results in 1, the corresponding summary bit is set to 1; otherwise, it is set to 0. | A queue used to keep a sequential record of status or information. In the queue structure, a bit is set to 1 only if data exists at the corresponding position in the queue; otherwise, a bit is 0. |

On the basis of the register model and the queue model thus explained, the standard model in the IEEE488.2 status data structure is assembled of two kinds of register models and one queue model.

<1> Standard Event Status register and Event Status Enable register

<2> Status Byte register and Standard Event Enable register Output queue

| Standard Event Status register | Status Byte Register | Output Queue |
|---|---|---|
| The Standard Event Status register is structured in the register model described above. Among all the events that the device may encounter, this register holds bits that represent eight kinds of standard events: <1> power-on, <2> user request, <3> command error, <4> execution error, <5> device-dependent error, <6> query error, <7> bus control request, and <8> operation complete. Bit 6 (DIO6) of the Status Byte Register works as an OR output bit to report an Event Summary Bit (ESB) summary message. | The Status Byte register holds an RQS bit seven summary message bits from the status data structure. Bit 6 (DIO7) of the Service Request Enable register is system-reserved as an RQS bit to report a service request to the external controller. The mechanism of this SRQ conforms to the specifications of IEEE488.1 | The Output Queue is structured in the queue model described above. Bit 4 (DIO5) of the Status Byte Register works as a Message Available (MAV) summary message to report the availability of data in the output buffer. |

## 4.4.2 Status Byte (STB) register

The STB register consists of an STB device and an RQS (or MSS) message.

### ESB and MAV summary messages

The ESB and MAV summary messages are described below.

#### ESB summary message

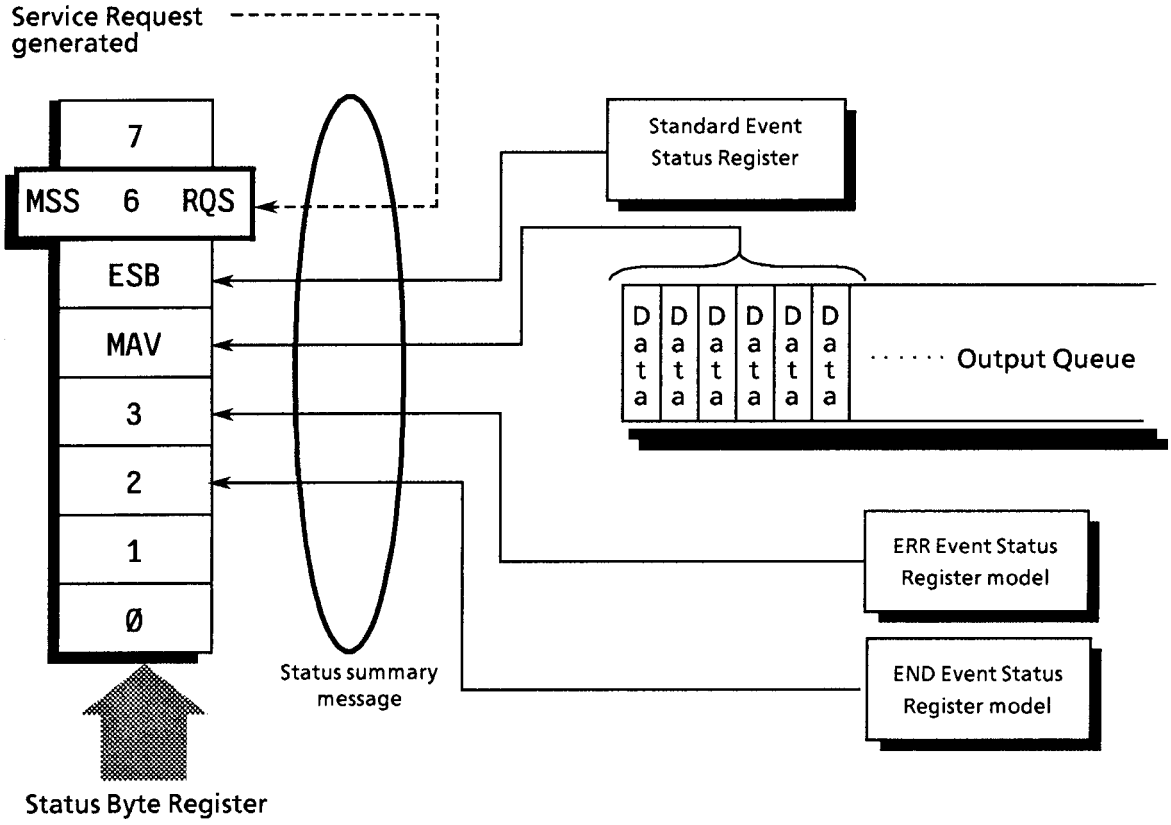
The ESB (Event Summary Bit) summary message is a message defined by IEEE488.2. It is reported by STB register bit 5. The ESB summary message is set to 1 when any one of the bits registered in the Standard Event Status register is set to 1 where event occurrence is enabled. The ESB summary bit is in turn set to 0 when none of the events registered in the Status Event Status register occur where event occurrence is enabled.

#### MAV summary message

The MAV (Message Available) summary message is a message defined by IEEE488.2. It is reported by STB register bit 4. This bit indicates whether the output queue is empty or not. It is used by the device to synchronize message exchanges with the controller. For example, the controller might transmit a query command to the device and wait for MAV to be set to 1. If reading from the output queue is begun without first checking MAV, all system bus actions are deferred until the device responds.

### 4.4.3 Device-dependent summary messages

Bit 0, bit 1, and bit 7 are not used in this instrument, but bits 2 and 3 are used as Event Status register summary bits. The Status Byte register is described below.



## 4.4.4 Reading from and clearing the STB register

The STB register is read from by serial polling or by using an ∗STB? query. Either way, an STB message as defined by IEEE488.1 is read, but the value that is transmitted to bit 6 (position) varies with each method used. The STB register can be cleared using the ∗CLS command.

### Use Serial Polling to Read from the STB Register

If serial polling is implemented under IEEE488.1, a 7-bit status byte and an RQS message bit based on IEEE488.1 are returned. Serial polling does not alter the value of the status byte. The device will set the RQS message bit to 0 immediately on polling.

### Use an ∗STB Common Query to Read from the STB Register

Issuing an ∗STB common query causes the device to transmit a response message, in the integer format, comprising the MSS (Master Summary Status) message in the STB register. Hence, a response to ∗STB? matches one to serial polling, except that an MSS summary message appears at the bit 6 position, instead of an RQS message.

### Define ∗MSS (Master Summary Status)

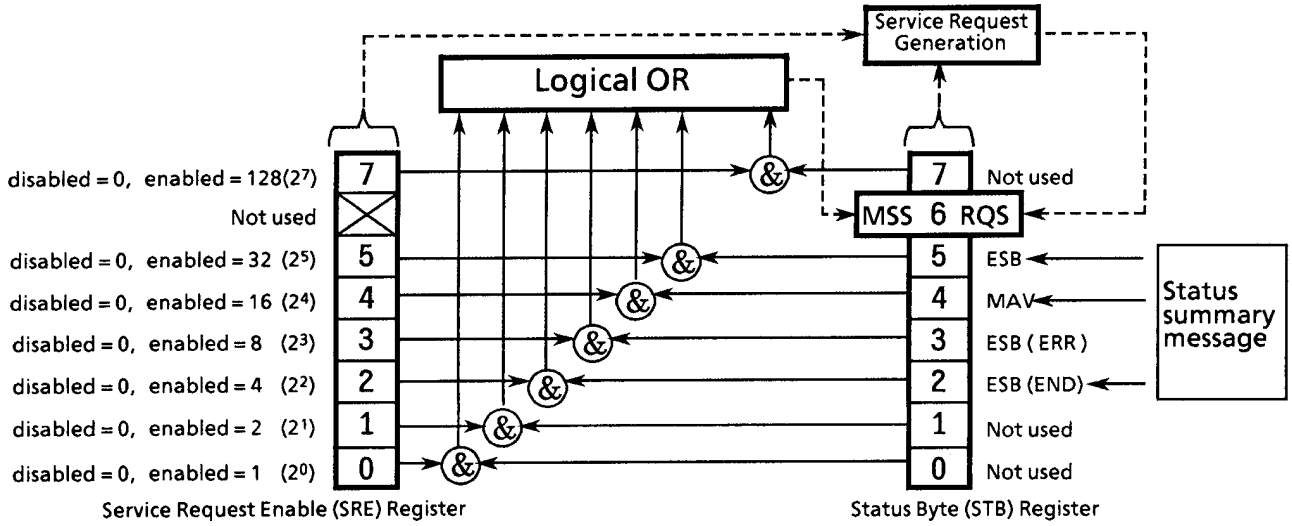
The MSS message indicates that the device has at least one service request condition. The MSS message appears at the bit 6 position as a device response to an ∗STB query, but not as a response to serial polling. It must not be viewed as part of the IEEE488.1 status byte. MSS is built by totally ORing the bits of the STB register and the SRQ Enable (SRE) register with one another.

### Use the ∗CLS Common Command to Clear the STB Register

The ∗CLS common command clears the entire status structure and also summary messages responding to it. The execution of ∗CLS does not affect the settings of the enable registers.

## 4.4.5 Service request (SRQ) enable operation

Bits 0 to 7 of the Service Request Enable (SRE) register control whether the corresponding bits of the STB register will generate an SRQ or not. The SRB register bits are associated with the STB register bits. If the STB register bit associated with a SRE register bit that is 1 is set to 1, the device sets the RQS bit to 1, issuing a service request to the controller.




### Read from the SRE register

The SRE register is read from using an ∗SRE? common query. A response message to this query is given as an integer between 0 and 255, equaling the sum of the values of the SRE register bits.

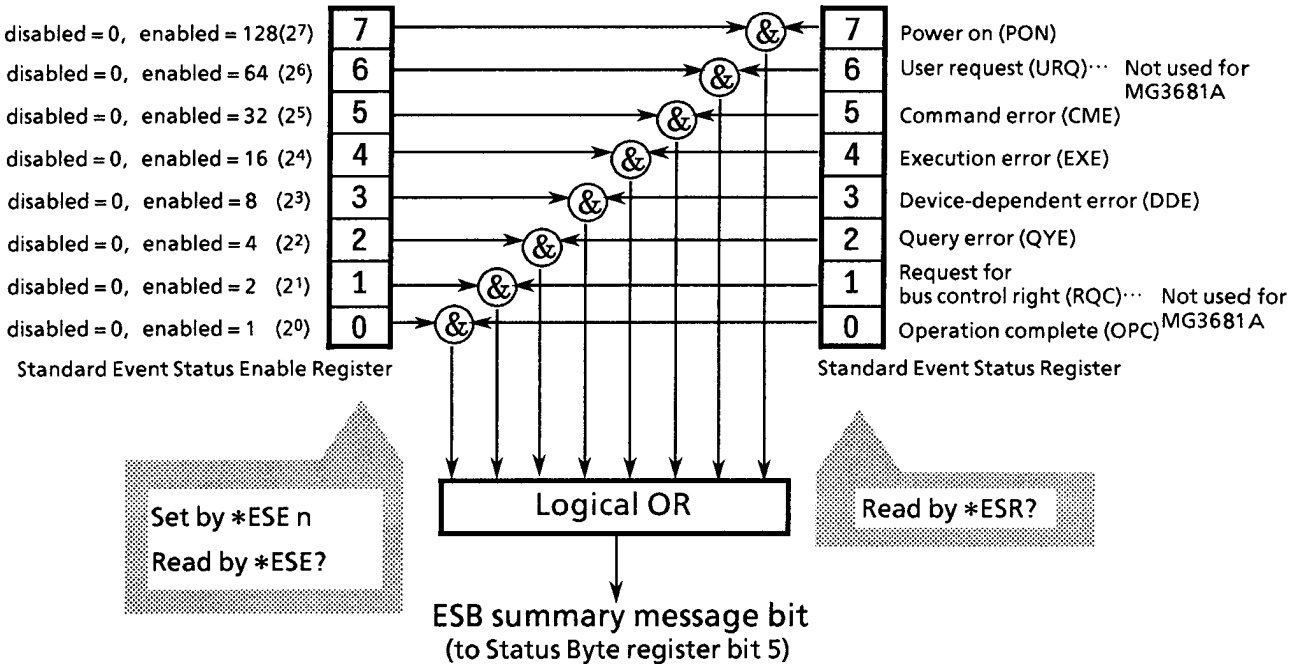
### Update the SRE register

The SRE register is written to using an ∗SRE common command with an integer between 0 and 255 as a parameter and with the SRE register bits being set to 0 or 1. The value of bit 6 is ignored.

## 4.4.6 Standard Event Status register

### Bit definitions of the Standard Event Status register

The operations of the Standard Event Status register are shown below.




The Standard Event Status Enable (ESE) register specifies which bit of the Event Status register will cause a summary message to become true when it is set.

| bit | Event name | Explanation |
|---|---|---|
| 7 | Power-on (PON) | Power transition from Off to On |
| 6 | Not used | — |
| 5 | Command error (CME) | Illegal program message or misspelled command received |
| 4 | Execution error (EXE) | Legal yet unexecutable program message received |
| 3 | Device-dependent error (DDE) | Error caused by a condition other than CME, EXE, and QYE (such as a parameter error) |
| 2 | Query error (QYE) | Attempt to read data from the output queue when it is empty or queued data lost before it is read |
| 1 | Not used | — |
| 0 | Operation complete (OPC) | Set to 1 when this instrument has processed the *OPC command. |

## Reading from, Writing to, and Clearing the Standard Event Status register

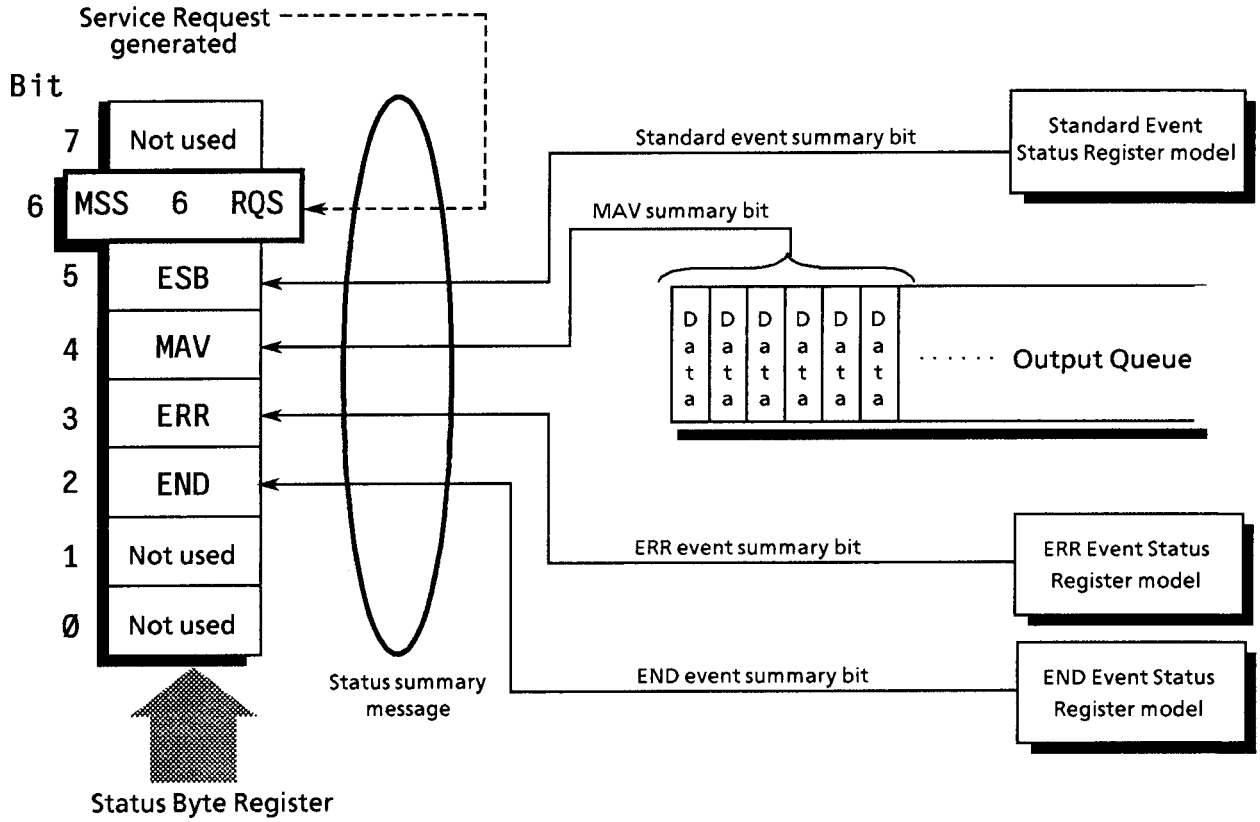
| | |
|---|---|
| Read | This register is read from using an ∗ESR? common query. It is cleared when read from. A response message is given as a binary-weighted sum of the event bits to a decimal integer. |
| Write | Except for clear, this register cannot be written externally. |
| Clear | This register is cleared when:<br><1> The ∗CLS command is received.<br><2> The power is turned on (bit 7 is turned on, with all other bits being cleared to 0).<br><3> An event is read in response to an ∗ESR? query command. |

## Reading from, Writing to, and Clearing the Standard Event Status Enable register

| | |
|---|---|
| Read | This register is read from using an ∗ESE? common query. A response message is given as a binary-weighted sum of the event bits to a decimal integer. |
| Write | This register is written to using an ∗ESE common command. |
| Clear | <1> An ∗ESE command with a data value of 0 is received.<br><2> The power is turned on.<br>The contents of the Standard Event Status Enable register are not affected by the following:<br><1> IEEE488.1 device clear function state changes<br><2> Receipt of an ∗RST common command<br><3> Receipt of a ∗CLS common command |

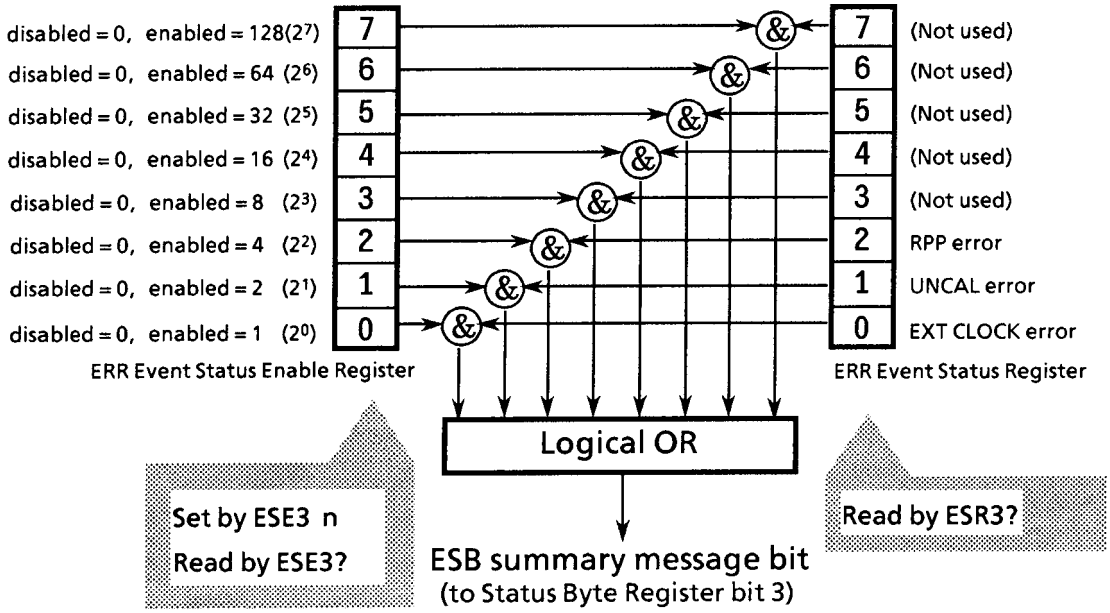
## 4.4.7 Extended Event Status register

This instrument has bit 1, bit 2, and bit 7 unused and has bits 2 and 3 assigned as an END and an ERR summary bit for use as status summary bits that are available from the extended register model.



## ERR Event Status register bit definitions

The operations of the ERR Event Status register are shown below.

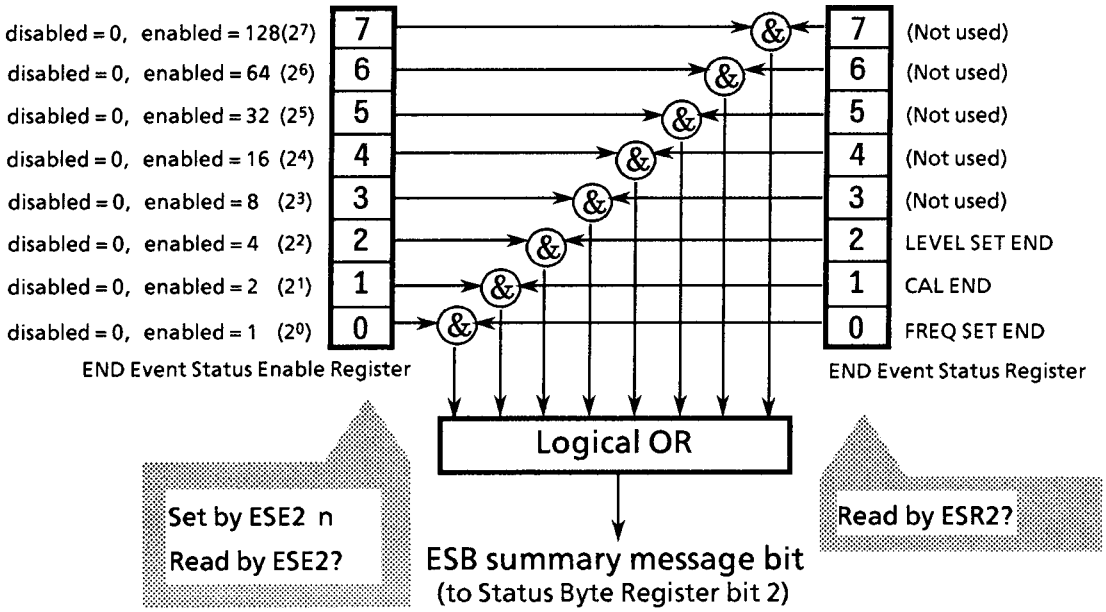



The ERR Event Status Enable register specifies which bit of the Event Status register will cause a summary message to become true when it is set.

| bit | Event name | Explanation |
|---|---|---|
| 7 | Not used | Not used |
| 6 | Not used | Not used |
| 5 | Download error | Set to 1 when a download of system or other data has failed. |
| 4 | Not used | Not used |
| 3 | PLL Unlock error | Set to 1 when a hardware error (PLL Unlock) is detected. |
| 2 | RPP | Set to 1 when the reverse power relay is tripped. |
| 1 | UNCAL error | Set to 1 when the output level is set to UNCAL. |
| 0 | External clock error | Set to 1 when the external modulation clock input signal is no longer valid. |

## END Event Status register bit definitions

The operations of the END Event Status register are shown below.




The END Event Status Enable register specifies which bit of the Event Status register will cause a summary message to become true when it is set.

| bit | Event name | Explanation |
|---|---|---|
| 7 | Not used | Not used |
| 6 | Not used | Not used |
| 5 | Download end | Set to 1 when a download of system or other data has ended. |
| 4 | BPM sweep end | Set to 1 when a BMP sweep has ended. |
| 3 | Not used | Not used |
| 2 | Level setting end (LEVEL SET END) | Set to 1 when level setting has ended. |
| 1 | Level CAL end (CAL END) | Set to 1 when level CAL has ended. |
| 0 | Frequency setting end (FREQ SET END) | Set to 1 when frequency setting has ended. |

## Reading from, Writing to, and Clearing the Extended Event Status register

| | |
|---|---|
| Read | This register is read from using an ESR2? or ∗ESR3? common query. It is cleared when read from. A response message is given as a binary-weighted sum of the event bits to a decimal integer. |
| Write | This register cannot be written to externally except that it is cleared. |
| Clear | This register is cleared when:<br><1> The ∗CLS command is received.<br><2> The power is turned on.<br><3> An event is read in response to an ∗ESR? query command. |

## Reading from, Writing to, and Clearing the Extended Event Status Enable register

| | |
|---|---|
| Read | This register is read from using an ESE2? or ESE3? query. A response message is given as a binary-weighted sum of the event bits to a decimal integer. |
| Write | This register is written to using an ∗ESE2 or ESE3 program command. Since register bits 0 to 7 are weighted to 1, 2, 4, 8, 16, 32, 64, and 128, respectively, write data is transmitted in the form of an integer representing a sum total of the desired bit digits. |
| Clear | This register is cleared when:<br><1> An ESE2 or ESE3 program command with a data value of 0 is received.<br><2> The power is turned on.<br>The contents of the Extended Event Status Enable register are not affected by the following:<br><1> IEEE488.1 device clear function state changes<br><2> Receipt of an ∗RST common command<br><3> Receipt of a ∗CLS common command |

## 4.4.8 Synchronizing This Instrument with the Controller

Because this instrument handles specified program messages each as a sequential command (completing each command before proceeding to process the next), one-to-one synchronization between this instrument and the controller does not require special consideration.

In order for the controller to be able to control multiple devices while keeping them synchronized, it is necessary to let the instrument complete all the commands that have been given to it before transmitting commands to other devices.

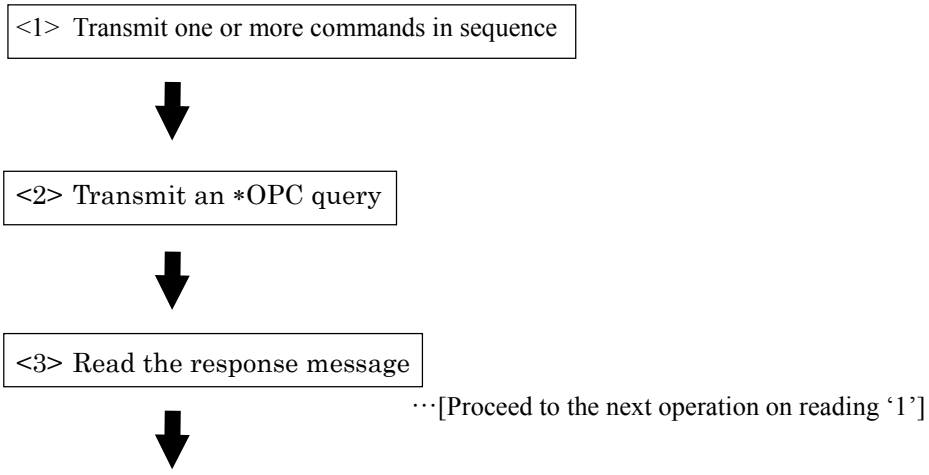
There are two ways to achieve synchronism between this instrument and the controller as follows:

<1> ∗OPC query response wait
<2> ∗OPC SRQ interrupt wait

### ∗OPC Query Response Wait

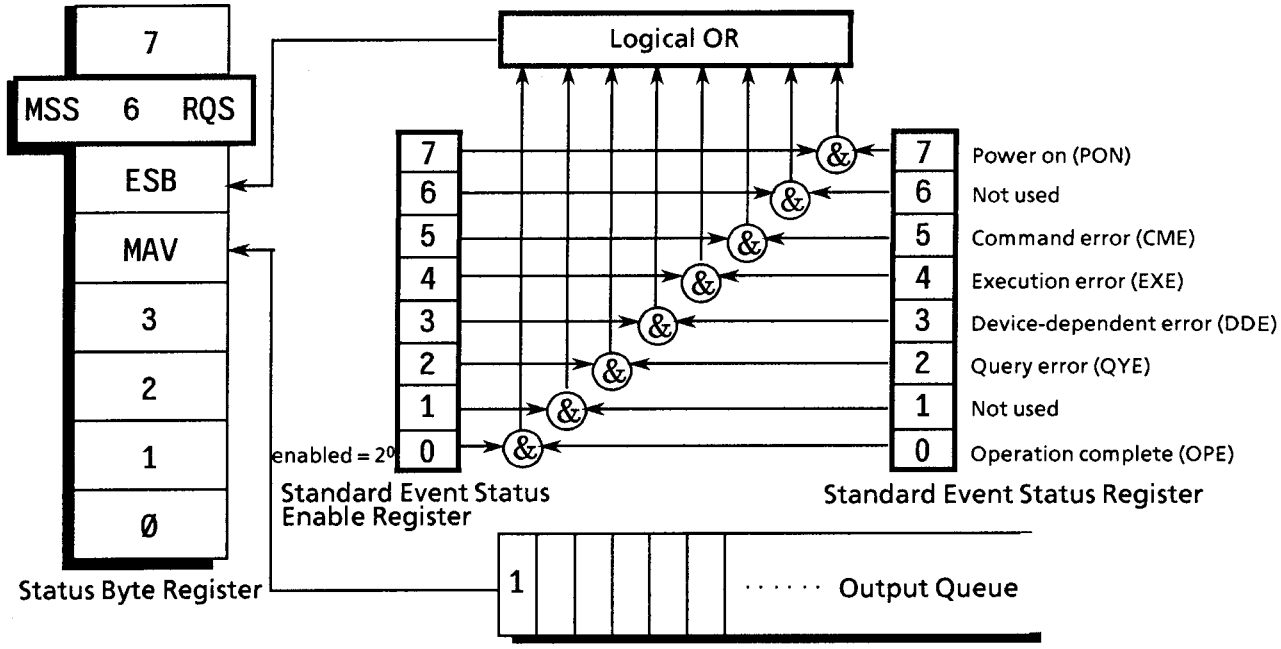
This instrument generates '1' as a response message when it has executed an ∗OPC query. The controller achieves synchronism by waiting for the arrival of this response message.

Controller program



## ∗OPC Service Request Wait

This instrument sets the Operation complete bit (bit 0) of the Standard Event Status register when it has executed an ∗OPC command. The controller achieves synchronism by waiting for the arrival of an SRQ interrupt.




Controller program

<1> Set bit $2^0$ of the Standard Event Status Enable register to Enable.

↓

<2> Set bit $2^5$ of the Service Request Enable register to Enable.

↓

<3> Let the device (this instrument) execute a specified operation.

↓

<4> Transmit an ∗OPC command.

↓

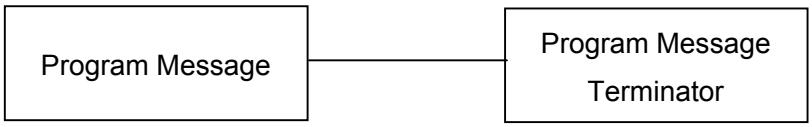
<5> Wait for an SRQ interrupt to occur (ESB summary message)

# 4.5 Device Message Details

## 4.5.1 Program message formats

Among all device messages, those that are transmitted from the controller to this instrument are called “program messages”. Program messages fall into two groups: program commands (commands), which set or specify instrument parameters, and program queries (queries), which request for parameters and measurement results.

An example of transmitting a program message from a controller program to this instrument with a PRINT or any other statement is shown below.

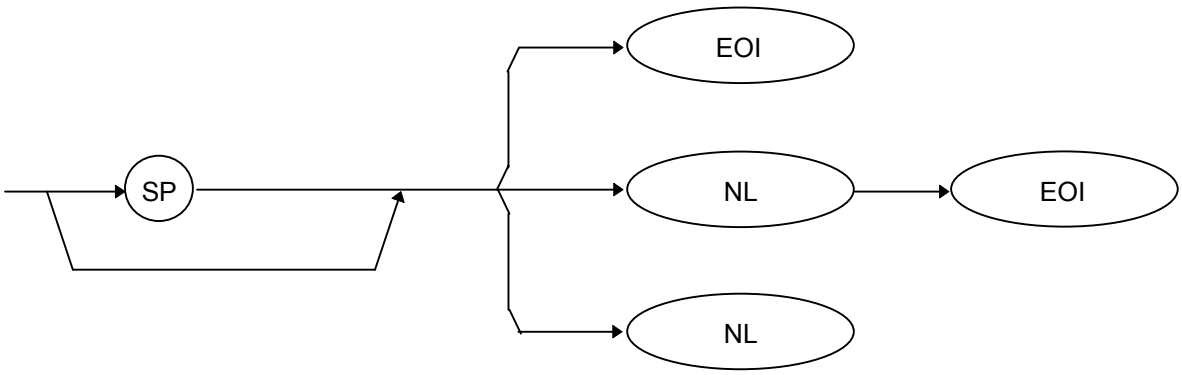



PRINT @1;”FREQ 1GHZ”

Program message

A program message, when transmitted from the controller to this instrument, is terminated by a specified terminator.

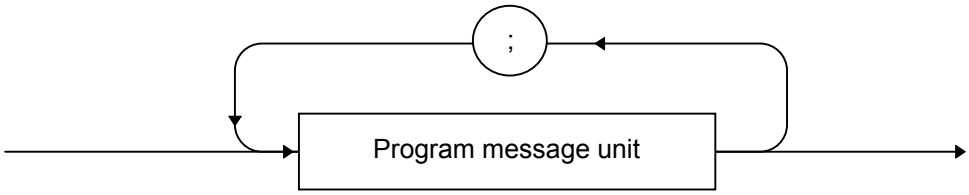
### Program Message Terminator




NL: New Line, also called Line Feed (LF).

CR (Carriage Return) is ignored without being processed as a terminator.

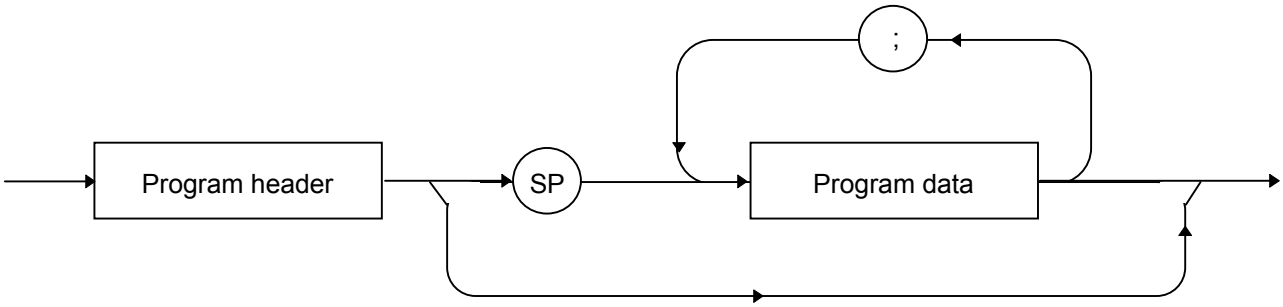
## Program Message




<Example>
PRINT @1; “FREQ 1GHZ; OVLV 0DBM”

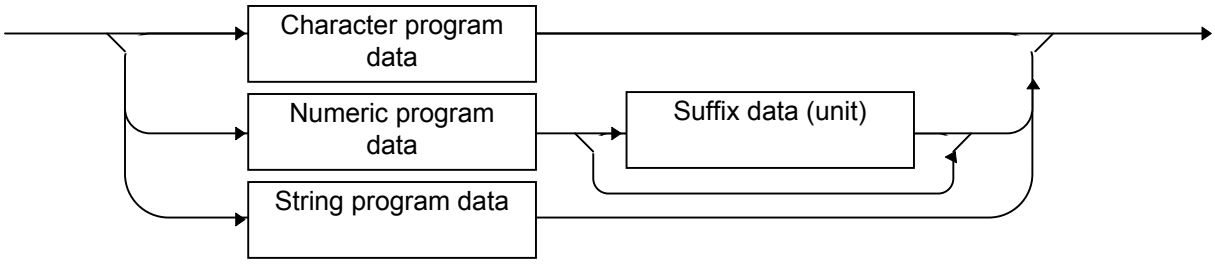
Multiple commands can be transmitted separately by separating them with semicolons (;).

## Program Message Unit




The program header of each IEEE488.2 common command begins with an asterisk (∗). The program header of each program query (query) generally ends with a question mark (?).

## Program Data




## Character Program Data

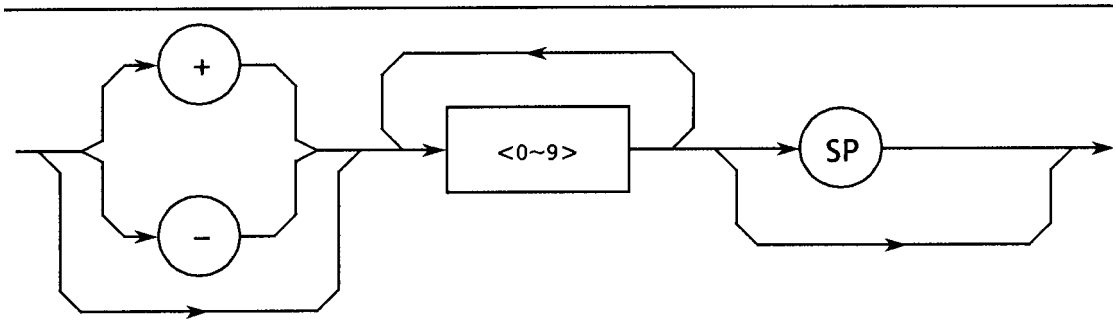
Defined strings of data are composed of any of the alphabetical lower case and upper case characters A to Z, the digits 0 through 9, and the underscore (_).

<Examples>
VDSPL TERM: Sets the output level voltage for display as a terminating voltage.
HEAD OFF: Attaches no header to the response message.

## Numeric Program Data

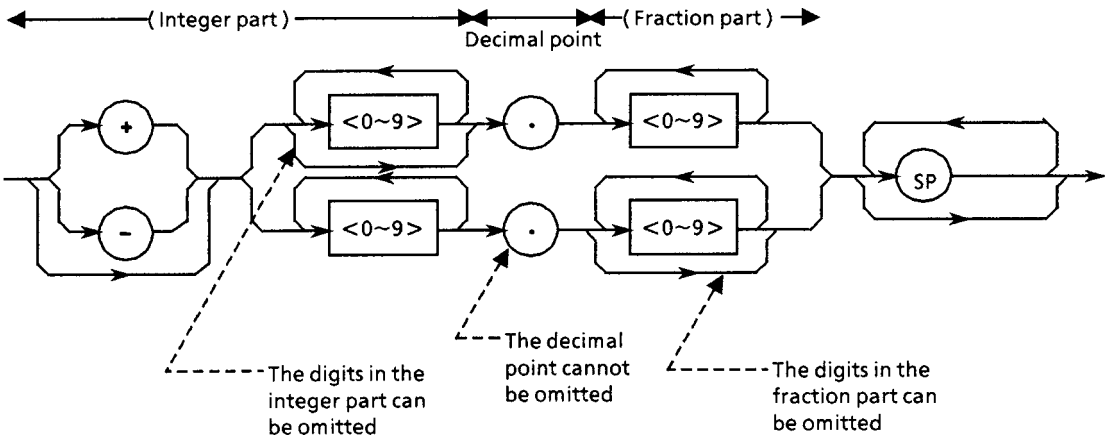
Numeric program data is grouped into four types: integral (NR1), fixed-point decimal (NR2), floating-point decimal (NR3), and hexadecimal.

## Integral (NR1)



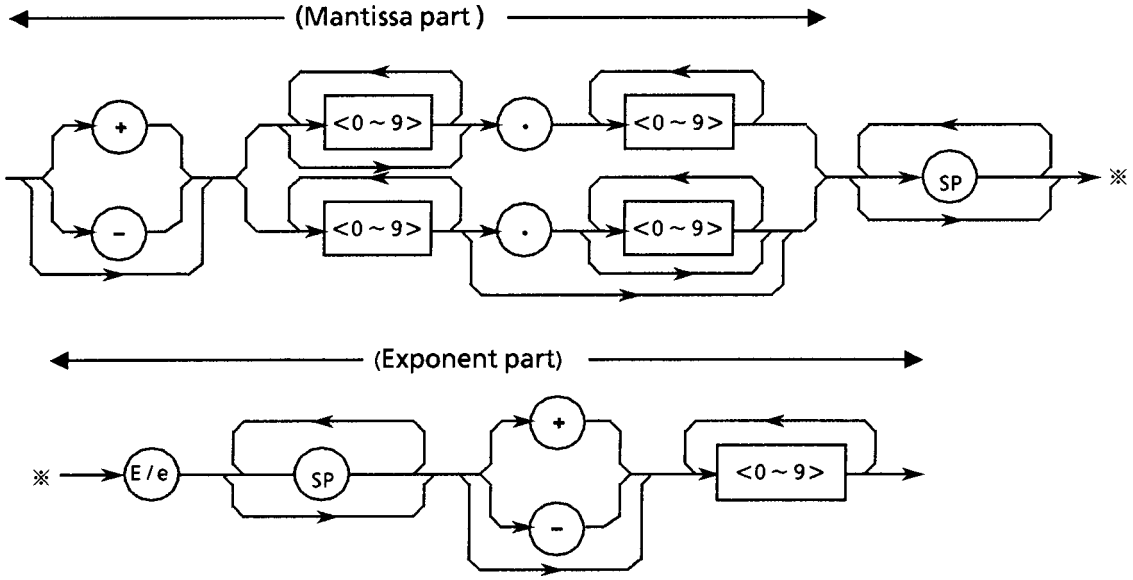

- Integral data can have leading zeros (e.g., 005, +005, –20).
- No space is allowed between a sign (+ or –) and the numeric value that follows it.
- The + sign can be omitted (e.g., 005, +005, –20).

## Fixed-point decimal (NR2)




- An integer is represented in the integral part.
- No space is allowed between a digit and the decimal point that follows it.
- The + sign can be omitted.
- The digit 0 in the integral part may be omitted.
- Any number of zeros may precede the numeric value in the integral part (e.g., –0.5, +.204, –5).

## Floating-point decimal (NR3)



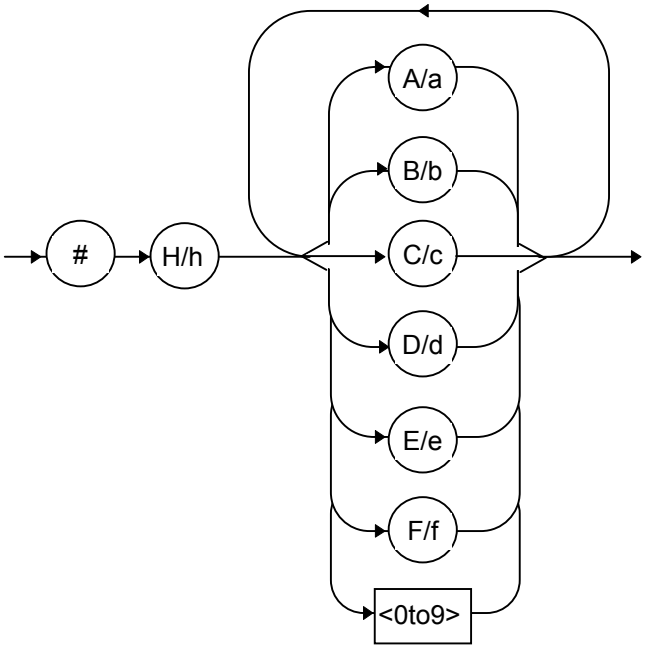

- E denotes raising to the power of 10, or the exponent part.
- Spaces are allowed both before and after, only before or only after E/e.
- A numeric value is required in the mantissa part.
- The + sign can be omitted (from both the mantissa and exponent parts).

<Examples>

$-22.34E+6 \rightarrow -22.34 \times 10^{6}$ (= −22340000)

$5.3e-4 \rightarrow 5.3 \times 10^{-4}$ (= 0.00053)

## Hexadecimal Data

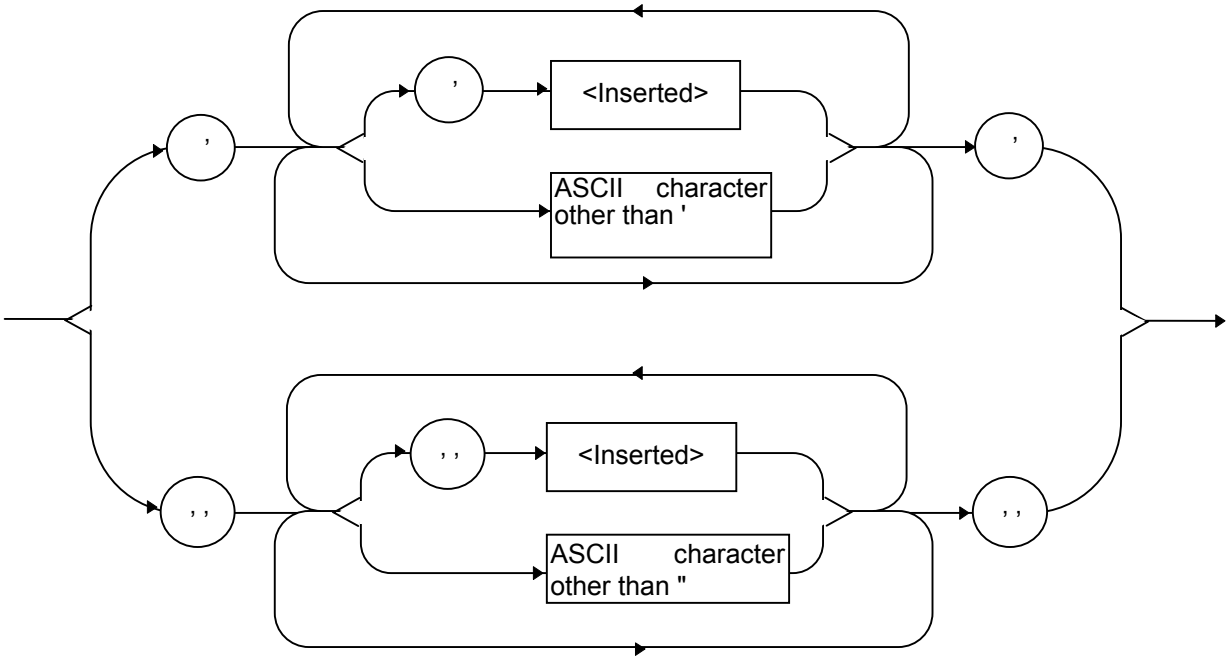


## Suffix Data

The table below lists the suffixes that are used in this instrument.

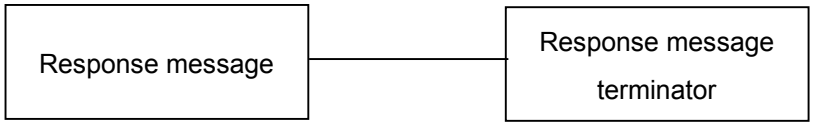
| Category | Unit | Suffix code |
|---|---|---|
| Frequency | GHz | GHZ, GZ |
| | MHz | MHZ, MZ |
| | kHz | KHZ, KZ |
| | Hz | HZ |
| Output level | dB | DB |
| | dBm | DBM |
| | dBμV | DBU |
| | V | V |
| | mV | MV |
| | μV | UV |
| | mW | MW |
| | aW | AW |
| | μW | UW |
| | nW | NW |
| | pW | PW |
| | fW | FW |
| Deviation (angle) | rad | RAD |
| | deg | DEG |

## String Program Data

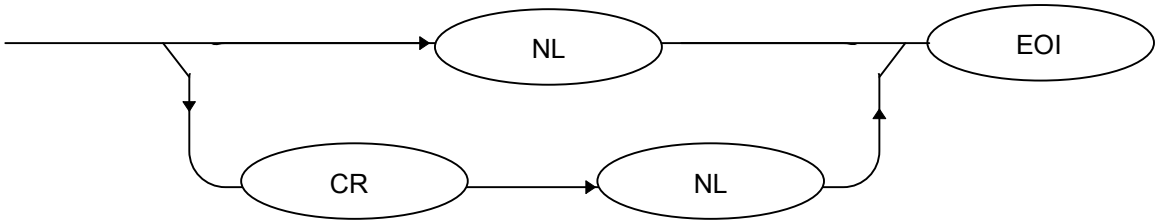


## 4.5.2 Response message formats

The formats in which the controller transmits response messages from this instrument by way of INPUT and other statements are described below.

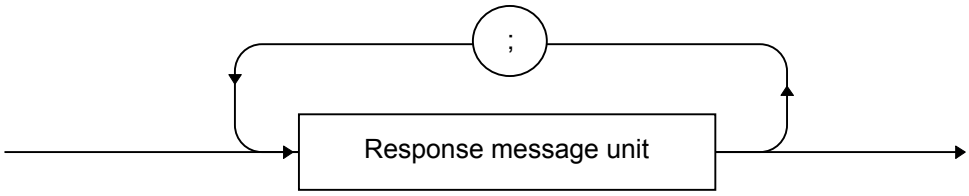



### Response Message Terminator



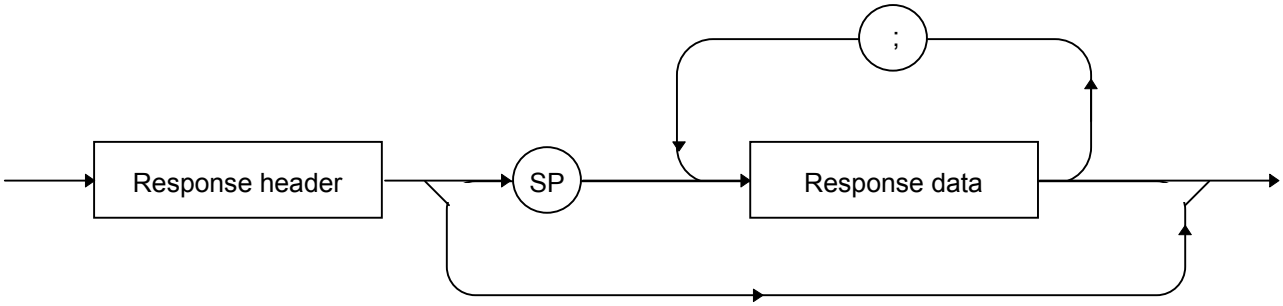

Use a TRM command to specify whether a response message or a terminator is used.

### Response Message

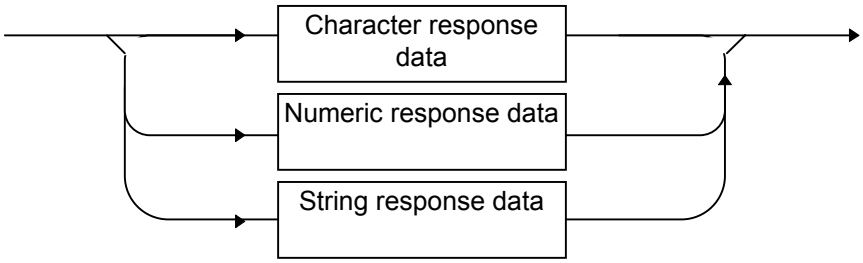



A response message is composed of one or more response message units to one or more program queries issued with one PRINT statement.

### Normal Response Message Unit



## Response Data

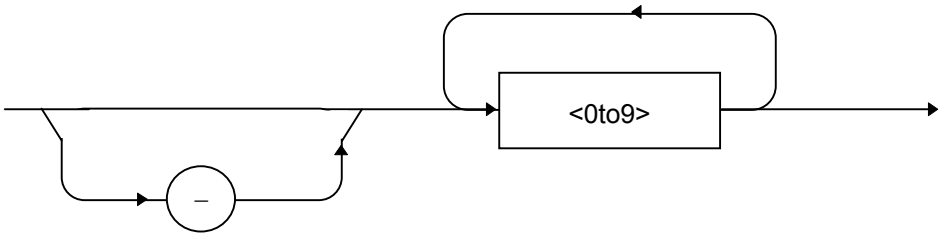



## Character Response Data

Defined strings of data are composed of any of the alphabetical lower case and upper case characters A to Z, the digits 0 through 9, and the underscore (_).

## Numeric Response Data

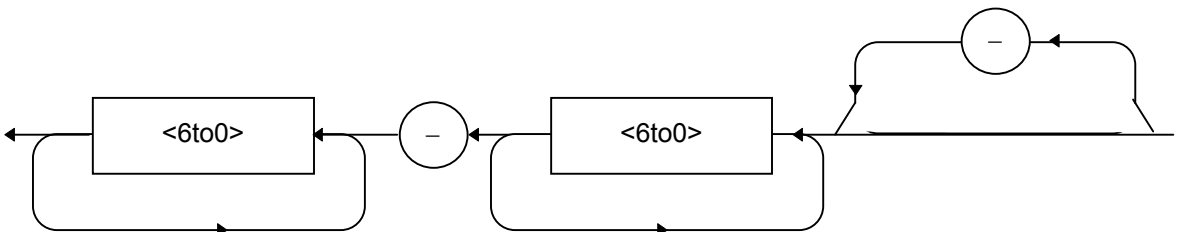
### Integral (NR1)




- The leading digit must be non-zero.

<Example>
123, –1234

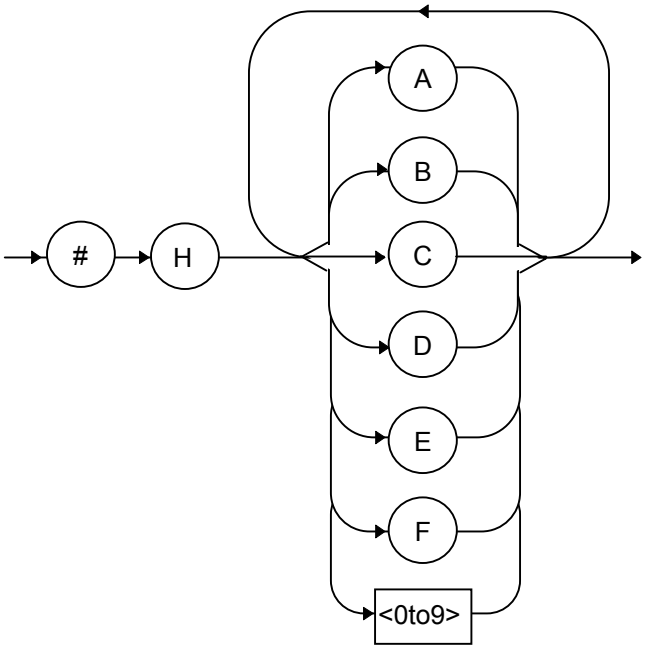
### Fixed-point decimal (NR2)



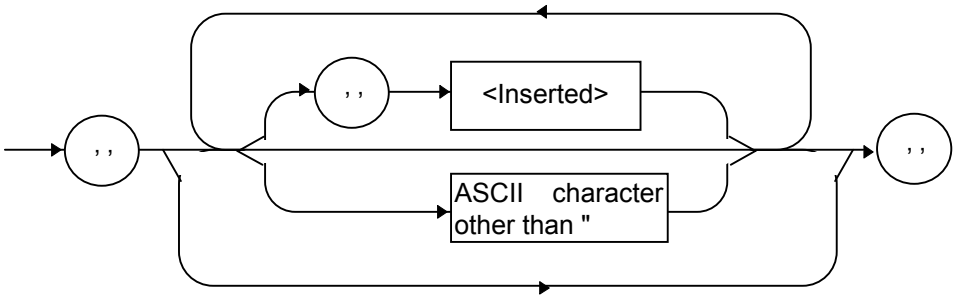

- The leading digit must be non-zero.
- A fixed-point decimal number having a value of 0 in its decimal place is outputted as an integer.

<Example>
12.34, –12.345

### Hexadecimal Data




### String Response Data



## 4.5.3 Common commands and supported commands

The table below lists the 39 kinds of common commands that are defined by the IEEE488.2 standard. The commands marked by a double circle are IEEE488.2 commands used with this instrument.

| Mnemonic | Full command name | IEEE488.2 default | Supported command |
|---|---|---|---|
| ∗AAD | Accept Address Command | Optional | |
| ∗CAL? | Calibration Query | Optional | |
| ∗CLS | Clear Status Command | Required | ◎ |
| ∗DDT | Define Device Trigger Command | Optional | |
| ∗DDT? | Define Device Trigger Query | Optional | |
| ∗DLF | Disable Listener Function Command | Optional | |
| ∗DMC | Define Macro Command | Optional | |
| ∗EMC | Enable Macro Command | Optional | |
| ∗EMC? | Enable Macro Query | Required | ◎ |
| ∗ESE | Standard Event Status Enable Command | Required | ◎ |
| ∗ESE? | Standard Event Status Enable Query | Required | ◎ |
| ∗ESR? | Standard Event Status Register Query | Optional | |
| ∗GMC? | Get Macro Contents Query | Required | ◎ |
| ∗IDN? | Identification Query | Optional | |
| ∗IST | Individual Status Query | Optional | |
| ∗LMC? | Learn Macro Query | Optional | |
| ∗LRN? | Learn Device Setup Query | Required | ◎ |
| ∗OPC | Operation Complete Command | Required | ◎ |
| ∗OPC? | Operation Complete Query | Optional | |
| ∗OPT? | Option Identification Query | Required if not C0 | ◎ (to be supported in future) |
| ∗PCB | Pass Control Back Command | Optional | |
| ∗PMC | Purge Macro Command | Optional | |
| ∗PRE | Parallel Poll Register Enable Command | Optional | |
| ∗PRE? | Parallel Poll Register Enable Query | Optional | |
| ∗PSC | Power On Status Clear Command | Optional | |
| ∗PSC? | Power On Status Clear Query | Optional | |
| ∗PUD | Protected User Data Command | Optional | |
| ∗PUD? | Protected User Data Query | Optional | |
| ∗RCL | Recall Command | Optional | |
| ∗RDT | Resource Description Transfer Command | Optional | |
| ∗RDT? | Resource Description Transfer Query | Optional | |
| ∗RST | Reset Command | Required | ◎ |
| ∗SAV | Save Command | Optional | |
| ∗SRE | Service Request Enable Command | Required | ◎ |
| ∗SRE? | Service Request Enable Query | Required if DT1 | ◎ |
| ∗STB? | Read Status Byte Query | Required | ◎ |
| ∗TRG | Trigger Command | Required | ◎ |
| ∗TST? | Self Test Query | Required | ◎ |
| ∗WAI | Wait to Continue Command | Required | ◎ |

***Note:***

All IEEE488.2 common commands begin with an asterisk (∗).

## 4.5.4 Common commands classified by group function

The table below lists the IEEE488.2 common commands supported by this instrument as classified by group function.

| Group | Group function | Mnemonic |
|---|---|---|
| System data | Provides information dependent on a device connected to the GPIB system (such as its manufacturer's name, type name, and serial number). | ∗IDN? |
| Internal action | Controls the internal action of a device.<br><1> Level 3 device reset<br><2> Internal device self-testing and error detection | ∗RST<br>∗TST? |
| Synchronization | Achieves synchronism between the device and controller in the following ways:<br><1> Service request wait<br><2> Device output queue response wait<br><3> Forced sequential execution | ∗OPC<br>∗OPC?<br>∗TRG<br>∗WAI |
| Status and event | The status byte consists of a 7-bit summary message, the individual summary bits of which are available from the Standard Event Register, the output queue, and the Extended Event register or extended queue. Three commands and four queries are supported to set, clear, enable, disable, and query these registers and the output queue. | ∗CLS<br>∗ESE<br>∗ESE?<br>∗ESR?<br>∗SRE<br>∗SRE?<br>∗STB? |

## 4.5.5 Function description of common commands

The table below provides a summary of the common command functions.

| Command | Function |
|---|---|
| ∗IDN? | Returns a character string that indicates “manufacturer's name, type name, serial number, firmware version number” |
| ∗RST | Gives Level 3 initialization to the device. |
| ∗TST? | Returns the result of an internal self-test run.<br>Free from error: 0<br>Any error detected: The result of OR operation of the following values is returned in the NR1 format:<br>Lower 8 bits of the hexadecimal representation: CPU error (FAIL reported by the self-test)<br>Upper 8 bits of the hexadecimal representation: Base machine error (UNLOCK or any other error reported) |
| ∗OPC | Sets SESR bit 0 when the execution of the preceding instruction has ended. (This is because more than one command, including an IEEE488.2 common command, cannot be processed at the same time.) |
| ∗OPC? | Always returns 1 when the execution of the preceding instruction has ended. (This is because more than one command, including an IEEE488.2 common command, cannot be processed at the same time.) |
| ∗TRG | BPM Recall (UP): Similar to the [Step Up] key |
| ∗WAI | Defers the start of execution of an instruction until the end of the execution of the preceding instruction. |
| ∗CLS | Clears the Status Byte register. |
| ∗ESE | Sets (or clears) specified bits of the Standard Event Status Enable register. |
| ∗ESE? | Returns the current value of the Standard Event Status Enable register in the NR1 format (0 to 255). |
| ∗ESR? | Returns the current value of the Standard Event Status register. |
| ∗SRE | Sets (or clears) specified bits of the Service Request Enable register. |
| ∗SRE? | Returns the current value of the Service Status Enable register in the NR1 format. |
| ∗STB? | Returns the value of the status byte defined by IEEE488.1 in the NR1 format. |

## 4.5.6 List of Device Messages by Function

### Command and query messages

The header of a command message is expressed in uppercase letters as a reserved word. The header of a query message is ended by a question mark (?). Command and query messages may have multiple arguments delimited from one another by a comma (,). The kinds of arguments that can be used are described below.

| | | |
|---|---|---|
| <1> | Uppercase | : Reserved word |
| <2> | Numeric | : Reserved word |
| <3> | Arguments in lowercase | : Numeric data (NR1, NR2, NR3 formats) |
| | f (frequency) | : GHZ, GZ, MHZ, KHZ, KZ, HZ; HZ if no unit is specified. |
| | $l_1$ (level) (absolute type) | : Numeric data (NR1, NR2, NR3 formats)<br>: DB, DBM, DBU, DU, V,MV, UV, W, MW, UW, NW, PW, FW, AW; DBM if no unit is specified. |
| | $l_2$ (level) (relative type) | : Numeric data (NR1, NR2, NR3 formats)<br>: DB<br>DB if no unit is specified. |
| | $l_3$ (level) (voltage value) | : Numeric data (NR1, NR2, NR3 formats)<br>: V, MV, UV<br>MV if no unit is specified. |
| | $l_4$ (angle value) | : Numeric data (NR1, NR2, NR3 formats)<br>: DEG, RAD<br>DEG if no unit is specified. |
| | t (time) | : Numeric data (NR1, NR2 formats)<br>: S, MS<br>S if no unit is specified. |
| | n (no-unit integer) | : Numeric data (NR1 format) |
| | h (non-unit hexadecimal) | : Numeric data (hexadecimal) |
| | s (string) | : Alphanumeric characters enclosed with “ ” or ‘ ’ |

***Note:***

With the header set to off, the header of a response message and the numeric data suffix code are not outputted.

## Response Messages

A response message is a reply to an incoming query message that is returned to an external controller. A response message is represented by a mix of a response header and response data. A response message may have multiple sets of response data delimited from one another by a comma (,). The kinds of response data that can be used are described below.

| | |
|---|---|
| <1> Uppercase | : Reserved word |
| <2> Numeric | : Reserved word |
| <3> Arguments in lowercase | : |
| f (Frequency) | : Numeric data (NR1 format)<br>: HZ, |
| $l_1$ (level) (absolute type) | : Numeric data (NR2 format)<br>: (transmitted in the unit that has been set by the output level) |
| $l_2$ (level) (relative type) | : Numeric data (NR2 format)<br>: DB |
| $l_3$ (level) (voltage value) | : Numeric data (NR2 format)<br>: V, MV, UV |
| l4 (angle value) | : Numeric data (NR2 format)<br>: DEG, RAD |
| t (time) | : Numeric data (NR1, NR2 formats) |
| Suffix codes | : S, MS; S if no unit is specified. |
| n (no-unit integer) | : Numeric data (NR1 format) |
| r (no-unit real) | : Numeric data (NR2 format) |
| h (non-unit hexadecimal) | : Numeric data (hexadecimal) |

***Note:***

With the header set to off, the header of a response message and the numeric data suffix code are not outputted.

## List of Device Messages by Function

### <Frequency>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| Frequency value | FREQ f | FREQ? | FREQ f |
| Step up | FRS UP | — | — |
| Step down | FRS DN | — | — |
| Knob up | FRK UP | — | — |
| Knob down | FRK DN | — | — |
| Offset frequency | FOS f | FOS? | FOS f |
| Offset on | FOF ON | FOF? | FOF ON |
| Offset off | FOF OFF | FOF? | FOF OFF |
| Relative frequency on | FRL ON | FRL? | FRL ON |
| Relative frequency off | FRL OFF | FRL? | FRL OFF |
| Resolution digit 0.01 Hz | FRR 0.01HZ | FRR? | FRR 0.01HZ |
| Resolution digit 0.1 Hz | FRR 0.1HZ | FRR? | FRR 0.1HZ |
| Resolution digit 1 Hz | FRR 1HZ | FRR? | FRR 1HZ |
| Resolution digit 10 Hz | FRR 10HZ | FRR? | FRR 10HZ |
| Resolution digit 100 Hz | FRR 100HZ | FRR? | FRR 100HZ |
| Resolution digit 1 kHz | FRR 1KHZ | FRR? | FRR 1KHZ |
| Resolution digit 10 kHz | FRR 10KHZ | FRR? | FRR 10KHZ |
| Resolution digit 100 kHz | FRR 100MHZ | FRR? | FRR 100MHZ |
| Resolution digit 1 MHz | FRR 1MHZ | FRR? | FRR 1MHZ |
| Resolution digit 10 MHz | FRR 10MHZ | FRR? | FRR 10MHZ |
| Resolution digit 100 MHz | FRR 100MHZ | FRR? | FRR 100MHZ |
| Resolution digit 1 GHz | FRR 1GHZ | FRR? | FRR 1GHZ |
| Resolution digit move right (lower) | FRR R | — | — |
| Resolution digit move left (upper) | FRR L | — | — |
| Incremental step frequency | FIS f | FIS? | FIS f |
| Reference frequency at relative frequency ON | FRLR f | FRLR? | FRLR f |
| Relative frequency (at relative frequency ON) | FRLV f | FRLV? | FRLV f |

## <Output Level>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| RF on | LVL ON | LVL? | LVL ON |
| RF off | LVL OFF | LVL? | LVL OFF |
| Output level | OLVL $l_1$ | OLVL? | OLVL $l_1$ |
| Step up | OLS UP | — | — |
| Step down | OLS DN | — | — |
| Knob up | OLK UP | — | — |
| Knob down | OLK DN | — | — |
| Select unit dBm | OLDBM | — | — |
| Select unit dBμV | OLDBU | — | — |
| Select unit V | OLV | — | — |
| Select unit W | OLW | — | — |
| Set voltage display to EMF | VDSPL EMF | VDSPL? | VDSPL EMF |
| Set voltage display to TERM | VDSPL TERM | VDSPL? | VDSPL TERM |
| Offset output level | OOS $l_2$ | OOS? | OOS $l_2$ |
| Offset on | OOF ON | OOF? | OOF ON |
| Offset off | OOF OFF | OOF? | OOF OFF |
| Relative frequency on | ORL ON | ORL? | ORL ON |
| Relative frequency off | ORL OFF | ORL? | ORL OFF |
| Continuous mode on | OCNT ON | OCNT? | OCNT ON |
| Continuous mode off | OCNT OFF | OCNT? | OCNT OFF |
| Resolution digit 0.01 dB | OLR 0.01DB | OLR? | OLR 0.01DB |
| Resolution digit 0.1 dB | OLR 0.1DB | OLR? | OLR 0.1DB |
| Resolution digit 1 dB | OLR 1DB | OLR? | OLR 1DB |
| Resolution digit 10 dB | OLR 10DB | OLR? | OLR 10DB |
| Resolution digit 100 dB | OLR 100DB | OLR? | OLR 100DB |
| Move resolution digit to right (lower) | OLR R | — | — |
| Move resolution digit to left (upper) | OLR L | — | — |
| Incremental step output level | OIS $l_2$ | OIS? | OIS $l_2$ |
| ALC mode on | ALC ON | ALC? | ALC ON |
| ALC mode off | ALC OFF | ALC? | ALC OFF |
| CAL execution | CAL | — | — |
| Reference level at relative output level ON | ORLR $l_1$ | ORLR? | ORLR $l_1$ |
| Relative output level (at relative level ON) | ORLV $l_1$ | ORLV? | ORLV $l_2$ |
| RF high level output mode ON | RFHIGH ON | RFHIGH? | RFHIGH ON |
| RF high level output mode OFF | RFHIGH OFF | RFHIGH? | RFHIGH OFF |
| RF high level output mode gain | — | RFHLVL? | RFHLVL $l_2$ |

## <Memory>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| Recall from BPM (Last recalled BPM location number) | RECBPM n<br>n : 0 to 511 | RECBPM? | RECBPM n |
| Step up | RBS UP | — | — |
| Step down | RBS DN | — | — |
| Knob up | RBK UP | — | — |
| Knob down | RBK DN | — | — |
| Save to BPM | SAVBPM n<br>n : 0 to 511 | — | — |
| Delete from BPM | DELBPM n<br>n : 0 to 511 | — | — |
| Move to BPM edit screen | MEMBPMED | — | — |
| Recall from APM (Last recalled APM location number) | RECAPM n<br>n : 0 to 99 | RECAPM? | RECAPM n |
| Save to APM | SAVAPM n<br>n : 0 to 99 | — | — |
| Save to APM (with a title) | SAVAPM n, s<br>n : 0 to 99<br>s : “title” | | |
| Delete from BPM | DELAPM n<br>n : 0 to 99 | — | — |
| Move to APM recall screen | MEMAPMREC | — | — |
| Move to APM save screen | MEMAPMSAV | — | — |
| Selected BPM location recall mode Frequency + Level | BPMMOD n, 0<br>n : 0 to 511 | BPMMOD? n | BPMMOD 0 |
| Selected BPM location recall mode Frequency only | BPMMOD n, 1<br>n : 0 to 511 | BPMMOD? n | BPMMOD 1 |
| Selected BPM location recall mode Level only | BPMMOD n, 2<br>n : 0 to 511 | BPMMOD? n | BPMMOD 2 |
| Selected BPM location skip on | BPMSKP n, ON<br>n : 0 to 511 | BPMSKP? n | BPMSKP ON |
| Selected BPM location skip off | BPMSKP n, OFF<br>n : 0 to 511 | BPMSKP? n | BPMSKP OFF |
| Selected BPM location Sweep Time | SWPTIM n, t<br>n : 0 to 511<br>t : 1MS to 600S | SWPTIM? n | SWPTIM t |
| Move to APM edit screen | MEMBPMSWP | — | — |
| BPM Sweep Pattern: Frequency + Level | SWPPAT 0 | SWPPAT? | SWPPAT 0 |
| BPM Sweep Pattern: Frequency only | SWPPAT 1 | SWPPAT? | SWPPAT 1 |
| BPM Sweep Pattern: Level only | SWPPAT 2 | SWPPAT? | SWPPAT 2 |
| BPM Sweep Mode: Auto | SWPMOD 0 | SWPMOD? | SWPMOD 0 |

## <Memory (continued)>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| BPM Sweep Mode: Single | SWPMOD 1 | SWPMOD? | SWPMOD 1 |
| Sweep Begin BPM location | SWPBEG n<br>n : 0 to 511 | SWPBEG? | SWPBEG n |
| Sweep End BPM location | SWPEND n<br>n : 0 to 511 | SWPEND? | SWPEND n |
| BPM Sweep Start | SWP START | SWP? | SWP START |
| BPM Sweep Stop | SWP STOP | SWP | SWP STOP |
| BPM Sweep Pause | SWP PAUSE | SWP? | SWP PAUSE |
| Export BMP | BPMEXP | — | — |
| Import BPM | BPMIMP | — | — |
| Export APM | APMEXP | — | — |
| Import APM | APMIMP | — | — |
| Move to memory screen (basic parameter display) | MEMORY | — | — |

## <Analog Modulation>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| Modulation on | AMOD ON | AMOD? | AMOD ON |
| Modulation off | AMOD OFF | AMOD? | AMOD OFF |
| Frequency | AF f | AF? | AF f |
| AF source sine wave | AFWAV SINE | AFWAV? | AFWAV SINE |
| AF source square wave | AFWAV SQUARE | AFWAV? | AFWAV SQUARE |
| AF source triangular wave | AFWAV TRIANGULAR | AFWAV? | AFWAV TRIANGULAR |
| AF source sawtooth wave | AFWAV SAWTOOTH | AFWAV? | AFWAV SAWTOOTH |
| AF source output on | AFO ON | AFO? | AFO ON |
| AF source output off | AFO OFF | AFO? | AFO OFF |
| AF source output level | AFOLVL $l_3$ | AFOLVL? | AFOLVL $l_3$ |
| AF source output offset level | AFOOS $l_3$ | AFOOS? | AFOOS $l_3$ |
| External AM input coupling AC | AMCP AC | AMCP ? | AMCP AC |
| External AM input coupling DC | AMCP DC | AMCP ? | AMCP DC |
| External FM/ϕM input coupling AC | FMCP AC | FMCP? | FMCP AC |
| External FM/ϕM input coupling DC | FMCP DC | FMCP? | FMCP DC |
| Wide-AM AM input on | WAM ON | WAM? | WAM ON |
| Wide-AM AM input off | WAM OFF | WAM? | WAM OFF |
| Internal AM modulation source | AMSRC INT | AMSRC? | AMSRC INT |
| External AM modulation source | AMSRC EXT | AMSRC? | AMSRC EXT |
| Internal and external AM modulation source | AMSRC INTEXT | AMSRC? | AMSRC INTEXT |
| AM on | AMO ON | AMO? | AMO ON |
| AM off | AMO OFF | AMO? | AMO OFF |
| AM modulation depth | AM r<br>r : −100.0 to 100.0 | AM? | AM r |
| Internal FM/ϕM modulation source | FMSRC INT | FMSRC? | FMSRC INT |
| External FM/ϕM modulation source | FMSRC EXT | FMSRC? | FMSRC EXT |
| Internal and external FM/ϕM modulation source | FMSRC INTEXT | FMSRC? | FMSRC INTEXT |
| FM/ϕM mode FM | FMPHM FM | FMPHM? | FMPHM FM |
| FM/ϕM mode ϕM | FMPHM PHM | FMPHM? | FMPHM PHM |
| FM/ϕM on | FMO ON | FMO? | FMO ON |
| FM/ϕM off | FMO OFF | FMO? | FMO OFF |
| FM frequency deviation | FMf | FM? | FM f |
| ϕM phase deviation | PHM $l_4$ | PHM? | PHM $l_4$ |
| Move to Analog Modulation edit screen | ANAROG | — | — |

## <Configuration Functions>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| Base frequency and base frequency source<br>10 MHz, internal<br>10 MHz, external<br>13 MHz, external | — | REF? | <br><br>10MHZ, INT<br>10MHZ, EXT<br>13MHZ, EXT |
| Manual ALC time constant 500ns | ALCPT 500NS | ALCPT? | ALCPT 500NS |
| Manual ALC time constant 2.4 μs | ALCPT 2400NS | ALCPT? | ALCPT 2400NS |
| Manual ALC time constant 5.0 μs | ALCPT 5000NS | ALCPT? | ALCPT 5000NS |
| Manual ALC time constant 24 μs | ALCPT 24000NS | ALCPT? | ALCPT 24000NS |
| Manual ALC time constant 50 μs | ALCPT 50000NS | ALCPT? | ALCPT 50000NS |
| Manual ALC time constant 240 μs | ALCPT 240000NS | ALCPT? | ALCPT 240000NS |
| Manual ALC time constant 500 μs | ALCPT 500000NS | ALCPT? | ALCPT 500000NS |
| RF output quadurature ratio adjustment | IQQSKEW n<br>n : −1000 to 1000 | IQQSKEW? | IQQSKEW n |
| I/Q output on | IQBOUT ON | IQBOUT? | IQBOUT ON |
| $\overline{I}$/Q output off | IQBOUT OFF | IQBOUT? | IQBOUT OFF |
| I-output quadurature ratio adjustment | IQOQSK $l_4$<br>$l_4$ : −5DEG to 5DEG | IQOQSK? | IQOQSK $l_4$ |
| I- output level adjustment | IOLTR r<br>r : 80.00 to 120.00 | IOLTR? | IOLTR r |
| Q-output level adjustment | QOLTR r<br>r : 80.00 to 120.00 | QOLTR? | QOLTR r |
| Total I/Q output offset | IQOOS $l_3$ | IQOOS? | IQOOS $l_3$ |
| I output offset | IOUTOS $l_3$ | IOUTOS? | IOUTOS $l_3$ |
| Q output offset | QOUTOS $l_3$ | QOUTOS? | QOUTOS $l_3$ |
| $\overline{I}$ output offset | IBOUTOS $l_3$ | IBOUTOS? | IBOUTOS $l_3$ |
| $\overline{Q}$ output offset | QBOUTOS $l_3$ | QBOUTOS? | QBOUTOS $l_3$ |
| Built-in buzzer on | BUZ ON | BUZ? | BUZ ON |
| Built-in buzzer off | BUZ OFF | BUZ? | BUZ OFF |
| Launch screen saver in 30 minutes | SCRSAV HALFH | SCRSAV? | SCRSAV HLAFH |
| Launch screen saver in 1 hour | SCRSAV ONEH | SCRSAV? | SCRSAV ONEH |
| Launch screen saver in 2 hours | SCRSAV TWOH | SCRSAV? | SCRSAV TWOH |
| Disable screen saver | SCRSAV NONE | SCRSAV? | SCRSAV NONE |
| Safety mode on | SAFE ON | SAFE? | SAFE ON |

## <Configuration Functions (continued)>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| Safety mode off | SAFE OFF | SAFE? | SAFE OFF |
| PLL mode normal | PLLMOD NORM | PLLMOD? | PLLMOD NORM |
| PLL mode narrow | PLLMOD NARR | PLLMOD? | PLLMOD NARR |
| Remote error display mode normal | REMDISP NORM | REMDISP? | REMDISP NORM |
| Remote error display mode Remain | REMDISP REMA | REMDISP? | REMDISP REMA |
| Remote error display mode Stop | REMDISP STOP | REMDISP? | REMDISP STOP |
| RF spectrum normal | SPREV OFF<br>SPREV NORM | SPREV? | SPREV OFF |
| RF spectrum reverse | SPREV ON<br>SPREV REV | SPREV? | SPREV ON |
| GPIB Terminator LF | TRM 0 | TRM? | TRM 0 |
| GPIB Terminator CR/LF | TRM 1 | TRM? | TRM 1 |
| Move to Config screen | CONFIG | — | — |
| Move to Config screen<br>: IF/RF Setup screen | CONFRF | — | — |
| Move to Config screen<br>: Basebamd screen | CONFBB | — | — |
| Move to Config screen<br>: Interface Setup screen | CONFIF | — | — |
| Move to Config screen<br>: Common Setup screen | CONFCO | — | — |
| Move to Config screen<br>: Hardware Check screen | CONFHW | — | — |
| Move to Config screen<br>: Maintenance Check screen | CONFMC | — | — |
| Move to Config screen<br>: Rear Panel Information screen | CONFRP | — | — |

## <Measuring Instrument Common Functions>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| RPP RESET | RS | — | — |
| Display on | DSPL ON | DSPL? | DSPL ON |
| Display off | DSPL OFF | DSPL? | DSPL OFF |
| GPIB Status: END Enable | ESE2 n<br>n : 0 to 256 | ESE2? | n<br>n : 0 to 256 |
| GPIB Status: END | — | ESR2? | n<br>n : 0 to 256 |
| GPIB Status: ERR Enable | ESE3 n<br>n : 0 to 256 | ESE3? | n<br>n : 0 to 256 |
| GPIB Status: ERR | — | ESR3? | n<br>n : 0 to 256 |
| Screen copy | SCOPY | — | — |
| Export Screen copy | SCPEXP | — | — |
| Add Response Header to Response Message | HEAD ON | — | — |
| Omit Response Header to Response Message | HEAD OFF | — | — |
| Trigger | ∗TRG | — | — |

For more information on ∗TRG, see Section 4.5.3, “IEE488.2 common commands”.

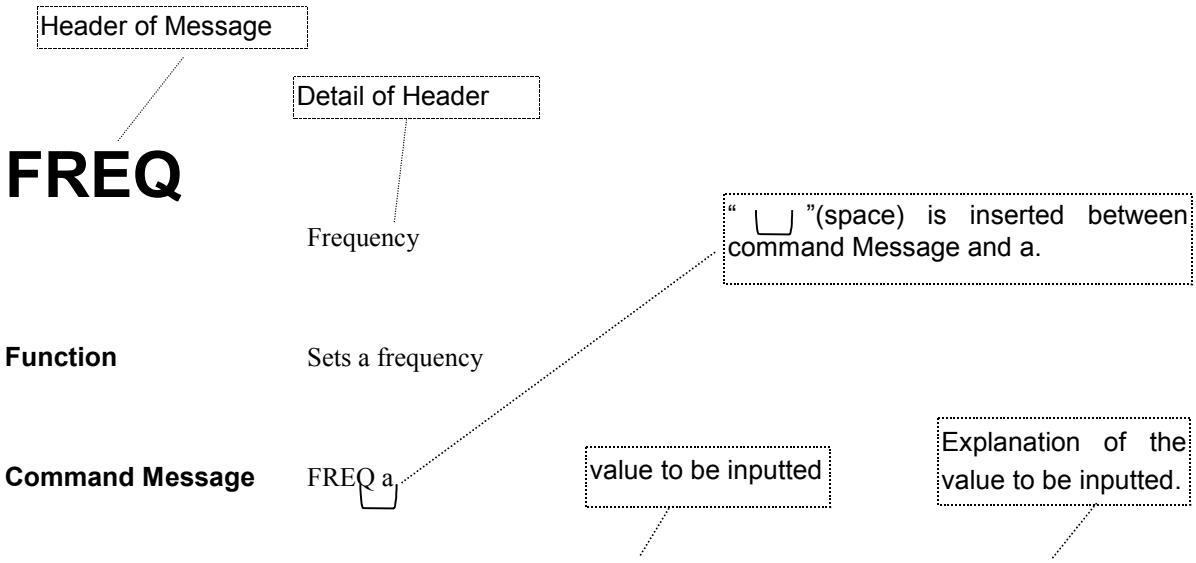
## < Digital modulation Functions>

| Item | Device message | | |
|---|---|---|---|
| Control item | Command message | Query message | Response message |
| Digital modulation on | DMOD ON | DMOD? | DMOD ON |
| Digital modulation off | DMOD OFF | DMOD? | DMOD OFF |
| I/Q source off | IQSRC OFF | IQSRC? | IQSRC OFF |
| I/Q source internal | IQSRC INT | IQSRC? | IQSRC INT |
| I/Q source external | IQSRC EXT | IQSRC? | IQSRC EXT |
| PM source off | PMO OFF | PMO? | PMO OFF |
| PM source internal | PMO INT | PMO? | PMO INT |
| PM source external | PMO EXT<br>PMO ON | PMO? | PMO EXT |
| Baseband ON | BASEBAND ON | BASEBAND? | BASEBAND ON |
| Baseband OFF | BASEBAND OFF | BASEBAND? | BASEBAND OFF |
| Select PDC system (as fullrate) | SYS PDC | SYS? | SYS PDC |
| Select PDC system (as Halfrate) | SYS PDC_H | SYS? | SYS PDC_H |
| Select GSM system | SYS GSM | SYS? | SYS GSM |
| Select W-CDMA system | SYS W-CDMA<br>SYS WCDMA | SYS? | SYS W-CDMA |
| Select IS-95 system | SYS IS-95<br>SYS IS95 | SYS? | SYS IS-95 |
| Digital modulation units not installed | — | SYS? | SYS NONE |
| Move to Digital modulation Edit screen (Basic Parameter screen) | DIGITAL | — | — |

SYS commands are valid when the corresponding Digital modulation unit and software are installed.

## 4.5.7 Device massage Details in alpha-numerical order

**< Example >**




**Function** Sets a frequency

**Command Message** FREQ a

**Value of a**

| | | |
|---|---|---|
| –3 to 3 GHZ | : | –3 to 3 GHz |
| –3000 to 3000 MHZ | : | –3000 to 3000 MHz |
| –3000000 to 3000000 KHZ | : | –3000000 to 3000000 kHz |
| –3000000000.00 to 3000000000 HZ | : | –3000000000.00 to 3000000000 Hz |

**Query Message** FREQ?

**Response Message** FREQ a

**Use Example** FREQ 123MHZ

# *CLS

Clear Status Command

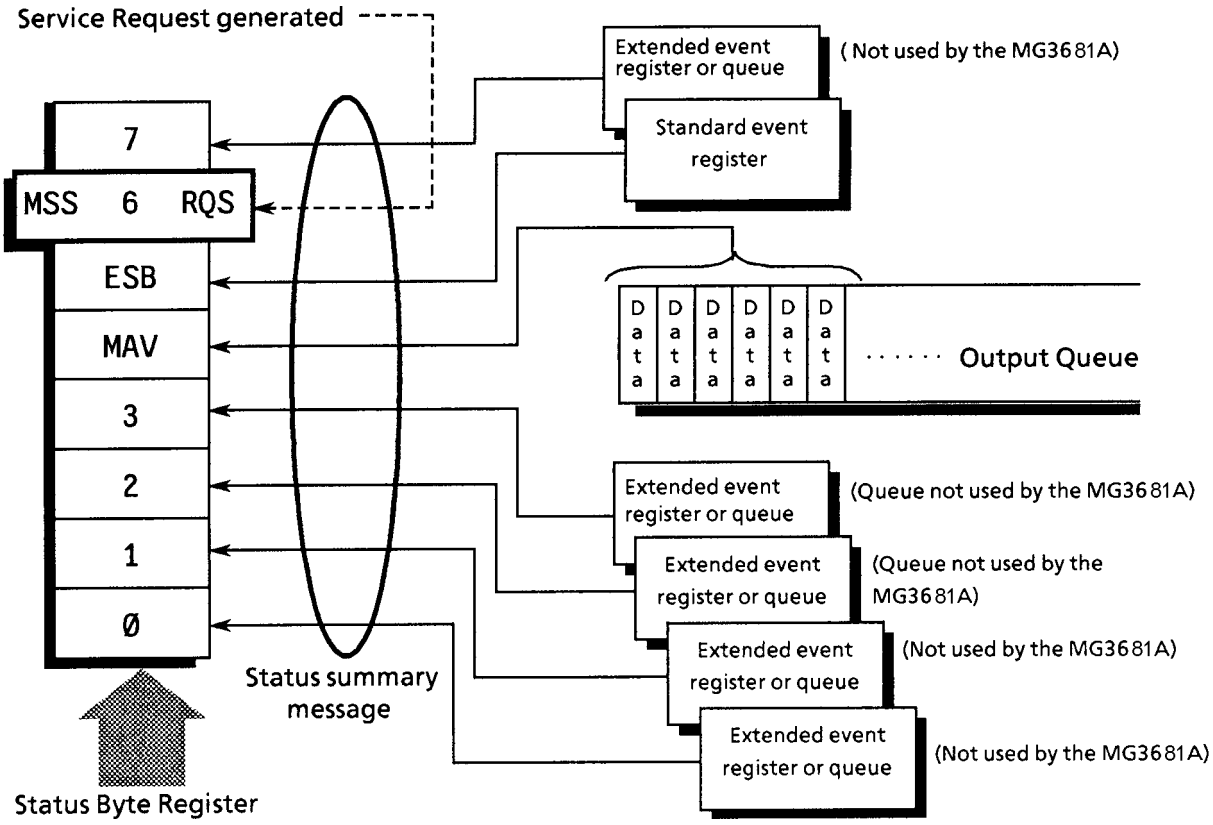
**Function** Clears the Status Byte register

**Command Message** *CLS

**Use Example** *CLS

**Explanation** *CLS all status data (namely, event registers and queues), except for the output queue and its MAV summary message, and also the associated summary messages.

If a *CLS command is transmitted after a program message terminator or before a query message unit element, the entire status byte is cleared, In this way, the output queue is cleared along with any unread messages. The execution of *CLS does not affect the setting of each enable register.



# *ESE

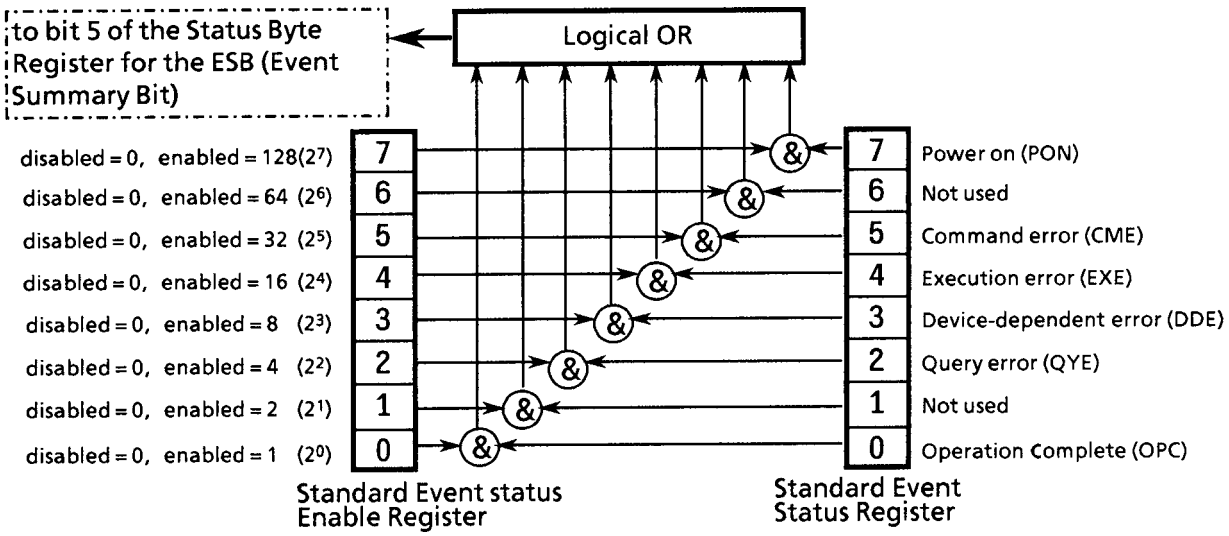
Standard Event Status Enable Command

**Function** Sets or clears the Standard Event Status Enable register.

**Command Message** *ESE

**Explanation** Program data equals the sum total of the digit values of the bits that are chosen to be enabled from among $2^0$= 1, $2^1$ = 2, $2^2$ = 4, $2^3$ = 8, $2^4$=16, $2^5$ = 32, $2^6$ = 64, and $2^7$ = 128 associated with Standard Event Status Enable register bits 0, 1, 2, 3, 4, 5, 6, and 7. The bits to be disabled have a digit value of 0.

**Use Example** *ESE40 Controller → This instrument
Enable CMD (bit 5) and RQC (bit3).



# *ESE?

Standard Event Status Enable Query

**Function** Returns the current value of the Standard Event Status Enable register.

**Command Message** ∗ESE?

**Explanation** ∗ESE? returns the current value of the Standard Event Status Enable register in the NR1 format.

**Response Message** NR1 = 0 to 255

**Use Example** ∗ESE? Controller → This instrument

# *ESR?

Standard Event Status Register Query

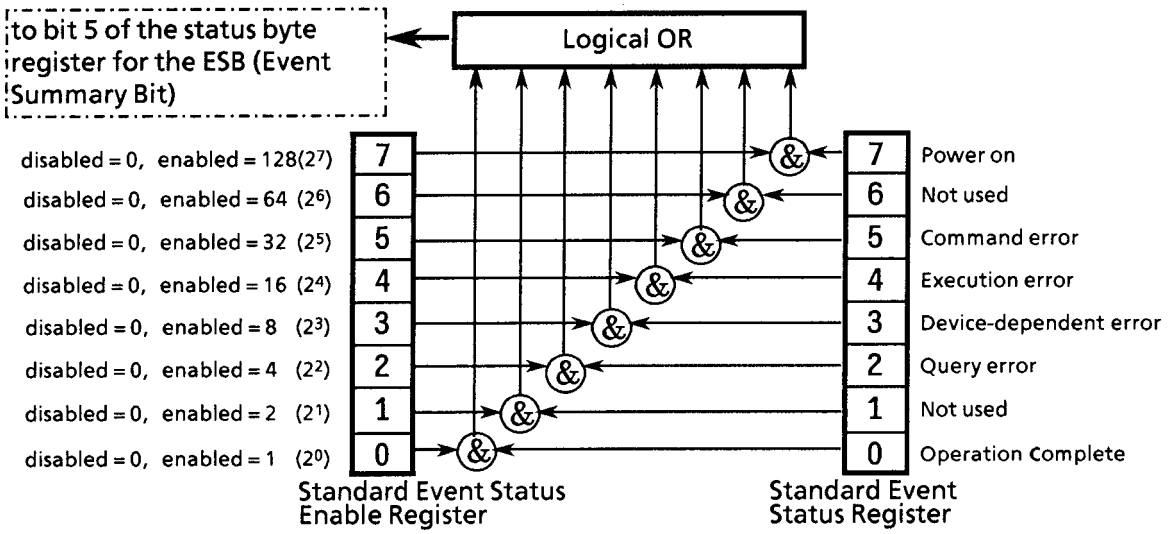
**Function** Returns the current value of the Standard Event Status register.

**Command Message** *ESR?

**Explanation** *ESR? returns the current value of the Standard Event Status register in the NR1 format. This value equals the sum total of the digit values of the bits that are chosen to be enabled from among $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^6 = 64$, and $2^7 = 128$ associated with Standard Event Status register bits 0, 1, 2, 3, 4, 5, 6, and 7. This resistor will be cleared on reading of a response (i.e. line 40).

**Response Message** NR1 = 0 to 255

**Use Example** *ESR? Controller → This instrument
3 This instrument → Controller



# *IDN?

Identification Query

**Function**

Returns the product manufacturer's name, type name and so on.

**Command Message**

IDN?

**Explanation**

Returns the manufacturer's name, type name, serial number, and firmware version number.

∗IDN? returns a response message comprising the four fields described above.

<1> Field 1: Product manufacturer's name (in this case, ANRITSU)

<2> Field 2: Type name (for this instrument, MG3681A)

<3> Field 3: Serial number (10-digit number)

<4> Field 4: Firmware version number (for this instrument, 1.0 to 9.99)

**Response Message**

∗IDN? returns a response message comprising the above four fields separated from one another by a comma (,) ASCII string data.

<Field 1>,<Field 2>,<Field 3>,<Field 4>

In the example cited in the explanation, the response message should look like:

ANRITSU, MG3681A, serial_number,1

The response message is up to 72 characters long.

**Use Example**

| | |
|---|---|
| ∗IDN? | Controller → This instrument |
| ANRITSU, MG3681A, 0123456789, 2.11 | This instrument → Controller |

# *O

## *OPC

Operation Complete Command

**Function**

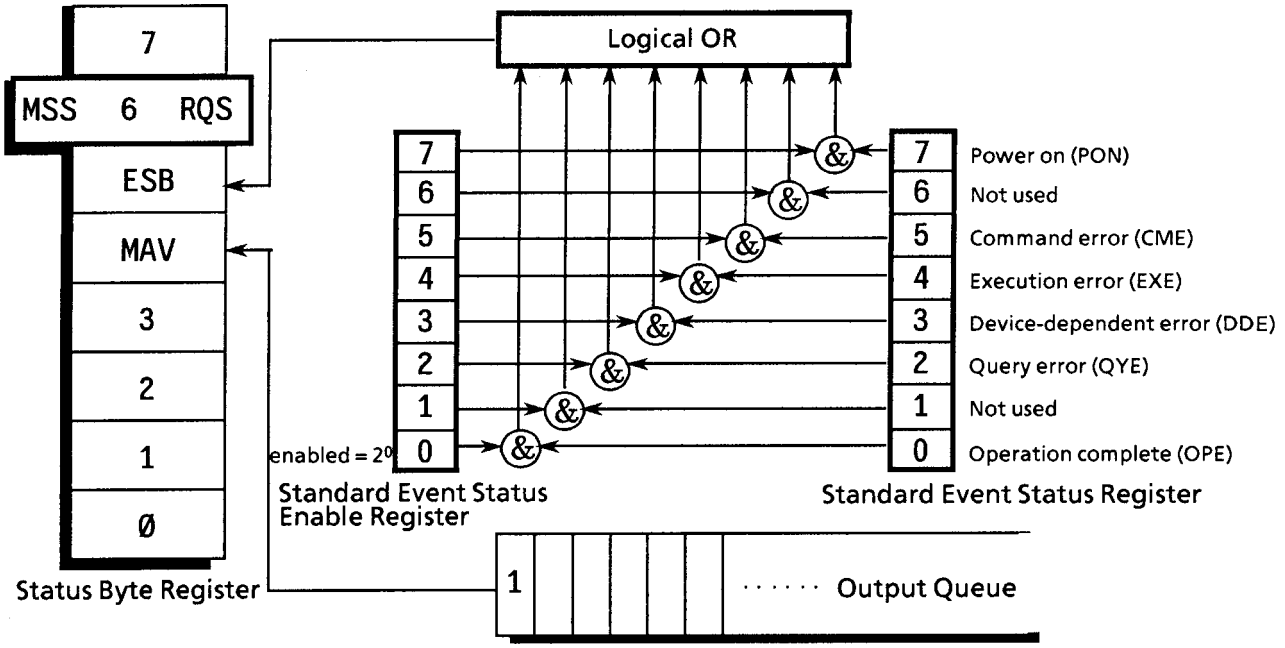
Sets bit 0 of the Standard Event Status register when the device operation is completed.

**Command Message**

*OPC

**Explanation**

*OPC sets bit 0, or Operation Complete Bit, of the Standard Event Status register when the entire device operation that has been selected is completed. This command is an overlap command.




**Use Example**

*OPC

## *OPC?

Operation Complete Query

**Explanation**

*OPC? sets '1' in the output queue when the entire selected device operation is completed to wait for a MAV summary message to be issued.

**Command Message**

*OPC?

**Response Message**

ASCII coded byte 31 hex representing '1' is returned as numeric data in the NR1 format.

**Use Example**

*OPC? Controller → This instrument
1 This instrument → Controller

# *RST

Reset Command

**Function**

Performs Level 3 initialization of the device

**Command Message**

*RST

**Explanation**

The RST (Reset) command performs Level 3 initialization of the device. The items of Level 3 initialization are as follows:

<1> Device-dependent functions and states are reset to predefined status. This instrument is reset to the status described in Appendix C.

<2> The device is put into the OCIS state (Operation Complete Command Idle State). The Operation Complete bit cannot be set in the Standard Event Status register with the *OPC command.

The device is put into the OQIS state (Operation Complete Query Idle State). The Operation Complete bit cannot be set in the output queue as a consequence. The MAV bit of the Status Byte register is cleared.

***Note:***

The execution of the *RST command does not affect the following:

- IEEE4488.1 interface status
- Device address
- Output queue
- Service Request Enable register
- Standard Event Status Enable register
- Calibration data affecting device specifications

**Use Example**

*RST Controller → This instrument

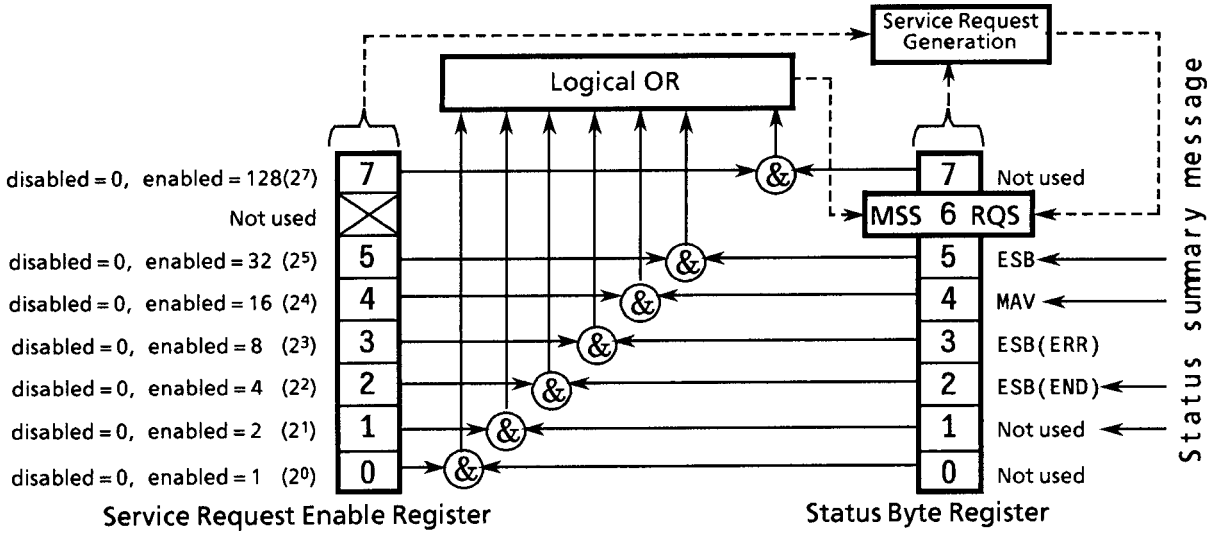
# *SRE

Service Request Enable Command

**Function** Sets the Service Request Status register bits.

**Command Message** *SRE

**Explanation** Program data equals the sum total of the digit values of the bits that are chosen to be enabled from among $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^6 = 64$, and $2^7 = 128$ associated with Service Request Enable register bits 0, 1, 2, 3, 4, 5, 6, and 7. The bits to be disabled have a digit value of 0.




**Use Example** *SRE48 Controller → This instrument
ESB (bit 5) and MAV (bit 4) are set to Enable.

# *SRE?

Service Request Enable Query

**Function** Sets Service Request Enable register bits.

**Command Message** ∗SRE?

**Explanation** ∗SRE? returns the current value of the Service Request Enable register in the NR1 format.

**Response Message** Since NR1 = bit 6 cannot be set, the value of NR1 falls somewhere between 0 and 64 and between 128 and 191.

**Use Example**

∗SRE? Controller → This instrument
48 This instrument → Controller
(following the execution of ∗SRE in the format above)

# *STB?

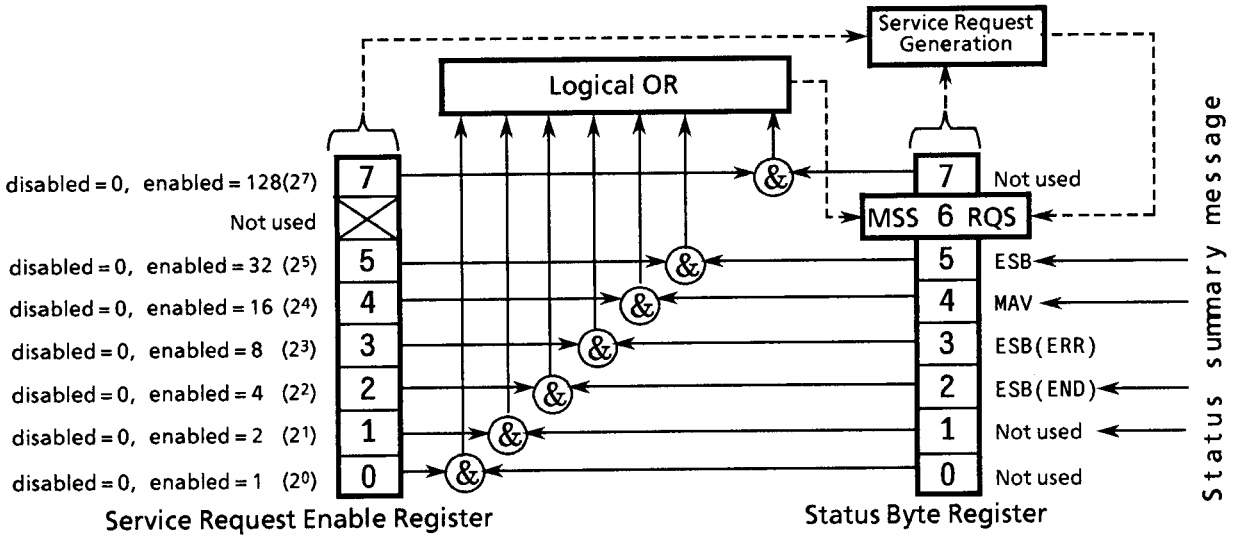
Read Status Byte Command

**Function** Returns the current value of the status byte, including the MSS bit.

**Command Message** *STB?

**Explanation** *STB? returns the sum of the current value of the status byte register weighted with binary and the MSS summary message as a response data in the NR1 numeric format.

**Response Message** The response message is an integer in the NR1 format between 0 and 255 equaling the sum total of the digit values of the bits of the Status Byte register. Bits 0 to 5 and bit 7 of the Status Byte register are weighted by 1,2, 4, 8, 16, 32, and 128, respectively; the MSS (Master Summary Status) bit is weighted by 64. MSS reports that there is at least one condition of a service request. The status byte conditions of this instrument are shown below.




| Bit | Bit weight | Bit name | Status Byte register condition |
|---|---|---|---|
| 7 | 128 | — | 0 =: Not used |
| 6 | 64 | MSS | 0 =: Service not requested; 1 =: service requested |
| 5 | 32 | ESB | 0 =: Event status not occurring; 1 = event status occurring |
| 4 | 16 | MAV | 0 =: No data in the output queue; 1 = data available in the output queue |
| 3 | 8 | ESB(ERR) | 0 =: Service not requested; 1 =: service requested |
| 2 | 4 | ESB(END) | 0 =: Service not requested; 1 =: service requested |
| 1 | 2 | — | 0 =: Not used |
| 0 | 1 | — | 0 =: Not used |

**Use Example**

*STB Controller → This instrument

4 This instrument → Controller (END event occurring)

# *TRG

Trigger Command

**Function** Requests the execution of a trigger.

**Command Message** *TRG

**Explanation** *TRG executes a triggered action. With this instrument, the contents of the next recallable BPM location are recalled. This will produce the same effect as pressing ( ^ ) while holding down ( • Memory ).

**Use Example** *TRG Controller → This instrument

# *TST?

Self-Test Query

**Function**

Runs an internal self-test to report on the presence or absence of errors.

**Command Message**

*TST?

**Explanation**

*TST? executes a self-test within the device. The test result is placed on the output queue to report whether the test has completed successfully without encountering errors. The self-test can be run without operator intervention. With this instrument, the results of the self-test at power-on time and information about hardware errors detected during its operation are returned. Any bit for which an error has been detected is set to 1.

**Response Message**

A response message is returned in the NR1 numeric format.
Data range = 0 to 65535

NR1 = 0: The test has ended without encountering errors.
NR1 ≠ 0: The test has encountered errors.

Response: 540 = 512 + 16 + 2
Errors detected in flash memory and battery by the power-on self-test, with an UNLOCK state being found in the PLL of the audio/clock unit.

Power-on CPU test: +1 if an error is detected
Power-on flash memory test: +2 if an error is detected
Power-on SDRAM test: +4 if an error is detected
Power-on SRAM test: +8 if an error is detected
Power-on backup battery test: +16 if an error is detected
Current local PLL status: +256 if UNLOCK is detected
Current audio/clock PLL status: +512 if UNLOCK is detected
Current base frequency oscillator PLL operating status: +1024 if UNLOCK is detected
Current ALC operating status: +2048 if ABNORMAL is detected

**Use Example**

*TST? Controller → This instrument
256 This instrument → Controller (hardware error)

# *WAI

Wait-to-Continue Command

**Function**

Keep the next command on stand-by if the device is currently executing a command

**Command Message**

∗WAI

**Explanation**

the ∗WAI common command executes overlap commands as sequential commands. An command or query (sent from controller to a device) is called an overlap command if the next command can start execution while it is executing some function in the device.

Executing the ∗WAI command (after an overlap command ) set the next command on hold and permits it to execute its function once the first command has finished. This is the same as sequential commands.
However, since over lap commands are not available with the MG3681A, so this command is not necessary.

**Use Example**

∗WAI Controller → This instrument

# A

## AF

Audio Frequency

**Function** Sets the oscillation frequency of the AF source in the analog modulation function.

**Command Message** AF f

**Value of f**

0.01HZ to 400000HZ : 0.01 Hz to 400000 Hz
0.00001KHz to 400KHz : 0.0001 kHz to 400 kHz

**Query Message** AF?

**Response Message** AF a

**Limitation** This command is functional only if an AF synthesizer (option 21) is mounted.

**Use Example** AF 123HZ

## AFO

Audio Frequency-Output (ON/OFF)

**Function** Sets AF source output to on or off.

**Command Message** AFO a

**Value of a**

ON : AF output on
OFF : AF output off

**Query Message** AFO?

**Response Message** AFO a

**Limitation** This command is functional only if an AF synthesizer (option 21) is mounted.

**Use Example** AFO ON

# AFOLVL

Audio-Frequency-Output Level

**Function** Sets the AF output level of the analog modulation function.

**Command Message** AFOLVL $l_3$

**Value of $l_3$**

| | | |
|---|---|---|
| 0V to 4V | : | 0 V to 4 V |
| 0MV to 4000MV | : | 0 mV to 4000 mV |

**Query Message** AFOLVL?

**Response Message** AFOLVL $l^3$

**Limitation** This command is functional only if an AF synthesizer (option 21) is mounted.

**Use Example**

```
AFOLVL 1V
```

# AFOOS

Audio-Frequency-Output Offset

**Function** Sets an offset of the AF source output level in the analog modulation function.

**Command Message** AFOOS $l_3$

**Value of $l_3$**

| | | |
|---|---|---|
| –2V to 2V, | : | –2 V to 2 V |
| –2000Mv to 2000MV | : | –2000 mV to 2000 mV |

**Query Message** AFOOS?

**Response Message** AFOOS $l_3$

**Limitation** This command is functional only if an AF synthesizer (option 21) is mounted.

**Use Example**

```
AFOOS 2V
```

# A

## AFWAV

Audio-Frequency Wave

**Function** Sets the AF source waveform for analog modulation.

**Command Message** AFWAV a

**Value of a**

| | | |
|---|---|---|
| SINE | : | Sine wave |
| SQUARE | : | Square wave |
| TRIANGULAR | : | Triangular wave |
| SAWTOOTH | : | Sawtooth wave |

**Query Message** AFWAV?

**Response Message** AFWAV a

**Limitation** This command is functional only if an AF synthesizer (option 21) is mounted

**Use Example** AFWAV SQUARE

## ALC

Auto Level Control (ON/OFF)

**Function** Sets ALC on or off.

**Command Message** ALC a

**Value of a**

| | | |
|---|---|---|
| ON | : | ALC on (continuous enabled) |
| OFF | : | ALC off (manual CAL enabled) |

**Query Message** ALC?

**Response Message** ALC a

**Use Example** ALC OFF

# ALCPT

Manual ALC Parameter

**Function** Sets ALC time constant f.

**Command Message** ALCPT a

**Value of a**

| | | |
|---|---|---|
| AUTO | : | Time constant is set automatically |
| 500NS | : | Time constant 500ns |
| 2400NS | : | Time constant 2.4μs (2400ns) |
| 5000NS | : | Time constant 5μs (5000ns) |
| 24000NS | : | Time constant 24μs (24000ns) |
| 50000NS | : | Time constant 50μs (50000ns) |
| 240000NS | : | Time constant 240μs (240000ns) |
| 500000NS | : | Time constant 500μs (500000ns) |

**Query Message** ALCPT?

**Response Message** ALCPT a

**Use Example** ALCPT 500NS

# AM

Amplitude Modulation

**Function** Sets the depth of amplitude modulation (AM) of the analog modulation function.

**Command Message** AM r

**Value of r** −100.0 to 100.0 : −100.0 to 100.0 %

**Query Message** AM?

**Response Message** AM r

**Use Example** AM 50

# A

## AMCP

Amplitude Modulation (AC/DC)

**Function** Selects between AC and DC external AM input coupling of the analog modulation function.

**Command Message** AMCP a

**Value of a**
AC : AC coupling
DC : DC coupling

**Query Message** AMCP?

**Response Message** AMCP a

**Use Example** AMCP DC

## AMO

Amplitude Modulation (ON/OFF)

**Function** Sets amplitude modulation (AM) on or off of the analog modulation function.

**Command Message** AMO a

**Value of a**
ON : AM On
OFF : AM Off

**Query Message** AMO?

**Response Message** AMO a

**Use Example** AMO ON

# AMOD

Analog Modulation (ON/OFF)

**Function** Selects between analog modulation on and off.

**Command Message** AMOD a

**Value of a**
ON : Analog modulation On
OFF : Analog modulation Off

**Query Message** AMOD a

**Response Message** AMOD?

**Use Example** AMOD ON

# AMSRC

Amplitude Modulation Source

**Function** Selects a source of amplitude modulation (AM) of the analog modulation function.

**Command Message** AMSRC a

**Value of a**
INT : Internal modulation source
EXT : External modulation source
INTEXT : Internal and external simultaneous modulation source

**Query Message** AMSRC?

**Response Message** AMSRC a

**Limitation** The modulation source is fixed at EXT (external modulation source) if an AF synthesizer (option 21) is not mounted.

**Use Example** AMSRC INT

# A

## ANALOG

Analog Modulation Screen

**Function** Displays the analog modulation setting screen.

**Command Message** ANALOG

**Query Message** None

**Response Message** None

**Use Example** ANALOG

## APMEXP

All Parameter Memory Export

**Function** Exports all-parameter memory contents to an ATA card.

**Command Message** APMEXP

**Query Message** None

**Response Message** None

**Limitation** An execution error occurs if an ATA card is not inserted.

**Use Example** APMEXP

# APMIMP

All Parameter Memory Import

**Function** Imports all-parameter memory data stored on an ATA card to the MG3681A's internal all-parameter memory.

**Command Message** APMIMP

**Query Message** None

**Response Message** None

**Limitation** An execution error occurs if an ATA card is not inserted or a file that has been created with the APMEXP command is not found.

**Use Example** APMIMP

# B

## BASEBAND Baseband (On/Off)

**Function** Selects On/Off of generating the internal I/Q signal.

**Command Message** BASEBAND a

**Value of a**
ON : On of generating the internal I/Q signal
OFF : Off of generating the internal I/Q signal

**Query Message** BASEBAND?

**Response Message** BASEBAND a

**Limitation** This command is functional only if an extension unit is mounted.

**Use Example** BASEBAND ON

## BPMEXP Basic Parameter Memory Export

**Function** Exports basic parameter memory contents to an ATA card.

**Command Message** BPMEXP

**Query Message** None

**Response Message** None

**Limitation** An execution error occurs if an ATA card is not inserted in position.

**Use Example** BPMEXP

# BPMIMP

Basic Parameter Memory Import

**Function** Imports basic parameter memory data stored on an ATA card to the MG3681A's internal basic parameter memory.

**Command Message** BPMIMP

**Query Message** None

**Response Message** None

**Limitation** An execution error occurs if an ATA card is not inserted or a file that has been created with the APMEXP command is not found.

**Use Example** BPMIMP

# BPMMOD

Basic Parameter Memory Mode

**Function** Sets the mode for recalling stored data from a selected Basic Parameter Memory (BPM) location.

**Command Message**
BPMMOD n, 0
BPMMOD n, 1
BPMMOD n, 2

**Value of n**
n = 0 to 511: Basic Parameter Memory (BPM) numbers 0 to 511
0: Both (frequency and level)
1: Freq (frequency only)
2: Level (level only)

**Query Message** BPMMOD? n

**Response Message**
BPMMOD 0
BPMMOD 1
BPMMOD 2

**Use Example** BPMMOD 511, 0

# B

## BPMSKP

Basic Parameter Memory SKIP (ON/OFF)

**Function** Selects between skip on and off for a selected Basic Parameter Memory (BPM) location.

**Command Message**
BPMSKP n, ON
BPMSKP n, OFF

**Value of n**
n＝0 to 511 : Basic Parameter Memory (BPM)numbers 0 to 511
ON : Skip On
OFF : Skip Off

**Query Message** BPMSKP? n

**Response Message** BPMSKP ON or BPMSKP OFF

**Use Example** BPMSKP 55, ON

## BUZ

Buzzer (ON/OFF)

**Function** Sets the built-in buzzer on or off.

**Command Message** BUZ a

**Value of a**
ON : Buzzer On
OFF : Buzzer Off

**Query Message** BUZ?

**Response Message** BUZ a

**Use Example** BUZ ON

# CAL

Calibration

**Function** Calibrates the level. The bit 1 of END event status register becomes 1.

**Command Message** CAL

**Query Message** None

**Response Message** None

**Limitation** This command is functional only if ALC is off.

**Use Example** CAL

# CONFBB

Config Baseband Setup Screen

**Function** Displays the Baseband Setup screen of the Config screen.

**Command Message** CONFBB

**Query Message** None

**Response Message** None

**Limitation** This command is available when the digital modulation unit is installed and auxiliary signal is inputted from the front/rear panel.

**Use Example** CONFBB

# C

## CONFCO

Config Common Setup Screen

| | |
|---|---|
| **Function** | Displays the Common Setup screen of the Config screen. |
| **Command Message** | CONFCO |
| **Query Message** | None |
| **Response Message** | None |
| **Use Example** | CONFCO |

## CONFHW

Config Hardware Check Screen

| | |
|---|---|
| **Function** | Displays the Hardware Check screen of the Config screen. |
| **Command Message** | CONFHW |
| **Query Message** | None |
| **Response Message** | None |
| **Use Example** | CONFHW |

# CONFIG

Configuration Setup Screen

**Function** Displays the Config screen. The Config screen, in this case, indicates the screen on which a frequency and output level are displayed.

**Command Message** CONFIG

**Query Message** None

**Response Message** None

**Use Example** CONFIG

# CONFIF

Config Interface Setup Screen

**Function** Displays the Interface Setup screen of the Config screen.

**Command Message** CONFIF

**Query Message** None

**Response Message** None

**Use Example** CONFIF

# C

## CONFMC

Config Maintenance Check Screen

**Function** Displays the Maintenance Check screen of the Config screen.

**Command Message** CONFMC

**Query Message** None

**Response Message** None

**Use Example** CONFMC

## CONFRF

Config IF/RF Setup Screen

**Function** Displays the IF/RF Setup screen of the Config screen.

**Command Message** CONFRF

**Query Message** None

**Response Message** None

**Use Example** CONFRF

# CONFRP

Config Rear Panel Information Screen

**Function** Displays the Rear Panel Information screen of the Config screen.

**Command Message** CONFRP

**Query Message** None

**Response Message** None

**Limitation** This command is available when the digital modulation unit is installed and auxiliary signal is inputted from the rear panel.

**Use Example** CONFRP

# D

## DELAPM

Delete All Parameter Memory

**Function** Deletes all-parameter memory contents addressed by an All Parameter Memory (APM) number.

**Command Message** DELAPM n

**Value of n** 0 to 99 : All Parameter Memory (APM) number 0 to 99

**Query Message** None

**Response Message** None

**Limitation** An execution error occurs if no data is stored at the specified All Parameter Memory (APM) location.

**Use Example** DELAPM 99

## DELBPM

Delete Basic Parameter Memory

**Function** Deletes basic parameter memory contents addressed by an Basic Parameter Memory (BPM) number.

**Command Message** DELBPM n

**Value of n** 0 to 511 : Basic Parameter Memory (BPM) number 0 to 511

**Query Message** None

**Response Message** None

**Limitation** An execution error occurs if no data is stored at the specified Basic Parameter Memory (BPM) location.

**Use Example** DELBPM 511

# DIGITAL

Digital Modulation

**Function** Moves to digital modulation setting screen.
Though the digital modulation setting screen varies depending on the modulation signal source and the selected system, this command displays the screen with frequency and output level indication.

**Command Message** DIGITAL

**Query Message** None

**Response Message** None

**Use Example** DIGITAL

# DMOD

Digital Modulation (ON/OFF)

**Function** Sets digital modulation on or off.

**Command Message** DMOD a

**Value of a**
ON : Digital modulation On
OFF : Digital modulation Off

**Query Message** DMOD

**Response Message** DMOD a

**Use Example** DMOD OFF

# D

## DSPL

Display (ON/OFF)

**Function** Sets the display on or off.

**Command Message** DSPL a

**Value of a**

ON : Display On
OFF : Display Off

**Query Message** DSPL?

**Response Message** DSPL a

**Use Example** DSPL ON

# ESE2

Event Status Enable Register (END)

**Function** Specifies which bit of the event register associated with the END Event Status Enable register will make ESB summary-message bit 2 true when it is set.

**Command Message** ESE2 n

**Value of n** 0 to 255

**Query Message** ESE2?

**Response Message** ESE2 n

**Use Example** ESE2 5

# ESE3

Event Status Enable Register (ERR)

**Function** Specifies which bit of the event register associated with the END Event Status Enable register will make ESB summary-message bit 3 true when it is set.

**Command Message** ESE3 n

**Value of n** 0 to 255

**Query Message** ESE3?

**Response Message** ESE3 n

**Use Example** ESE3 5

# E

## ESR2?

Event Status Register (END)

**Function** Reads the event bits of the END Event Status register converted to a binary-weighted sum total. The END Event Status register is reset to 0 after its read.

**Command Message** None

**Query Message** ESR2?

**Response Message** ESR2 n

**Value of n** 0 to 255

**Use Example** ESR2?

## ESR3?

Event Status Register (ERR)

**Function** Reads the event bits of the ERR Event Status register converted to a binary-weighted sum total in decimal. The ERR Event Status register is reset to 0 after its read.

**Command Message** None

**Query Message** ESR3?

**Response Message** ESR3 n

**Value of n** 0 to 255

**Use Example** ESR3?

# FIS

Frequency-Incremental-Step Value

**Function** Sets a frequency incremental step value.

**Command Message** FIS f

**Value of a**

| | | |
|---|---|---|
| 0.00000000001 to 1GHZ | : | 0.00000000001 to 1 GHz |
| 0.00000001 to 1000MHZ | : | 0.00000001 to 1000 MHz |
| 0.00001 to 1000000KHZ | : | 0.00001 to 1000000 kHz |
| 0.01 to 1000000000HZ | : | 0.01 to 1000000000 Hz |

**Query Message** FIS?

**Response Message** FIS f

**Use Example** FIS 2000KHZ

# FM

Frequency Modulation

**Function** Sets a deviation frequency for frequency modulation (FM) of the analog modulation function.

**Command Message** FM f

**Value of f**

| | | |
|---|---|---|
| –2 to 2MHZ | : | –2 to 2 MHz |
| –2000 to 2000KHZ | : | –2000 to 2000 kHz |
| –2000000 to 2000000HZ | : | –2000000 to 2000000 Hz |

**Query Message** FM?

**Response Message** FM

**Use Example** FM 2000KHZ

# F

## FMCP

Frequency Modulation /Phase Modulation Coupling (AC/DC)

**Function** Selects external FM/ϕ M input coupling of the analog modulation function between AC and DC.

**Command Message** FMCP a

Value of a
AC : Coupling AC
DC : Coupling DC

**Query Message** FMCP?

**Response Message** FMCP a

**Use Example** FMCP DC

## FMO

Frequency Modulation/ Phase Modulation（On/Off）

**Function** Selects frequency modulation (FM) or phase modulation (ϕ M) of the analog modulation function between on and off.

**Command Message** FMO a

**Value of a**
ON : FM/ϕ M on
OFF : FM/ϕ M off

**Query Message** FMO?

**Response Message** FMO a

**Use Example** FMO ON

# FMPHM

Frequency Modulation /Phase Modulation (FM/PHM)

**Function** Selects analog modulation between frequency modulation (FM) and phase modulation (ϕ M).

**Command Message** FMPHM a

**Value of a**
FM : FM
PHM : ϕ M

**Query Message** FMPHM?

**Response Message** FMPHM a

**Use Example** FMPHM PHM

# FMSRC

Frequency Modulation /Phase Modulation Source

**Function** Sets a modulation source for FM or ϕ M of the analog modulation function.

**Command Message** FMSRC a

**Value of a**
INT : Internal modulation source
EXT : External modulation source
INTEXT : Internal and external simultaneous modulation

**Query Message** FMSRC?

**Response Message** FMSRC a

**Limitation** The modulation source is fixed at EXT (external modulation source) if an AF synthesizer (option 21) is not mounted.

**Use Example** FMSRC INT

# F

## FOF

Frequency Offset (ON/OFF)

**Function** Sets frequency offset mode on or off.

**Command Message** FOF a

**Value of a**

ON : Frequency offset mode On
OFF : Frequency offset mode Off

**Query Message** FOF?

**Response Message** FOF a

**Limitation** Frequency offset mode may not be set to On depending on the frequency offset value.

**Use Example** FOF ON

## FOS

Frequency Offset

**Function** Sets a frequency offset.

**Command Message** FOS f

**Value of f**

| | | |
|---|---|---|
| –3G to 3GHZ | : | –3 to 3 GHz |
| –3000 to 3000MHZ | : | –3000 to 3000 MHz |
| –3000000 to 3000000KHZ | : | –3000000 to 3000000 kHz |
| –3000000000.00 to 3000000000.00HZ | : | –300000000.00 to 3000000000.00 Hz |

**Query Message** FOS?

**Response Message** FOS f

**Limitation** With frequency offset mode on, a frequency offset may not be set depending on the frequency setting.

**Use Example** FOS 3000MHZ

# FREQ

Frequency

**Function** Sets a frequency.

**Command Message** FREQ f

**Value of f**

| | | |
|---|---|---|
| –3 to 3GHZ | : | –3 to 3 GHz |
| –3000 to 3000MHZ | : | –3000 to 3000 MHz |
| –3000000 to 3000000KHZ | : | –3000000 to 3000000 kHz |
| –3000000000.00 to 3000000000.00HZ | : | –3000000000.00 to 3000000000.00 Hz |

**Query Message** FREQ?

**Response Message** FREQ f

**Limitation** Certain conditions, such as frequency offset on or off and relative frequency display on or off, may not allow a frequency to be set.

**Use Example** FREQ 123MHZ

# FRK

Frequency Rotary-Knob (Up/Down)

**Function** Increases or decreases a frequency in increments of a preset frequency resolution.

**Command Message** FRK a

**Value of a**

| | | |
|---|---|---|
| UP | : | Resolution digit frequency Up |
| DN | : | Resolution digit frequency Down |

**Query Message** FRK?

**Response Message** FRK a

**Use Example** FRK UP

# F

## FRL

Frequency-Relative (On/Off)

**Function** Sets relative frequency display mode on or off.

**Command Message** FRL a

**Value of a**
ON : Relative frequency display mode On
OFF : Relative frequency display mode Off

**Query Message** FRL?

**Response Message** FRL a

**Use Example** FRL ON

## FRLR?

Frequency-Relative, Reference Value

**Function** Returns the reference frequency (which was set when the relative-frequency display mode was set to ON).

**Command Message** None

**Query Message** FRLR?

**Response Message** FRLR f

**Value of f** 0.00 to 3000000000.00HZ : 0.00 to 3000000000.00 Hz

**Use Example** FRLR?

# FRLV?

Frequency-Relative, Displayed Value

**Function** Returns the displayed frequency when the relative-frequency mode is On.

**Command Message** None

**Query Message** FRLV?

**Response Message** FRLV f

**Value of f** −3000000000.00 to 3000000000.00HZ : −3000000000.00 to 3000000000.00 Hz

**Use Example** FRLV?

# F

## FRR

Frequency-Resolution

**Function** Sets a frequency setup resolution.

**Command Message** FRR a

**Value of a**

| | | |
|---|---|---|
| 0.01HZ | : | 0.01 Hz |
| 0.1HZ | : | 0.1 Hz |
| 1HZ | : | 1 Hz |
| 10HZ | : | 10 Hz |
| 100HZ | : | 100 Hz |
| 1KZ, 1KHZ | : | 1 KHz |
| 10KZ, 10KHZ | : | 10 kHz |
| 100KZ, 100KHZ | : | 100 kHz |
| 1MZ, 1MHZ | : | 1 MHz |
| 10MZ, 10MHZ | : | 10 MHz |
| 100MZ, 100MHZ | : | 100 MHz |
| 1GHZ | : | 1 GHz |
| R | : | Move resolution digit to right (lower) |
| L | : | Move resolution digit to left (upper) |

**Query Message** FRR?

**Response Message** FRR a

**Use Example** FRR 100 HZ

# FRS

Frequency-Incremental-Step (Up/Down)

**Function** Ups and downs a frequency in increments of a preset frequency step.

**Command Message** FRS a

**Value of a**

UP : Incremental step frequency Up
DN : Incremental step frequency Down

**Query Message** FRS?

**Response Message** FRS a

**Use Example** FRS UP

# H

## HEAD

Response Message Header (On/Off)

**Function** Sets On/Off of the addition of the response message header.

**Command Message** HEAD a

**Value of a**

ON : Adds the response header and the unit.
OFF : Adds no response header and unit.

**Query Message** None

**Response Message** None

**Use Example** HEAD OFF

# IBOUTOS

$\overline{I}$ Output Offset

**Function** Sets an $\overline{I}$-output (differential I signal) offset.

**Command Message** IBOUTOS $l_3$

**Value of $l_3$** –0.5 to 1.5V : –0.5 to 1.5 V
–500.0 to 1500.0MV: –500.0 to 1500.0 mV (0.5 mV step)

**Query Message** IBOUTOS?

**Response Message** IBOUTOS $l_3$

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** IBOUTOS 1.5V

# IOLTR

I Output-Level Trim

**Function** Trims the I-output level.

**Command Message** IOLTR r

**Value of r** 80.00 to 120.00 : 80.00 to 120.00 %

**Query Message** IOLTR?

**Response Message** IOLTR r

**Limitation** This command is functional only if the enhanced I/Q signal output option (option 11) is mounted.

**Use Example** IOLTR 80.00

# I

## IOUTOS

I Output Offset

**Function** Sets an I-output offset.

**Command Message** IOUTOS l3

**Value of l3**
–0.5 to 1.5V : –0.5 to 1.5 V
–500.0 to 1500.0MV: –500.0 to 1500.0 mV (0.5 mV step)

**Query Message** IOUTOS?

**Response Message** IOUTOS $l_3$

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** IOUTOS 1.5V

## IQBOUT

$\bar{I}/\bar{Q}$ Output (ON/OFF)

**Function** Sets $\bar{I}/\bar{Q}$ output (I/Q differential signal output) on or off.

**Command Message** IQBOUT a

**Value of a**
ON : $\bar{I}/\bar{Q}$ output On
OFF : $\bar{I}/\bar{Q}$ output Off

**Query Message** IQBOUT?

**Response Message** IQBOUT a

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted. I/Q output cannot be set on if the digital modulation source (IQ signal source) is EXT.

**Use Example** IQBOUT ON

# IQOOS

I/Q Output Offset

**Function** Sets an I/O output level offset.

**Command Message** IQOOS $l_3$

**Value of $l_3$** –0.5 to 1.5V : –0.5 to 1.5 V
–500.0 to 1500.0MV: –500.0 to 1500.0 mV (0.5 mV step)

**Query Message** IQOOS?

**Response Message** IQOOS $l_3$

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** IQOOS 1.5MV

# IQQSKEW

RF Output I/Q Quadrature Skew

**Function** Adjusts the I/O Quadrature Skew of the RF output signal.

**Command Message** IQQSKEW n

**Value of n** –1000 to 1000 : Quadrature Skew (integer with no-unit)

**Query Message** IQQSKEW?

**Response Message** IQQSKEW n

**Use Example** IQQSKEW –1000

# I

## IQOQSK

I/Q Output I/Q Quadrature Skew

**Function** Adjusts the I/O Quadrature Skew of the I/Q signal output terminal.

**Command Message** IQOQSK n

**Value of n** −5.0 to 5.0DEG : −5.0 to 5.0 deg (0.5 deg Step)

**Query Message** IQOQSK?

**Response Message** IQOQSK n

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** IQOQSK −4.5DEG

## IQSRC

I/Q Signal Source

**Function** Sets a source (I/Q signal source) for digital modulation unit.

**Command Message** IQSRC a

**Value of a**
INT : Internal modulation source
EXT : External I/Q signal source
OFF : Internal I/Q signal off

**Query Message** IQSRC?

**Response Message** IQSRC a

**Limitation** The source of digital modulation can not select to INT (Internal I/Q signal source) if a digital modulation unit (expansion unit) is not mounted.

**Use Example** IQSRC INT

# LVL

Level (ON/OFF)

**Function** Sets the RF output level on or off.

**Command Message** LVL a

**Value of a**
ON : RF output level On
OFF : RF output level Off

**Query Message** LVL?

**Response Message** LVL a

**Use Example** LVL ON

# M

## MEMAPMREC Memory All Parameter Memory Recall

**Function** Opens the All Parameter Memory (APM) recall screen of the memory function.

**Command Message** MEMAPMREC

**Query Message** None

**Response Message** None

**Use Example** MEMAPMREC

## MEMAPMSAV Memory All Parameter Memory Save

**Function** Opens the All Parameter Memory (APM) save screen of the memory function.

**Command Message** MEMAPMSAV

**Query Message** None

**Response Message** None

**Use Example** MEMAPMSAV

# MEMBPMED

Memory Basic Parameter Memory Edit Screen

**Function** Opens the Basic Parameter Memory (BPM) edit screen of the memory function.

**Command Message** MEMBPMED

**Query Message** None

**Response Message** None

**Use Example** MEMBPMED

# MEMBPMSWP

Memory-Basic Parameter Memory Sweep Screen

**Function** Displays the Basic Parameter Memory Sweeping screen of the memory function.

**Command Message** MEMBPMSWP

**Query Message** None

**Response Message** None

**Use Example** MEMBPMSWP

# O

## OCNT

Output-Continuous (ON/OFF)

**Function** Sets output-level continuous mode on or off.

**Command Message** OCNT a

**Value of a**
ON : Continuous mode On
OFF : Continuous mode Off

**Query Message** OCNT?

**Response Message** OCNT a

**Limitation** When ALC is Off, or output-level unit system is W or V; the continuous mode becomes Off. (When the continuous mode is set to On, it changes to Off, automatically.)

**Use Example** OCNT OFF

## OIS

Output Level Increment Step Value

**Function** Sets an output level incremental step value.

**Command Message** OIS $l_2$

**Value of $l_2$** 0.01 to 100DB : 0.01 to 100 dB

**Query Message** OIS?

**Response Message** OIS $l_2$

**Use Example** OIS 100DB

# OLDBM

Output-Level Unit to dBm

**Function** Switches the output level unit to dBm.

**Command Message** OLDBM

**Query Message** None

**Response Message** None

**Use Example** OLDBM

# OLDBU

Output-Level Unit to DBU

**Function** Switches the output level unit to dBμV.

**Command Message** OLDBU

**Query Message** None

**Response Message** None

**Use Example** OLDBU

# O

## OLK

Output-Level Rotary-Knob (Up/Down)

**Function** Ups and downs the output level in increments of a preset output level resolution.

**Command Message** OLK a

**Value of a**

| | | |
|---|---|---|
| UP | : | Up by preset output level resolution |
| DN | : | Down by preset output level resolution Down |

**Query Message** OLK?

**Response Message** OLK a

**Use Example** OLK UP

## OLR

Output-Level Resolution

**Function** Sets an output level setup resolution.

**Command Message** OLR a

**Value of a**

| | | |
|---|---|---|
| 0.01DB | : | 0.01 dB |
| 0.1DB | : | 0.1 dB |
| 1DB | : | 1 dB |
| 10DB | : | 10 dB |
| 100DB | : | 100 dB |
| R | : | Move resolution digit to right (lower) |
| L | : | Move resolution digit to left (upper) |

**Query Message** OLR?

**Response Message** OLR a

**Limitation** When the level unit system on screen display is V or W, the specification of 0.01 DB to 100 DB becomes invalid.

**Use Example** OLR 0.1DB

# OLS

Output-Level-Incremental-Step Up/Down

**Function** Ups and downs the output level in increments of a preset step.

**Command Message** OLS a

**Value of a**
UP : Up by incremental step output level
DN : Down by incremental step output level

**Query Message** OLS?

**Response Message** OLS a

**Use Example** OLS DOWN

# OLV

Output-Level Unit to volt

**Function** Switches the output level unit to V.

**Command Message** OLV

**Query Message** None

**Response Message** None

**Use Example** OLV

# O

## OLVL

Output Level

**Function** Sets an output level.

**Command Message** OLVL $l_1$

**Value of $l_1$**

| | | |
|---|---|---|
| –193 to 67DBM | : | –193.00 to 67.00 dBm |
| 5.0AW to 50.1MW | : | 5.0 aW to 50.1 mW |
| –79.99 to 180.01DBU | : | –79.99 to 180.01 dBμV |
| 0.016UV to 1.58V | : | 0.016 μV to 1.58 V |
| 0.032UV to 3.16V | : | 0.032 μV to 3160 mV |

**Query Message** OLVL?

**Response Message** OLVL $l_1$

**Limitation** Certain conditions (such as output level offset on or off, relative level display mode on or off, and continuous mode on or off) may not allow an output level to be set.

**Use Example** OLVL 10.00DBM

## OLW

Output-Level Unit to watt.

**Function** Switches the output level unit to W.

**Command Message** OLW

**Query Message** None

**Response Message** None

**Use Example** OLW

# OOF

Output-Level-Offset (ON/OFF)

**Function** Sets output level offset mode on or off.

**Command Message** OOF a

**Value of a**
ON : Output level offset mode On
OFF : Output level offset mode Off

**Query Message** OOF?

**Response Message** OOF a

**Limitation** With output level unit W or V, output level offset mode is fixed at off. (If output level offset mode has been set to on, it is set at off automatically.)

**Use Example** OOF OFF

# OOS

Output-Level Offset Value

**Function** Sets an output level offset.

**Command Message** OOS $l_2$

**Value of $l_2$** −50.00 to 50.00DB : −50.0 to 50.00 dB (0.01 dB steps)

**Query Message** OOS?

**Response Message** OOS $l_2$

**Limitation** With output level offset mode on, an output level offset may not be set depending on its setting.

**Use Example** OOS 15DB

# O

## ORL

Output-Level-Relative (ON/OFF)

**Function** Sets relative output level display mode on or off.

**Command Message** ORL a

**Value of a**
ON : Relative output level display mode On
OFF : Relative output level display mode Off

**Query Message** ORL?

**Response Message** ORL a

**Limitation** With output level unit W or V, relative output level display mode is fixed at off. (If relative output level display mode has been set to on, it is set at off automatically.)

**Use Example**
```
ORL OFF
```

## ORLR?

Output-Level-Relative, Reference Value

**Function** Returns the reference output level which was set when the relative output level display mode was set to ON.

**Command Message** None

**Query Message** ORLR?

**Response Message** ORLR $l_1$

**Value of $l_1$** −143 to 17DBM : −143.00 to 17.00 dBm

**Use Example**
```
ORLR?
```

# ORLV?

Output-Level-Relative, Displayed Value

**Function** Returns the output level displayed on the screen when the relative output level display mode is ON.

**Command Message** None

**Query Message** ORLV?

**Response Message** ORLV $l_1$

**Value of $l_1$** −160 to 160DB : −160.00 to 160.00 dB

**Use Example** ORLV?

# P

## PHM

Phase Modulation

**Function** Sets a phase modulation (ϕ M) deviation.

**Command Message** PHM $l_4$

**Value of $l_4$**
−12.56 to 12.56RAD : −12.56 to 12.56 rad (0.01 rad steps)
−720 to 720DEG : −720 to 720 deg (1 deg step)

**Query Message** PHM?

**Response Message** PHM $l_4$

**Use Example** PHM 10.00RAD

## PLLMODE

PLL Mode

**Function** Selects the loop characteristics of PLL synthesizer circuit.

**Command message** PLLMOD a

**Value of a**
NORM : Normal（SSB phase noise characteristics at near to carrier are good.）
NARR : Narrow（SSB phase noise characteristics at far from carrier are good.）

**Query Message** PLLMOD

**Response Message** PLLMOD a

**Use Example** PLLMOD NARR

# PMO

Pulse-Modulation (ON/OFF)

**Function** Sets pulse modulation (PM) signal source of digital modulation function.

**Command Message** PMO a

**Value of a**

ON : External pulse-modulation signal source
OFF : Pulse modulation Off
INT : Internal pulse-modulation signal source
EXT : External pulse-modulation signal source

**Query Message** PMO?

**Response Message** PMO a

**Limitation** The source of pulse modulation can not select to INT (internal pulse-modulation signal source) if a digital modulation unit (expansion unit) is not mounted.

**Use Example**

```
PMO OFF
```

# Q

## QBOUTOS $\overline{Q}$ Output Offset

**Function** Sets a $\overline{Q}$ output (differential Q signal) offset.

**Command Message** QBOUTOS $l_3$

**Value of $l_3$** –0.5 to 1.5V : –0.5 to 1.5 V
–500.0 to 1500.0MV: –500.0 to 1500.0 mV (0.5 mV steps)

**Query Message** QBOUTOS?

**Response Message** QBOUTOS $l_3$

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** QBOUTOS 1500MV

## QOLTR Q Output Level Trim

**Function** Trims the Q output level.

**Command Message** QOLTR r

**Value of r** 80.00 to 120.00 : 80.00 to 120.00 %

**Query Message** QOLTR?

**Response Message** QOLTR r

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** QOLTR 110

# QOUTOS

Q-Output Offset

**Function** Sets a Q output offset.

**Command Message** QOUTOS $l_3$

**Value of $l_3$**

| | | |
|---|---|---|
| −0.5 to 1.5V | : | −0.5 to 1.5 V |
| −500.0 to 1500.0MV | : | −500.0 to 1500.0 mV (0.5 mV steps) |

**Query Message** QOUTOS?

**Response Message** QOUTOS $l_3$

**Limitation** This command is functional only if the additional function of I/Q signal output option (option 11) is mounted.

**Use Example** QOUTOS 1500MV

# R

## RBK

Recall Basic Parameter Memory UP/Down

**Function** Increments or decrements the basic parameter memory location number to read the stored data.

**Command Message** RBK a

**Value of a**
UP : Basic Parameter Memory (BPM) number Up
DN : Basic Parameter Memory (BPM) number Down

**Query Message** None

**Response Message** None

**Use Example** RBK UP

## RBS

Recall Basic Parameter Memory UP/DOWN

**Function** Increments or decrements the basic parameter memory location number to read the stored data.

**Command Message** RBS a

**Value of a**
UP : Basic Parameter Memory (BPM) number Up
DN : Basic Parameter Memory (BPM) number Down

**Query Message** None

**Response Message** None

**Use Example** RBS DN

# RECAPM

Recall All Parameter Memory

**Function** Recalls the stored data from a specified all-parameter memory location.

**Command Message** RECAPM n

**Value of n** 0 to 99 : All Parameter Memory (APM) number 0 to 99

**Query Message** RECAPM?

**Response Message** RECAPM n

**Limitation** If the digital modulation unit in use is not mounted when the data is to be saved, parameters corresponding to the unit cannot be recalled.

**Use Example** RECAPM 55

# RECBPM

Recall Basic Parameter Memory

**Function** Recalls the stored data from a specified basic parameter memory location.

**Command Message** RECBPM n

**Value of n** 0 to 511 : Basic Parameter Memory (BPM) number 0 to 511

**Query Message** RECBPM?

**Response Message** RECBPM n

**Use Example** RECBPM 55

# R

## REF ?

Reference Frequency Source

**Function** Retrieves information about the reference frequency signal for this instrument.

**Command Message** None

**Query Message** REF?

**Response Message** REF a1, a2

**Value of a1**

10MHZ : 10 MHz
13MHZ : 13 MHz

**Value of a2**

INT : Internal reference oscillator
EXT : External reference oscillator

**Use Example** REF?

## REMDISP

Remote Error Message Display Mode

**Function** Selects the error message display mode at error on remote control.

**Command message** REMDISP a

**Value of a**

NORM : Normal (Error message is erased by the next command reception.)
REMA : Remain (Error message is not erased by the next command reception.)
STOP : Stop (Neglects the following commands.)

**Query Message** REMDISP?

**Response Message** REMDISP a

**Use Example** REMDISP REMA

# RFHIGH

RF high level output On/Off

**Function** Sets a RF high level output mode.

**Command Message** RFHIGH a

**Value of n**

| | | |
|---|---|---|
| ON | : | RF high level output mode On |
| OFF | : | RF high level output mode Off |

**Query Message** RFHIGH?

**Response Message** RFHIGH a

**Limitation** This command is functional only if an RF high level output (option 42) is mounted.

**Use Example** RFHIGH ON

# RFHLVL?

RF high level value

**Function** Returns the level gain (which was set when the RF high level output mode was set to ON).

**Command Message** None

**Query Message** RFHLVL?

**Response Message** RFHLVL $l_2$

**Value of $l_2$**

| | | |
|---|---|---|
| 0 to 20 DB | : | 0 to 20 dB (Option 42 is 8 dB fix) |

**Limitation** This command is functional only if an RF high level output (option 42) is mounted.

**Use Example** RFHLVL?

# S

## SAFE

Safety-Mode (ON/OFF)

**Function** Sets safety mode on or off at the time of output level setup.

**Command Message** SAFE a

**Value of a**
ON : Safety mode On
OFF : Safety mode Off

**Query Message** SAFE?

**Response Message** SAFE a

**Use Example** SAFE OFF

## SAVAPM

Save All Parameter Memory

**Function** Saves a parameter to a specified all parameter memory location.

**Command Message**
SAVAPM n,
SAVAPM n, s

**Values of n and s**
n = 0 to 99 : All Parameter Memory (APM) number 0 to 99
s = "Title name" or 'Title name'
8 or less alphanumeric characters (upper case or lower case), and symbol marks (-+/=!#$%&()^@[]{}<>?_|)

**Query Message** SAVAPM?

**Response Message** SAVAPM n, s

**Limitation** If data already exists at the specified All Parameter Memory (APM) number, it is overwritten without a request for confirmation.

**Use Example** SAVAPM 56, "ABCDEF"

# SAVBPM

Save Base Parameter Memory

**Function** Saves a parameter to a specified Basic Parameter Memory location.

**Command Message** SAVBPM n

**Value of n** 0 to 511 : Basic Parameter Memory (BPM) number 0 to 511

**Query Message** SAVBPM?

**Response Message** SAVBPM n

**Limitation** If data already exists at the specified Basic Parameter Memory (BPM) number, it is overwritten without a request for confirmation.

**Use Example** SAVBPM 55

# SCOPY

Screen Copy

**Function** Copies the current display image. It is outputted to it as a bitmap file, If an ATA card is inserted. Refer to paragraph 3.5.5 for the file name of bit map file. When the ATA card is not inserted, the screen data is temporally saved in the internal memory.

**Command Message** SCOPY

**Query Message** None

**Response Message** None

**Limitation** When the power is turned Off, the screen data temporally saved in the internal memory is erased.
Export the copied screen data at ATA card using SCPEXP command, before power off.

**Use Example** SCOPY

# S

## SCPEXP

Screen Copy Export

**Function** Outputs the screen copy (Bit Map file) to the ATA card.

**Command Message** SCPEXP

**Query Message** None

**Response Message** None

**Limitation** This command is available when the ATA card is installed.

**Use Example** SCPEXP

## SCRSAV

Screen Saver

**Function** Sets a period of time that should expire before the screen saver is launched.

**Command Message** SCRSAV a

**Value of a**

| | | |
|---|---|---|
| HALFH | : | 30 minutes |
| ONEH | : | 60 minutes |
| TWOH | : | 120 minutes |
| NONE | : | Disable screen saver |

**Query Message** SCRSAV?

**Response Message** SCRSAV a

**Use Example** SCRSAV TWOH

# SPREV

RF Spectrum Reverse

**Function** Sets RF spectrum reversing (Exchange I phase for Q phase.)

**Command Message** SPREV a

**Value of a**

| | | |
|---|---|---|
| ON, REV | : | Spectrum reverse |
| OFF, NORM | : | Spectrum normal |

**Query Message** SPREV a

**Response Message** SPREV?

**Use Example** SPREV ON

# SWP

Sweep Control

**Function** Controls the Basic Parameter Memory Sweeping function.

**Command Message** SWP a

**Value of a**

| | | |
|---|---|---|
| START | : | Sweeping On |
| STOP | : | Sweeping Off |
| PAUSE | : | Sweeping temporarily Off |

**Query Message** SWP?

**Response Message** SWP a

**Use Example** SWP START

# S

## SWPBEG

Sweep Begin

**Function** Specifies the number of the Basic Parameter Memory with which a sweep starts.

**Command Message** SWPBEG n

**Value of n** 0 to 511 : Basic Parameter Memory number 0 to 511

**Query Message** SWPBEG ?

**Response Message** SWPBEG n

**Use Example** SWPBEG 62

## SWPEND

Sweep End

**Function** Specifies the number of the Basic Parameter Memory with which a sweep finishes.

**Command Message** SWPEND n

**Value of n** 0 to 511 : Basic Parameter Memory number

**Query Message** SWPEND?

**Response Message** SWPEND n

**Use Example** SWPEND 511

# SWPMOD

Sweep Mode

**Function** Sets the sweep mode when the Basic Parameter Memory is sweeped.

**Command Message** SWPMOD a

**Value of a**
0 : Auto (Repeated sweeping)
1 : Single (Single sweeping)

**Query Message** SWPMOD?

**Response Message** SWPMOD a

**Use Example** SWPMOD 0

# SWPPAT

Sweep Pattern

**Function** Sets the pattern to read the specified Basic Parameter Memory being sweeped.

**Command Message** SWPPAT a

**Value of a**
0 : Both (Frequency and level)
1 : Frequency (Only frequency)
2 : Level (Only level)

**Query Message** SWPPAT?

**Response Message** SWPPAT a

**Use Example** SWPPAT 2

# S

## SWPTIM

Sweep Time

**Function** Sets the interval to read the specified Basic Parameter Memory number being swept.

**Command Message** SWPTIM a1 a2

**Value of a**

| | | |
|---|---|---|
| a1＝0 to 511 | : | Basic Parameter Memory number |
| a2＝1MS to 600S | : | Interval (1ms to 600s, 1ms steps) |

**Query Message**
SWPTIM?
SWPTIM? a1

**Response Message** SWPTIM a2

**Use Example** SWPTIM 511 1MS

## SYS

System

**Function** Sets up a digital modulation system.

**Command Message** SYS a

**Value of a**

| | | |
|---|---|---|
| NONE | : | A digital modulation unit is not mounted. |
| WCDMA | : | W-CDMA (Differs depending on the system being used.) |

**Query Message** SYS?

**Response Message** SYS a

**Use Example** SYS WCDMA

# TRM

GPIB Terminator

**Function** Switches the response message terminator.

**Command Message** TRM a

**Value of a**

0 : LF
1 : CR/LF

**Query Message** TRM?

**Response Message** TRM? a

**Use Example** TRM 1

# V

## VDSPL

Volt Unit for Display

**Function** Switches the voltage unit.

**Command Message** VDSPL a

**Value of a**

| | | |
|---|---|---|
| EMF | : | EMF (emf voltage display) |
| TERM | : | TERM (Terminating voltage display) |

**Query Message** VDSPL?

**Response Message** VDSPL a

**Use Example** VDSPL EMF

# WAM

Wide Band Amplitude Modulation (ON/OFF)

**Function** Sets wide-band amplitude modulation (W-AM) of analog modulation function on or off.

**Command Message** WAM a

**Value of a**
ON : W-AM On
OFF : W-AM Off

**Query Message** WAM ?

**Response Message** WAM a

**Limitation** When the digital modulation is On, the W-AM is fixed to Off.
(When the digital modulation is set to On at W-AM On; the W-AM becomes Off, automatically.)

**Use Example** WAM ON

# Section 5 Calibration and Performance Test

This section describes the type of measuring apparatus and equipment required to perform calibration and performance test of the instrument as preventive maintenance, how to set them up, and how to perform calibration and performance test of the instrument.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# 5.1 Calibration

## 5.1.1 Calibration

Even if the unit is functioning normally, calibrate it periodically to keep its performance from being degraded.
Calibrating the unit once or twice a year is recommended.
If the unit fails to meet specifications after calibration, contact our service department.

**CAUTION ⚠**

**Before performing the calibration, let the unit and calibration apparatus warm up for at least 30 minutes to allow them to fully stabilize. For optimal measuring accuracy, run the unit at room temperature (0 to 50 °C) from an AC voltage source with low fluctuations (100 to 120 VAC, 200 to 240 VAC), in an environment free from noise, vibration, dust, moisture, and other harmful ambient conditions.**

## 5.1.2 Calibration apparatus

The table below specifies the types of apparatus used to calibrate this unit.

| Recommended apparatus name | Performance requirement | Calibration item |
|---|---|---|
| Oscilloscope | Capable of measuring 10 MHz<br>External triggering available | Reference oscillator frequency accuracy |
| Frequency standard | Standard radio receiver or having an equivalent capability<br>(accuracy: on the order of $1 \times 10^{-9}$ or better) | Reference oscillator frequency accuracy |

NOTE: Some of the performance characteristics required to cover the measuring ranges of the individual tests are listed above.

## 5.1.3 Calibrating frequencies with an oscilloscope

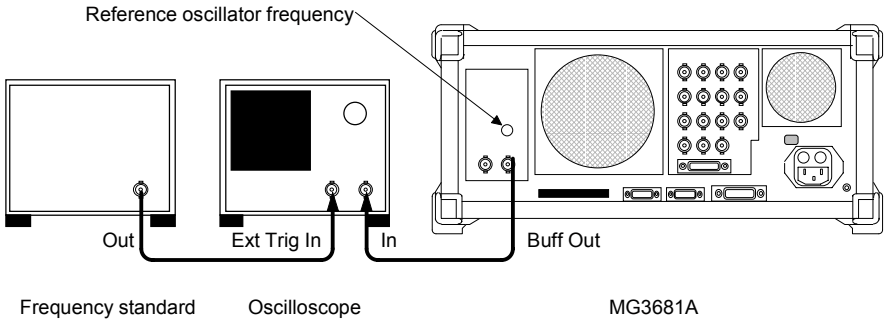
Use an oscilloscope to calibrate the reference oscillator frequency. Use a frequency standard (signal synchronized with a standard radio signal or with a rubidium atomic standard) offering better accuracy than the reference oscillator installed in this unit.

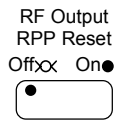
### Calibration Specifications

| Reference oscillator | Aging rate | Temperature stability |
|---|---|---|
| Internal reference oscillator | $\pm 1\times10^{-6}$/year | $\pm 1\times10^{-6}$ (0 to 50 °C) |
| Option 01 | $\pm 5\times10^{-9}$/day | $\pm 3\times10^{-8}$ (0 to 50 °C) |
| Option 02 | $\pm 5\times10^{-10}$/day | $\pm 5\times10^{-9}$ (0 to 50 °C) |

### Calibration Procedure

The flow of calibration using an oscilloscope is described below.

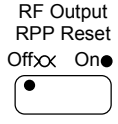



<1> Keep turned off.

<2> Connect the reference signal output (Buff Output) on the rear panel of the unit to the Y-axis terminal of the oscilloscope.

<3> Connect the reference signal output from the frequency standard to the external trigger input terminal of the oscilloscope.




<4> Turn on .

<5> Adjust the oscilloscope to observe the input waveform. If the input waveform appearing on the oscilloscope swings to the left or right out of synchronism, it means that the frequency of the unit's reference oscillator does not match the standard frequency. There will be no swing if synchronism is achieved.

<6> If synchronism is not achieved, turn the trimmer in the reference oscillator frequency calibration hole on the unit's rear panel with a screwdriver until the input waveform appearing on the oscilloscope comes to rest.

If a 10 MHz standard signal is applied from this unit to the X-axis terminal of the oscilloscope, a Lissajous waveform will be generated. In this case, adjust the reference oscillator to bring the Lissajous waveform to rest.

## CAUTION ⚠

**Allow the unit to warm up for at least 30 minutes before starting it, or for 24 hours if it is to be started at a low temperature.**

# 5.2 Performance Test

## 5.2.1 Performance test

Perform the performance test of the unit as preventive maintenance to keep its performance from being degraded.
Carry out the performance test if verification of the unit performance is required, such as after an inspection, after a scheduled inspection, or after a repair period.
If the unit fails to meet the specifications as a result of performance test, contact our service department.

The performance test that is performed on this unit involves tests with respect to the following characteristics:

- Output frequency
- Output level frequency response
- Output level accuracy
- Harmonic spurious output
- Amplitude modulation frequency response
- Frequency modulation frequency response
- Phase modulation frequency response
- Vector modulation frequency response

Carry out the performance test periodically as preventive maintenance with respect to those characteristics that are considered critical. We recommend carrying out the performance test once or twice a year.

**CAUTION ⚠**

**Before proceeding with performance test, allow the unit and the calibration apparatus to warm up for at least 30 minutes to fully stabilize. For optimal measuring accuracy, run the unit at room temperature from an AC voltage source with low fluctuation, in an environment free from noise, vibration, dust, moisture, and other harmful ambient conditions.**

## 5.2.2 Test apparatus for MG3681A

The apparatuses used for testing the unit are shown below:

| Performance test | Performance requirement* | Recommended apparatus name (Anritsu model name) |
|---|---|---|
| Output frequency | 100 kHz to 3 GHz, resolution 10 mHz | Frequency counter (MF2412A) |
| Output level frequency response | Resolution 0.01 dB | Power meter (ML4803A) |
| | 100 kHz to 3 GHz, –30 to + 20 dBm | Power sensor (MA4601A) |
| Output level accuracy | 100 kHz to 3 GHz | Calibration receiver (ML2530A) |
| Harmonic spurious output | 100 kHz to 10.5 GHz | Spectrum analyzer (MS2665C) |
| Amplitude modulation frequency response | 400 kHz to 3 GHz, AM 100 % | Modulation analyzer (MS616B) |
| | 20 Hz to 20 kHz, 2 V(p-p) / 600Ω | Low-frequency oscillator |
| Frequency modulation frequency response | 10 MHz to 3 GHz, FM 400 kHz | Modulation analyzer (MS616B) |
| | 20 Hz to 20 kHz, 2 V(p-p) / 600Ω | Low-frequency oscillator |
| Phase modulation frequency response | 10 MHz to 3 GHz, ϕM 400 rad | Modulation analyzer (MS616B) |
| | 20 Hz to 20 kHz, 2 V(p-p) / 600Ω | Low-frequency oscillator |
| Vector modulation frequency response | 100 Hz to 30 MHz, 1 V(p-p) / 50Ω, 2 ch | Two-channel synthesizer |
| | 100 MHz to 3 GHz | Spectrum analyzer (MS2665C) |

NOTE: Some of the performance characteristics needed to cover the measuring ranges of the individual tests are listed above.

## 5.2.3 Testing the output frequency

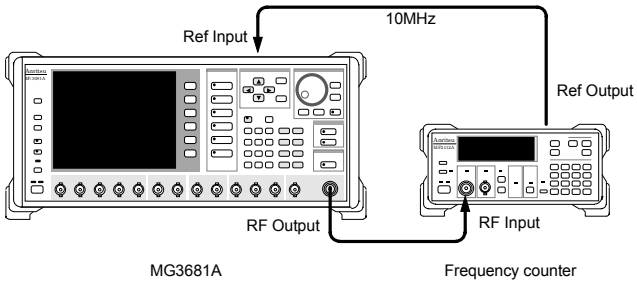
Using a frequency counter, check if the preset signal is generated correctly.

### Test Specifications

Frequency Range: 250 kHz to 3000 MHz
Resolution setting: 0.01 Hz

### Test Procedure

The sequence of testing the output frequency with a frequency counter is described below.




<1> Connect the reference signal output (10 MHz) of the frequency counter to the external reference input terminal (Ref Input) of this unit to achieve frequency synchronism.

<2> Set the frequency counter to 10 mHz measuring resolution.

<3> Press Preset to preset the unit.

<4> Set the unit to a 0 dB output level.

<5> Set the unit to an optional output frequency.

<6> Check if the frequency counter correctly reads the frequency set with the unit.

<7> By varying the frequency setting, repeat the measurement sequence above.

The frequency counter reading includes a ± count error.

## 5.2.4 Testing the output level frequency response

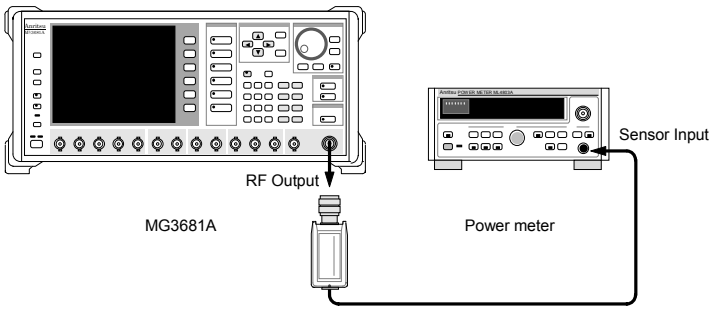
Using a power sensor and a power meter, test the output level frequency response.

### Test Specification

±1 dB or less (0 dBm output)

### Test Procedure

The sequence for testing the output level frequency response is described below.




<1> Press Preset to preset the unit.

<2> Calibrate the sensor (zero point, sensitivity).

<3> Connect the power sensor directly to the unit's RF output connector.

<4> Set the unit to a 0 dBm output level.

<5> Set the unit's frequency. Also, set the power sensor correction coefficient at the set frequency to the power meter

<6> Read the output level with the power meter and record it.

<7> By varying the frequency setting, repeat Steps <5> and <6> above.

## 5.2.5 Testing the output level accuracy

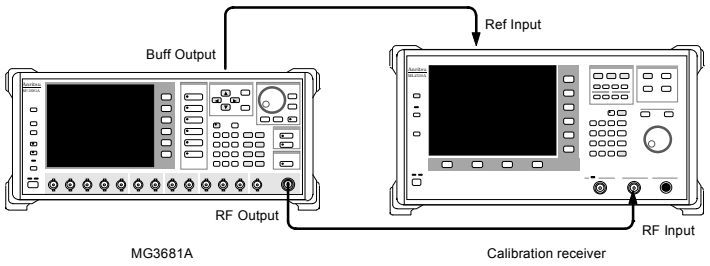
Using a calibration receiver, test the output level accuracy.

### Test Specifications

| Output level | ≤ 1 GHz | > 1 GHz |
|---|---|---|
| ≤ +13 dBm, ≥ –127 dBm | ± 1 dB | ± 2 dB |
| < –127 dBm | ± 2 dB | ± 3 dB |

#### Test Procedure

The sequence of testing the output level accuracy is described below.




<1> Connect the unit's reference signal output (Buff Output) to the external reference input terminal (Ref Input) of this unit to achieve frequency synchronism.

<2> Press Preset to preset the unit.

<3> Set the calibration receiver to a 1 Hz resolution bandwidth and calibrate the calibration receiver for each measuring frequency (for range-to-range errors).

<4> Set frequencies for the unit and the calibration receiver.

<5> After setting the unit's output level, measure the level with the calibration receiver.

<6> Sum up and record the deviation between the unit's output level and the level measured at a 0 dBm setting and the value measured at the same frequency in Section 5.2.4.
[Level error] = [Level measurement value] – [Level measurement value at 0 dBm] + [Value recorded at the same frequency in Section 5.2.4]

<7> Vary the output level setting and repeat Steps <5> and <6>.

<8> Vary the frequency setting and repeat Steps <4> to <7>.

***Note:***

To protect the measurement from the external input noise and residual response of measuring instrument, set the measurement frequency value to that (such as 100.012 345 MHz) apart from a integer value (such as 100.000 000 MHz).

## 5.2.6 Testing the harmonic spurious output

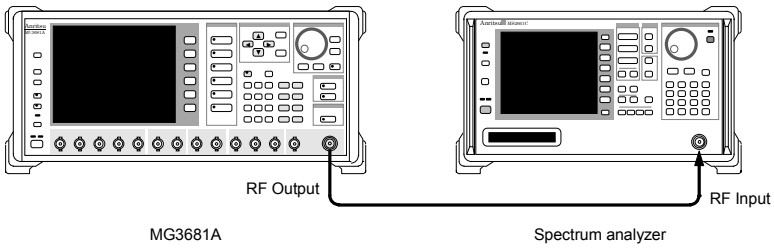
Using a spectrum analyzer, test the harmonic spurious output.

### Test Specification

< –30 dBc (CW, ≤ 0 dBm output)

### Test Procedure

The sequence of testing the harmonic spurious output is described below.



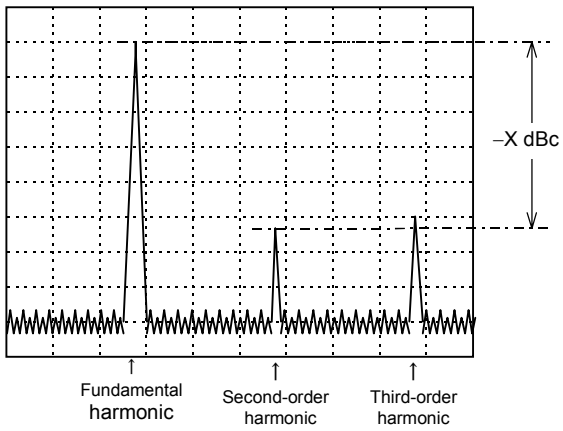

<1> Press Preset to preset the unit.

<2> Set the spectrum analyzer to a +10 dBm reference level. Also, set the unit to a 0 dBm output level.

<3> Set the unit's frequency.

<4> Set the spectrum analyzer to a frequency range of 0 Hz to the measuring frequency x 3.5.

<5> Measure and record the second- and third-order harmonic level deviations relative to the fundamental wave using the spectrum analyzer.




<6> Vary the frequency setting and repeat Steps <3> to <5>.

## 5.2.7 Testing the amplitude modulation frequency response

Carry out amplitude modulation using a low-frequency oscillator as a modulating signal source and then test the amplitude modulation frequency response using a modulation analyzer.

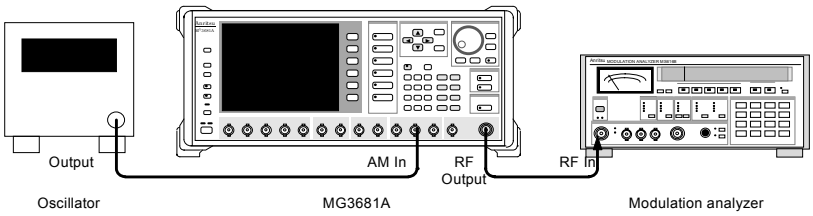
### Test Specifications

≤0 dBm, with a ±1.5 dB bandwidth relative to a 1 kHz modulating frequency

| Frequency | AM 30% | AM 80% |
|---|---|---|
| ≥0.4 MHz, <2 MHz | DC/20 Hz to 3 kHz | DC/20 Hz to 1 kHz |
| ≥2 MHz, <10 MHz | DC/20 Hz to 10 kHz | DC/20 Hz to 10 kHz |
| ≥10 MHz | DC / 20 Hz to 10 kHz | |

#### Test Procedure

The sequence for testing the amplitude modulation frequency response is described below.




<1> Press Preset to preset the unit.

<2> Set the low-frequency oscillator to 2 V (p-p) output (600Ω terminating voltage).

<3> Set the unit to a 0 dBm output level and the source of amplitude modulation to external (Ext), and then turn on amplitude modulation.

<4> Set the modulation analyzer to demodulation mode AM and detection mode Average.

<5> Set frequencies for the unit and the modulation analyzer.

<6> Set a depth of amplitude modulation for the unit.

<7> Vary the frequency setting of the low-frequency oscillator and measure the depth of modulation with the modulation analyzer and record the deviation from the depth of modulation at 1 kHz.

<8> Vary the depth of amplitude modulation setting for this unit and repeat Steps <6> to <7>.

<9> Vary the frequency setting and repeat Steps <5> to <8>.

## 5.2.8 Testing the frequency modulation frequency response

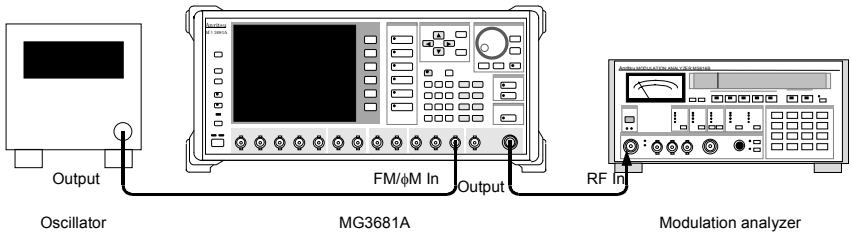
Carry out frequency modulation using a low-frequency oscillator as a modulating signal source and then test the frequency modulation frequency response using a modulation analyzer.

### Test Specifications

DC/20 kHz (With a ± 1 dB bandwidth relative to a l kHz modulating frequency).

#### Test Procedure

The sequence for testing the frequency modulation frequency response is described below.




<1> Press Preset to preset the unit.

<2> Set the low-frequency oscillator to 2 V (p-p) output (600Ω terminating voltage).

<3> Set the unit to a 0 dBm output level and the source of frequency modulation to external (Ext), and then turn on frequency modulation.

<4> Set the modulation analyzer to demodulation mode FM and detection mode Average.

<5> Set frequencies for the unit and the modulation analyzer.

<6> Set a frequency modulation deviation for the unit.

<7> Vary the frequency setting of the low-frequency oscillator and measure the frequency deviation with the modulation analyzer and record the deviation from the deviation at 1 kHz.

<8> Vary the frequency deviation for this unit and repeat Steps <6> to <7>.

<9> Vary the frequency setting and repeat Steps <5> to <8>.

## 5.2.9 Testing the phase modulation frequency response

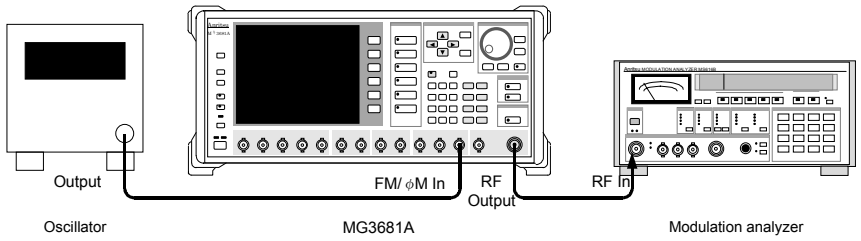
Carry out phase modulation using a low-frequency oscillator as a modulating signal source and then test the phase modulation frequency response using a modulation analyzer.

### Test Specifications

DC/20 Hz to 20 kHz (with a ±1 dB band with relative to a 1 kHz modulating frequency)

#### Test Procedure

The sequence for testing the phase modulation frequency response is described below.




<1> Press Preset to preset the unit.

<2> Set the low-frequency oscillator to 2 V (p-p) output (600Ω terminating voltage).

<3> Set the unit to a 0 dBm output level and the source of phase modulation to external (Ext), and then turn on phase modulation.

<4> Set the modulation analyzer to demodulation mode ϕM and detection mode Average.

<5> Set frequencies for the unit and the modulation analyzer.

<6> Set a phase modulation deviation for the unit.

<7> Vary the frequency setting of the low-frequency oscillator and measure the frequency deviation with the modulation analyzer and record the deviation from the deviation at 1 kHz.

<8> Vary the frequency deviation for this unit and repeat Steps <6> to <7>.

<9> Vary the frequency setting and repeat Steps <5> to <8>.

## 5.2.10 Testing the vector modulation frequency response

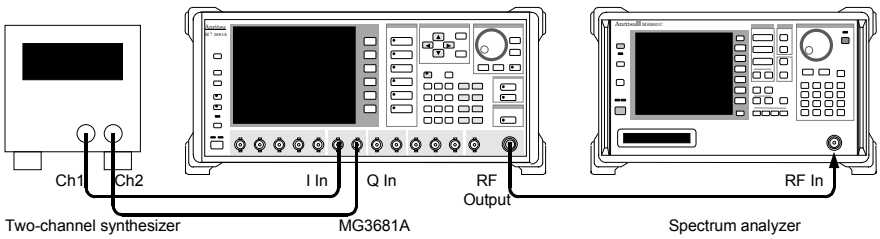
Carry out vector modulation using a complex sine wave generated from a two-channel synthesizer, and then the vector modulation frequency response using a spectrum analyzer.

### Test Specifications

≥100 MHz, ≤0 dBm, I/Q = 0.5 V (rms)
DC to 15 MHz (±2 dB bandwidth)
DC to 30 MHz (±3 dB bandwidth)

### Test Procedure

The sequence for testing the vector modulation frequency response is described below.




<1> Press Preset to preset the unit.

<2> Set the two-channel synthesizer to 1 V (p-p) output (50Ω terminating voltage) and a phase gap of 90° between CH1 and CH2.

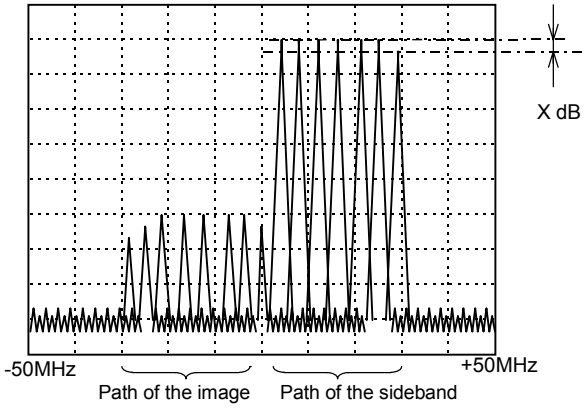
<3> Set the unit to a 0 dBm output level and the source of digital modulation to external (Ext), and then turn on digital modulation.

<4> Set the unit to an ALC off.

<5> Set the spectrum analyzer to a frequency span of 100 MHz and a reference level of +10 dBm.

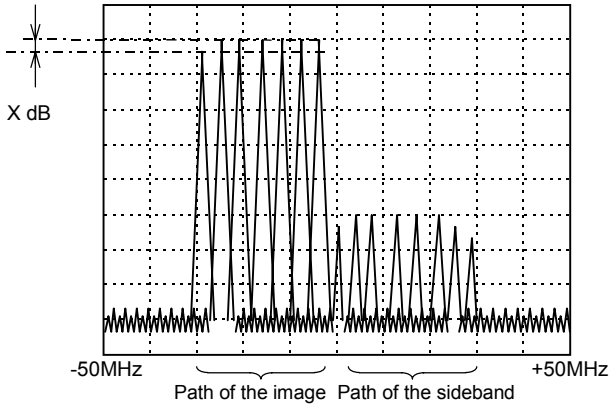
<6> Set a frequency for the unit and a central frequency for the spectrum analyzer.

<7> Vary the frequency setting of the two-channel synthesizer and measure and record the sideband signal level with the spectrum analyzer.




<8> Set the two-channel synthesizer to a phase gap of 90° between CH1 and CH2.

<9> Vary the frequency setting of the two-channel synthesizer and measure and record the sideband signal level deviation with the spectrum analyzer.




<10> Vary the frequency setting and repeat Steps <6> to <9>.

# 5.3 Consumables

## 5.3.1 About Consumable Supplies

The following parts installed in MG3681A have the lifetimes according to the number of times of the operation or the electrified time.
Pay attention to the lifetimes of the parts when using the equipment continuously.

### Step attenuator

It is a mechanical attenuator to vary the output level.
Along with the number of operations, the accuracy of the output level and the reproducibility are influenced.
It depends on environment, but it is recommended that the attenuator be replaced when it is used approximately 3,000,000 times.

### Cooling Fan

There are two cooling fans on the rear side panel.
If the following phenomenon is confirmed, contact Anritsu or agencies immediately.

- A wind does not come from the cooling fan.
- They sound unusually.
- The equipment becomes hot unusually.

### The cold cathode-ray tube has been adopted as the back light of the LCD.

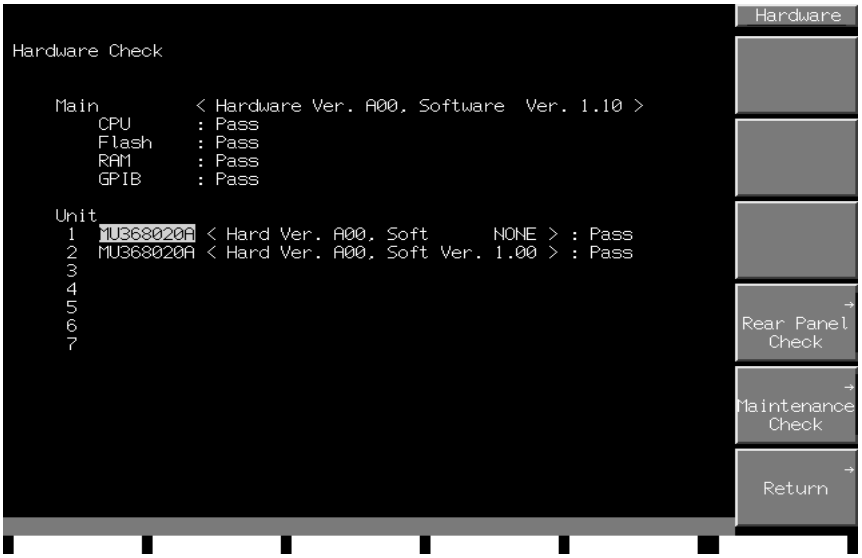
Along with time to turn on the display, luminosity falls.
The lifetime of a back light can be prolonged by turning off the equipment or using a screen saver function.
The lifetime of a back light is approximately 5,000 hours.

## 5.3.2 Checking on the Maintenance Screen

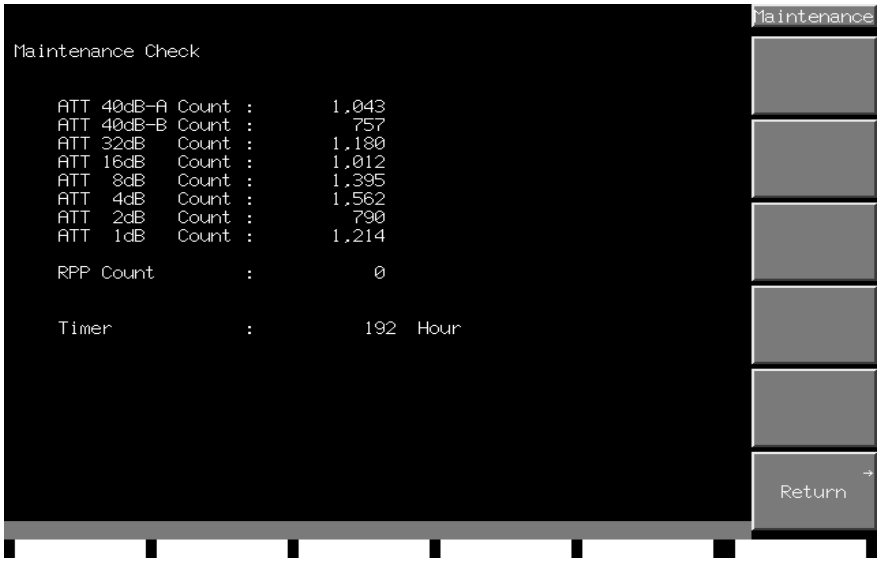
Using the Maintenance screen, you can check the operation time of this unit and the operation count of the step attenuator (consumable supply).

The procedure to open the Maintenance screen is as follows:

<1> Press [Config], then press [F5] (Hardware Check) to open the Hardware Check screen.




<2> Press [F5] (Maintenance Check) to open the Maintenance window.



# Section 6 Storage and Transportation

Before daily maintenance of the unit, be sure to turn it off and unplug it from the AC outlet.


6.1 Daily Maintenance ..... 6-3
6.2 Tips on Storing the Unit for an Extended Period ..... 6-3
6.3 Repackaging and Shipping ..... 6-4
6.4 Storing Memory Cards ..... 6-4

# 6.1 Daily Maintenance

Before daily maintenance of the unit, be sure to turn the power off and unplug it from the AC outlet.

### Unit surface dirt

When surface dirt is noticeable, after the unit has been used in a dusty environment, or when the unit has not been used for an extended period of time, wipe its surface with a cloth moistened in detergent.

### Screen surface dirt

If the screen surface is dirty, first wipe it dry with a soft cloth. If the dirt persists, wipe the surface gently with a cloth dipped in detergent.

### Loose screws

Use Phillips and flat-head screwdrivers to tighten screws.

# 6.2 Tips on Storing the Unit for an Extended Period

Wipe off dust, fingerprint marks, stains, spots, etc. from the surface of the unit before storing it. Avoid storing the unit in these places:

- Places that are exposed to direct sunlight
- Dusty places
- Damp places where condensation may occur on the unit surface
- Places where the unit may be corroded by active gases
- Places where the unit may be oxidized
- Places having temperatures and relative humidities in the following ranges:
  Temperature: $< -20$ °C, $> 60$ °C
  Relative humidity: $\geq 90$ %

### Recommended storage conditions

It is recommended that the unit be stored in a place that meets the ambient conditions suggested above, plus the following conditions, if it is not to be used for a long period of time:

- Temperature: 0 to 50 °C
- Relative humidity: 40 to 80 %
- Little temperature and relative humidity variations within one day

# 6.3 Repackaging and Shipping

When shipping the unit, consider these instructions:

### Recapping

Repack the unit in the packing material (box) in which it had been delivered. If the packing material has been scrapped or damaged, repack the unit in the following manner:

<1> Wrap the unit in vinyl or a similar material.

<2> Procure a corrugated fiberboard box, wooden box, or aluminum box that is large enough to house the instrument and the cushioning material around it.

<3> Put the unit in the box, and then the cushioning material to secure the unit in the box.

<4> Fasten the box firmly with strings, adhesive tapes, or other materials.

### Shipping

Shipping the unit with maximum protection against vibration and in compliance with the suggested storage conditions is recommended.

# 6.4 Storing Memory Cards

Store memory cards at temperatures of 4 to 53 °C and relative humidities of 8 to 90 % (no condensation). Avoid storing memory cards in places that are:

- Dusty or damp
- Close to magnetic substances
- Exposed to direct sunlight
- Close to heat sources

# Appendix A Specifications

## Basic Performance

### <Frequency>

| Item | Specification |
|---|---|
| Range | 250 kHz to 3000 MHz (setting range: 0 to 3000 MHz) |
| Resolution | 0.01 Hz |
| Accuracy | Based on the reference oscillator accuracy<br>Accuracy during frequency modulation: Accuracy of reference oscillator ± (5% of FM deviation + 5 Hz) |
| Internal reference oscillator | |
| • Aging rate | $\pm 1\times10^{-6}$ /year |
| • Temperature stability | $\pm 1\times10^{-6}$ (0 to 50°C) |
| External reference input | |
| • Frequency | 10 MHz, 13 MHz (Selected automatically) |
| • Working range | ± 10 ppm |
| • Input level | ≥ 0.7 V(p-p) / 50Ω (AC coupling) |
| • Connector | Rear panel, Ext Ref Input, BNC connector |
| Buffer output | |
| • Frequency | 10 MHz |
| • Output level | TTL level (DC coupling) |
| • Connector | Rear panel, Buff Input, BNC connector |
| Switching time | Response time from issue of the last command to attainment within ± 500 Hz of the set frequency (CW, ALC On, GPIB):<br>20 ms (excluding the times of passing by 600 MHz and 1010 MHz) |

## <Output Level>

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Range</td><td>–143 to +13 dBm (setting range: –143 to +17 dBm)</td></tr>
<tr><td>Unit</td><td>Power units :<br>dBm (–143.00 to +17.00 dBm)<br>W (5.01 to 999 aW, 1.00 to 999 fW, 1.00 to 999 pW, 1.00 to 999 nW, 1.00 to 999 μW, 1.00 to 50.1 mW)<br>Voltage units :<br>dBμV (Terminating voltage display: –36.01 to +123.99 dBμV)<br>(Open voltage display: –29.99 to +130.01 dBμV)<br>V (Terminating voltage display: –0.016 to 999 μV, 1.00 to 999 mV, 1.00 to 1.58 V)<br>(Open voltage display: –0.032 to 999 μV, 1.00 to 999 mV, 1.00 to 3.16 V)</td></tr>
<tr><td>Resolution</td><td>dBm, dBμV unit : 0.01 dB<br>V, W unit : 3 digits</td></tr>
<tr><td>Frequency response</td><td>±1 dB at 0 dBm with CW and ALC on</td></tr>
<tr><td>Accuracy</td><td>With CW and ALC on
<table>
<tr><th>Level range</th><th>≤1GHz</th><th>>1GHz</th></tr>
<tr><td>≤ +13 dBm, ≥ –127 dBm</td><td>±1 dB</td><td>±2 dB</td></tr>
<tr><td>< –127 dBm</td><td>±2 dB</td><td>±3 dB</td></tr>
</table></td></tr>
<tr><td>Output connector<br>• Impedance<br>• Connector</td><td><br>50Ω<br>Front panel, RF Output, N-type connector</td></tr>
<tr><td>Switching time</td><td>Response time from issue of the last command to attainment within ± 0.5 dB of the last level (CW, ALC On, GPIB):<br>≤ 50 ms (Normal mode)<br>≤ 100 ms (Safety mode)<br>≤ 10 ms (Continuous mode)</td></tr>
<tr><td>Special setup modes<br>• Continuous mode<br>• Safety mode</td><td><br>The level can be changed within ±10 dB (CW) of the set value without interrupting the output. This mode is effective only when dB unit is used.<br>When vector modulation is performed by the digital modulation unit, the modulation settings take effect.<br>While the mechanical attenuator is operating, the level is lowered to prevent large spike signals from being generated.</td></tr>
</table>

**<Output Level (continued)>**

| Item | Specification |
|---|---|
| ALC mode | |
| • ALC On | Application : Used to generate a continuous wave or a pulse modulation wave (burst wave) whose RF On time is 10 μs or longer.<br>ALC time constant: Auto/500ns/2.4 μs/5 μs/24 μs/50 μs/240 μs/500 μs In the Auto mode, the ALC time constant is selected automatically according to the frequency, amplitude modulation state, and vector modulation state (when a digital modulation unit is used). Even when a time constant is specified, the minimum value is forcibly limited according to the set frequency value. |
| • ALC Off | Application : Used to generate a pulse modulation wave (burst wave) whose RF On time is less than 10 μs.<br>Restriction : Amplitude modulation is disabled.<br>ALC Cal : ALC Cal is executed automatically when ALC Cal operation is performed or a set frequency or level is changed. |

## <Signal Purity>

| Item | Specification |
|---|---|
| Spurious | |
| • Harmonic | ≤0 dBm at CW, Continuous mode off |
| • Nonharmonic | < –30 dBc |
| • Power supply-related item | < –40 dBc |
| SSB phase noise | 20 kHz offset at CW<br>< –118 dBc/Hz (≥10 MHz, ≤1010 MHz)<br>< –112 dBc/Hz (>1010 MHz) |

| Carrier frequency | 15 kHz to 300 MHz offset | >300 MHz offset | Fixed frequency spurious |
|---|---|---|---|
| ≤2500 MHz | < –60 dBc | < –30 dBc | –50 dBc (660 MHz, 1320 MHz) |
| >2500 MHz | < –30 dBc | | — |

# Modulation Function

## <Amplitude Modulation (AM)>

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Range</td><td>0 to 100%<br>(INT AM and EXT AM cannot be set separately when they are modulated at the same time.)</td></tr>
<tr><td>Resolution</td><td>0.1 %</td></tr>
<tr><td>Modulation frequency response</td><td>≤ 0 dBm, ALC On, reference modulation frequency = 1 kHz, ±1.5 dB bandwidth:<br>Lower frequency limit : DC (INT AM or EXT AM DC Coupling)<br>20 Hz (EXT AM AC Coupling)<br>Upper frequency limit : See the table below.
<table>
<tr><th rowspan="2">Carrier frequency</th><th colspan="2">Vector modulation and Wide AM Off</th><th>Vector modulation or Wide AM On</th></tr>
<tr><th>AM30%</th><th>AM80%</th><th>AM30%</th></tr>
<tr><td>≥0.4 MHz <2 MHz</td><td>3 kHz</td><td>1 kHz</td><td rowspan="3">1 kHz</td></tr>
<tr><td>≥2 MHz <10 MHz</td><td>10 kHz</td><td>10 kHz</td></tr>
<tr><td>≥10 MHz</td><td colspan="2">10 kHz</td></tr>
</table></td></tr>
<tr><td>Internal modulation<br>(INT AM)</td><td>Comply with the specification of AF synthesizer (option 21)</td></tr>
<tr><td>External modulation<br>(EXT AM)<br>• Proper input level<br>• Coupling<br>• Input impedance<br>• Input connector</td><td><br><br>Approx. 2 V (p-p)<br>Switchable between AC/DC<br>600Ω<br>Front panel, AM input, BNC connector</td></tr>
<tr><td>Modulation signal polarity</td><td>Switchable between positive and negative (To switch to negative polarity, input a negative value as a modulation depth.)</td></tr>
</table>

## <Frequency Modulation (FM)>

| Item | Specification |
|---|---|
| Range | 0 to 1000 kHz (≥10 MHz, ≤1010 MHz)<br>0 to 2000 kHz (>1010 MHz)<br>(INT FM and EXT FM cannot be set separately when they are modulated at the same time.) |
| Resolution | 10 Hz (0 to 10 kHz deviation)<br>100 Hz (10.1 to 100 kHz deviation)<br>1 kHz (101 to 1000 kHz deviation)<br>10 kHz (1010 to 2000 kHz deviation, at >1010 MHz) |
| Modulation frequency response | Reference modulation frequency = 1 kHz, ± 1 dB band width:<br>Lower frequency limit : DC (INT FM or EXT FM DC Coupling)<br>: 20 Hz (EXT FM AC Coupling)<br>Upper frequency limit : 20 kHz |
| Internal modulation (INT FM) | Comply with the specification of AF synthesizer (Option 21) |
| External modulation (EXT FM) | |
| • Proper input level | Approx. 2 V (p-p) |
| • Coupling | Switchable between AC/DC |
| • Input impedance | 600Ω |
| • Input connector | Front panel, FM/ϕM input, BNC connector |
| Modulation signal polarity | Switchable between positive and negative (To switch to negative polarity, input a negative value as a modulation factor.) |

## <Phase Modulation (ϕM)>

| Item | Specification |
|---|---|
| Range | 0 to 6.28 rad (≥10 MHz, ≤1010 MHz)<br>0 to 12.56 rad (>1010 MHz)<br>(INTϕM and EXTϕM cannot be set separately when they are modulated at the same time.) |
| Unit | rad, deg |
| Resolution | 0.01 rad or 1 deg |
| Modulation frequency responce | Reference modulation frequency = 1 kHz, ± 1dB band width:<br>Lower frequency limit : DC (INTϕM or EXTϕM DC Coupling)<br>: 20 Hz (EXTϕM AC Coupling)<br>Upper frequency limit : 20 kHz |
| Internal modulation (INTϕM) | Comply with the specification of AF synthesizer (option 21) |
| External modulation (EXTϕM) | |
| • Proper input level | Approx. 2 V (p-p) |
| • Coupling | Switchable between AC/DC |
| • Input impedance | 600Ω |
| • Input connector | Front panel, FM/ϕM input, BNC connector |
| Modulation signal polarity | Switchable between positive and negative (To switch to negative polarity, input a negative value as a modulation deviation.) |

### <High-Speed Analog Modulation (Wide AM)>

| Item | Specification |
|---|---|
| Modulating frequency response | External modulation, input level = 0.9 V (p-p), carrier frequency ≥ 100MHz, output level ≤ 0 dBm, reference modulation frequency = 1 kHz:<br>DC to 15 MHz (±2 dB)<br>DC to 30 MHz (±3 dB) |
| Internal modulation | Depends on the attached digital modulation unit |
| External modulation<br>• Input level<br>• Input sensitivity<br>• Coupling<br>• Input connector | <br>≤1 V (p-p)<br>1 V (p-p) = 100%<br>DC<br>Impedance : 50Ω<br>Connector : Front panel, Wide AM Input (also used as I Input), BNC connector |
| Modulating signal polarity | Fixed at positive polarity |

### <Pulse Modulation (PM)>

| Item | Specification |
|---|---|
| On/Off ratio | >60 dB |
| Rise/fall time | <100 ns |
| Minimum pulse width | <500 ns |
| Pulse repetition frequency | DC to 1 MHz (at ALC off) |
| Maximum delay time | <150 ns |
| Overshoot ringing | <20% |
| Internal modulation | Depends on the attached digital modulation unit |
| External modulation<br>• Input level<br>• Logic<br><br>• Input connector | <br>Range : 0 to 5 V<br>Threshold : Applox. 1 V<br>Positive logic<br>Impedance : 50Ω<br>Connector : Front panel, Pulse Input, BNC connector |

## <Vector Modulation>

| Item | Specification |
|---|---|
| Modulating frequency response | External modulation, input level = 0.5 V (rms), carrier frequency ≥ 100 MHz, and output level ≤ 0 dBm, reference modulation frequency = 1 kHz:<br>DC to 15 MHz (±2 dB)<br>DC to 30 MHz (±3 dB) |
| Vector accuracy | External modulation, input level = 0.5 V (rms), carrier frequency ≥ 100 MHz, and output level ≤ 0 dBm, 3.84 Msps QPSK modulation<br>≤2.5% (rms) |
| Internal modulation | Depends on the attached digital modulation unit |
| External modulation | |
| • Level<br>• Input connector | $\sqrt{I^2 + Q^2}$ = 0.5 V(rms) (Level at which the output level matches its setting)<br>−1.5 V(peak) ≤ I, Q ≤ +1.5 V (peak)<br>Impedance : 50Ω<br>Connector : Front panel, I/Q Input, BNC connector |
| Quadurature skew adjustment | Adjustment range : ± 1 deg or more |
| I/Q change | I and Q signals interchangeable (Reverse RF spectrum) |

## <Simultaneous Modulation>

| Item | Specification |
|---|---|
| Simultaneous modulation | Simultaneous modulation is enabled excluding the following combinations:<br>• Frequency modulation and phase modulation<br>• Wide band amplitude modulation and vector modulation<br>• Vector modulation (internal) and vector modulation (external)<br>• Vector modulation (internal) and pulse modulation<br>The modulation factors and deviations are the same for the following combinations:<br>• Internal modulation and external modulation of amplitude<br>• Internal modulation and external modulation of frequency<br>• Internal modulation and external modulation of phase<br>The signal source frequencies/waveforms are the same for the following combinations:<br>• Amplitude modulation (internal) and frequency modulation (internal)<br>• Amplitude modulation (internal) and phase modulation (internal) |

### <AF Signal Output> ∗Only when the AF synthesizer (option 21) is installed

| Item | Specification |
|---|---|
| Level | Depends on the installed AF synthesizer |
| Output signal source | Depends on the installed AF synthesizer |
| Output connector | Impedance : 600Ω<br>Connector : Front panel, AF Output, BNC connector |

### <I/Q Signal Output> ∗Performance upgradable with option 11 installed

| Item | Specification |
|---|---|
| Level | Depends on the attached digital modulation unit |
| Output signal source | Depends on the attached digital modulation unit |
| Output connector | Impedance : 50Ω<br>Connector : Front panel, I/Q Output, BNC connector |

### <Clock Signal Generation Feature>

| Item | Specification |
|---|---|
| Internal clock signal | |
| • Range | 4 kHz to 240 MHz |
| • Resolution | 1 Hz |
| • Accuracy | Same as the reference oscillator |
| External clock signal | |
| • Input frequency range | 10 kHz to 32 MHz |
| • Buffered clock frequency range | Same as the external clock signal frequency |
| • Sync clock frequency range | Two, four, eight, and 16 times the buffered clock signal frequency<br>(Up to eight times when buffered clock signal frequency > 3.75 MHz) |
| • External clock input | Input level : TTL level or 0.5 V (p-p) (50Ω termination AC coupling)<br>The input level may be limited by the digital modulation Unit mounted.<br>Logic : Positive or negative logic, selectable<br>Connector : Front panel, Digital Input 5, BNC connector |

# Other Functions

## <Memory Function>

| Item | Specification |
|---|---|
| Basic parameter memory | |
| • Kinds of items stored | Frequency and level |
| • Memory capacity | 512 sets |
| • Memory recall modes | • Frequency only : Only frequencies are recalled and set.<br>• Output level only : Only output levels are recalled and set.<br>• Both frequency and output level : Both frequencies and output levels are recalled and set. |
| • Memory attributes | The following memory attribute can be set for each memory location:<br>• Skip setting : Selected memory locations can be removed from the scope of incremental or decremental recall using sweep function or trigger function. |
| All-parameter memory | |
| • Kinds of items stored | All parameters, including those related to analog and digital modulation units |
| • Memory capacity | Max. 100 sets. |
| • Memory attribute | The following memory attribute can be set for each memory location:<br>• Memory name: Each memory location can be named using a string of up to eight alphanumeric characters and symbols. |

## <Sweep Function>

| Item | Specification |
|---|---|
| Sweep parameter | Basic parameter memory address |
| Sweep pattern | Start address → Stop address |
| Sweep time | 1 ms to 600 s per memory<br>(The lower limit depends on the time required for memory recall.) |
| Sweep mode | Auto (repetitive sweep), Single (single sweep) |

## <Relative Value Display>

| Item | Specification |
|---|---|
| Parameters | Frequency and output level (dB unit only) |
| Setting and display in relative value display mode | Entered and displayed as relative values.<br>[Current setting] = [Entered and displayed value]<br>+ [Setting in relative value display mode] |
| Current display | The actual frequency and output level can be displayed in relative value display mode. |

### <Offset Display>

| Item | Specification |
|---|---|
| Parameters | Frequency and output level (dB unit only) |
| Setting and display in offset value display mode | Entered and displayed as offset values.<br>[Current setting] = [Entered and displayed value] – [Offset value] |
| Offset range<br>• Frequency<br>• Output level | <br>–3 to +3 GHz<br>–50 to +50 dB |
| Current display | The actual frequency and output level can be displayed in offset value display mode. |

### <Display>

| Item | Specification |
|---|---|
| Screen size | 7.2-inch, 480×640 dots, color DSTN, or 6.5-inch, 480×640 dots, color TFT |
| ON/OFF setting | The panel display can be turned on and off. |
| Contrast control | The display control can be adjusted.<br>(When the LCD screen consists of TFT, the contrast cannot be adjusted.) |
| Screen saver | The screen saver is launched when the instrument's panel is left idle for a certain period of time, with the display being turned off. The backlight turns off at the same time. The display and backlight turn on when any key is pressed.<br>Time to launch: 0.5h, 1h, 2h or infinite selectable |
| Screen copy | The current display image can be saved to a PC card as an image file.<br>Image format: 256-color bitmap |

### <Backup Facility>

| Item | Specification |
|---|---|
| Backup items | All the items are restored when the power is turned on again, except for:<br>• Data then being entered<br>• Remote state<br>• Data then being transferred by GPIB<br>• RPP operating status<br>• Display transitions<br>• Main function selection conditions |

### <Panel Lock Feature>

| Item | Specification |
|---|---|
| Panel lock | Disables all the keys, except for the front-panel power switch, the Local key, the Panel Lock key, and the Contrast keys. |
| Knob hold | Disables the front-panel rotary knob. |

# External Control

### <GPIB>

| Item | Specification |
|---|---|
| Controlled items | All functions, except for the power switch, the Local key, the Panel lock key, and the Contrast key, can be controlled. |
| Interface | SH1, AH1, T5, L4, TE0, SR1, RL1, DP0, PP0, DC1, DT1, C1, E2 |
| Connector | Rear panel |

### <RS-232C>

| Item | Specification |
|---|---|
| Controlled items | All functions, except for the power switch, the Local key, the Panel lock key, and the Contrast key, can be controlled. |
| Communication method | Asynchronous (start-stop method), Half Duplex |
| Communication control method | X-ON/OFF control by commands |
| Baud rate | 1200, 2400, 4800, 9600, 19200, 38400 bps |
| Data bit | 7 or 8 bits |
| Parity | Odd, Even, None |
| Start bit | 1 bit |
| Stop bit | 1 or 2 bits |
| Connector | D-sub 9-pin, female |

### <PC Cards>

| Item | Specification |
|---|---|
| Function | Memory card (Screen hard copy) |
| Connector | Rear panel, JEID Rear panel, JEIDA Ver4/4.1 PCMCIA Rel2.0-compatible, 1 slot |

### <Trigger>

| Item | Specification |
|---|---|
| Controlled items | Among the following items, those specified by the command input signal (3 bit ) are executed:<br>• Frequency incrementing/decrementing<br>• Output level incrementing/decrementing<br>• Basic parameter memory recall address incrementing/decrementing<br>• Output level on/off |
| Interface | • Command input signal : TTL level (pull up) × 3<br>• Trigger input signal : TTL level (pull up), run on the rising edge<br>• Auxiliary power output : +5 V, 100 mA (built-in short-circuit and overcurrent protective circuits |
| Connector | Rear panel, D-sub, 9-pin, female |

## Protective Circuit

### <Reverse Power Protection>

| Item | Specification |
|---|---|
| Protective means | The RF output circuit is cut off upon application of External Electric power to the RF output, to protect the internal circuit. The RF output circuit is released by reset input from the panel or under external control. |
| Maximum reverse input power | ≤ 1 GHz : 50 W<br>> 1 GHz : 25 W<br>DC : ±50 V |

## General Performance

### <General Performance>

| Item | Specification |
|---|---|
| Power supply | AC 100 to 120 V, 200 to 240 V<br>(−15/+10%, up to 250 V; 100 and 200 V sources switched automatically)<br>47.5 to 63 Hz<br>≤ 300 VA |
| Temperature range | Operating temperature : 0 to 50°C<br>Storage temperature : –20 to 60°C |
| 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) |
| Physical dimensions and mass | 177 mm × 426 mm × 451 mm (H × W × D) (excluding protrusions)<br>≤ 25 kg (excluding the expansion unit) |

# Options

## <Reference Crystal Oscillator, Option 01>

| Item | Specification |
|---|---|
| Frequency | 10 MHz |
| Aging rate | $\pm 5 \times 10^{-9}$ /day |
| Startup characteristics | $\pm 1 \times 10^{-7}$ (after 10 minutes of operation, relative to 24 hours after power was turned on) |
| Temperature stability | $\pm 3 \times 10^{-8}$ (0 to 50°C) |

## <Reference Crystal Oscillator, Option 02>

| Item | Specification |
|---|---|
| Frequency | 10 MHz |
| Aging rate | $\pm 5 \times 10^{-10}$ /day |
| Startup characteristics | $\pm 1 \times 10^{-7}$ (after 10 minutes of operation, relative to 24 hours after power was turned on) |
| Temperature stability | $\pm 5 \times 10^{-9}$ (0 to 50°C) |

## <Additional Function of I/Q Signal Output, Option 11>

| Item | Specification |
|---|---|
| Summary | Level and offset setup and differential output capabilities added to the I/Q signal output |
| Level | At 50Ω termination |
| • Range | 80 to 120% of the specified output (The two sets of I-$\overline{\text{I}}$ and Q-$\overline{\text{Q}}$ can be independently fine-tuned) |
| • Resolution | 0.1% |
| Offset | At 50Ω termination |
| • Range | −0.5 to +1.5 V (The four sets of I, $\overline{\text{I}}$, Q, $\overline{\text{Q}}$ can be independently fine-tuned) |
| • Resolution | 0.5 mV |
| Differential output | $\overline{\text{I}}$ and $\overline{\text{Q}}$ signals available for output (via the I/Q Input connector as it is switched) |
| Output signal source | Depends on the attached digital modulation unit |
| Output connector | |
| • Impedance: | 50Ω |
| • Connector | Front panel, I/Q Output, $\overline{\text{I}}$/$\overline{\text{Q}}$ Output, BNC connector |

## <AF Synthesize, Option 21>

| Item | Specification |
|---|---|
| Summary | Can be used as an AF output facility and as a source of internal modulating signals for analog modulation |
| Frequency | |
| • Range | 0.01 Hz to 400 kHz |
| • Resolution | 0.01 Hz |
| • Accuracy | Same as the reference oscillator accuracy |
| • Waveforms | Sine, triangular, square, sawtooth waves |
| Frequency response | Sine wave, Level = 2 V (p-p), Offset = 0 V, 600 Ω termination, ±1 dB in a range of 10 Hz to 100 kHz relative to 1 kHz |
| Harmonic distortion | Sine wave, Level = 2 V (p-p), Offset = 0 V, 600 Ω termination, ≤ –50 dB at 1 kHz |
| Waveforms | Sine, triangular, square, sawtooth waves |
| Level | At 600 Ω termination |
| • Range | 0 to 4 V (p-p) |
| • Resolution | 1 mV (p-p) |
| • Accuracy | ± (8% of setting + 2 V (p-p)) at 1 kHz, Sine wave |
| Offset | At 600 Ω termination |
| • Range | –2 to +2 V |
| • Resolution | 1 mV |
| • Accuracy | ± (8% of setting +2 V) at 1 kHz, Sine wave |
| Output connector | |
| • Impedance | 600 Ω |
| • Connector: | Front panel, AF Output, BNC connector |

## <RF High Level Output, Option 42>

| Item | Specification |
|---|---|
| Summary | 8 dB increases a maximum output level in the W-CDMA band. |
| Frequency range | 1900 to 2300 MHz |
| Gain | 8 dB ±1 dB (At 2.1 GHz, relative to RF high level output Off, –3 dBm) |
| Gain frequency response | ±1 dB (At +5 dBm output, relative to 2.1 GHz) |

# Appendix B Message Displays

## Error Messages

### Filing Errors

| Error message | Explanation |
|---|---|
| No ATA PC Card | Invalid ATA PC card |
| Down Load Failure | Download failure |
| Invalid File Version | Unmatched version number (Download failure) |
| Invalid File Format | Invalid file format |
| No Spaces In PC Card | Not enough space |
| Card Removed During Access | PC card removed while being accessed (The validity of filed and imported data becomes unpredictable) |

### Operational Error

| Error message | Explanation |
|---|---|
| Entry Out Of Range | Entry out of range |

### Memory Errors

| Error message | Explanation |
|---|---|
| Memory Area Full | Not enough space to save |
| Memory Number Full | Not enough space at the save destination (remote control) |
| No Target Units<br>(Related Parameters Not Recalled) | No unit to recall to (unit not mounted). Parameters not recalled. |
| Memory Not Found | Memory number not saved |
| Invalid Version (Exported By Old Version) | Memory import failure (memory exported by using an older version of software) |

### Remote Control Errors

| Error message | Explanation |
|---|---|
| REMOTE: Undefined Command | Undefined (illegal) command |
| REMOTE: Invalid Numeric Data | Invalid parameter format (number) |
| REMOTE: Invalid Unit | Invalid parameter format (unit) |
| REMOTE: Invalid Parameter | Invalid parameter format (defined character string) |
| REMOTE: Invalid Format | Invalid parameter format (such as a parameter count) |
| REMOTE: Command Not Accepted | Command rejected |
| REMOTE: Invalid Status | Not available in the current state |
| REMOTE: Out of Range | Invalid parameter format (range) |

## Internal Errors

| Error message | Explanation |
|---|---|
| Backup Failure, All Parameter Initialized | Corrupted SRAM (Backup failure) |
| REMOTE: Response Failure | Remote message response failure |
| Unlock | Hardware error |

# Status Messages

## Operation in progress

| Status Messages | Explanation |
|---|---|
| Wait A Moment: File Downloading | File being downloaded |
| Wait A Moment: Memory Storing | Writing to internal memory |
| Wait A Moment: File Exporting | File being exported |
| Wait A Moment: File Importing | File being imported |
| Wait A Moment: Calculating | Pattern being calculated |

*The messages will be erased when the operation is completed.

## Completion Notices

| Status Messages | Explanation |
|---|---|
| All Parameter Are Initialized | Parameters initialized |
| File Export Complete | Export completed |
| File Import Complete, Parameter Restorted | Import completed |
| Software Updated | Software update completed |
| Screen Copy Completed | Screen copy completed |

## Reports

| Status Messages | Explanation |
|---|---|
| PC Card Inserted | PC card inserted |
| PC Card Removed | PC card remove |
| Uncal | UNCAL detected |

# Appendix C Default Value List

## <Frequency Functions>

| | |
|---|---|
| Screen display frequency | 0.250 000 00 MHz |
| Offset frequency | 0.00 Hz |
| Offset On/Off | Off |
| Relative On/Off | Off |
| Resolution digit (reverse digit) | 0.01 Hz (least significant digit) |
| Incremental step frequency | 0.01 Hz |

## <Output Level Functions>

| | |
|---|---|
| RF On/Off | On |
| Output level | –143.00 dBm |
| Display unit | dBm |
| Voltage unit | EMF |
| Offset output level | 0.00 dB |
| Offset On/Off | Off |
| Relative On/Off | Off |
| Continuous On/Off | Off |
| Resolution digit (reverse digit) | 0.01 dBm (least significant digit) |
| Incremental step output level | 0.01 dB |
| SAFETY mode on/off | Off |
| ALC On/Off | ALC On |
| ALC time constant | Auto |
| RF high level output | Off |

## <Memory Functions>

| | |
|---|---|
| Screen display BPM location number | ——— (display) |
| Attribute-edited BPM location number | 1 |
| Last saved BPM location number | 0 |
| APM recall result | None |
| All APM location titles | None |
| Selected BPM location recall | Both |
| Selected BPM location skip mode | Off |

∗: BPM= Base Parameter Memory
APM = All Parameter Memory

## <Analog Modulation Functions>

| | |
|---|---|
| Analog modulation on/off | Off |
| Internal AF source oscillation frequency * | 1,000.00 Hz |
| frequency resolution digit * | 0.01 Hz digit |
| Internal AF source waveform * | Sine |
| Internal AF source output on/off * | Off |
| Internal AF source output level * | 0.000 V (p-p) |
| Internal AF source output offset * | 0.000 V (p-p) |
| External AM input coupling | AC |
| External FM/ϕM input coupling | AC |
| Wide AM (external input) on/off | Off |
| AM modulation source *f | Ext |
| AM on/off | Off |
| AM modulation depth | 0.0 % |
| FM/ϕM modulation source * | Ext |
| FM/ϕM selection | FM |
| FM/ϕM On/Off | Off |
| Frequency modulation deviation | 0 Hz |
| ϕM deviation | 0 rad |
| ϕM deviation unit | rad |
| PM modulation on/off | Off |

* Displayed only if an AF synthesizer option is installed.

## <Digital Modulation Function>

| | |
|---|---|
| I/Q source Int/Ext | Unit available, Int |
| | Unit not available, Ext |

## <Configuration Functions>

| | |
|---|---|
| RF output quadurature ratio adjustment | 0 |
| RF spectrum reverse | Off |
| I/Q output on/off * | Off |
| I/Q output quadurature ratio adjustment | 0 deg |
| I/$\overline{\text{I}}$-output level adjustment * | 100.0 % |
| Q/$\overline{\text{Q}}$-output level adjustment * | 100.0 % |
| I-output offset * | 0.00 V |
| $\overline{\text{I}}$-output offset * | 0.00 V |
| Q-output offset * | 0.00 V |
| $\overline{\text{Q}}$-output offset * | 0.00 V |
| Remote control port * | None |
| GPIB operation mode* | Device |
| GPIB address* | 3 |
| GPIB Terminator (as Talker) * | LF |
| | |
| Internal buzzer on/off | On |
| Screen saver launch time | None |

* Displayed only if an additional function of I/Q signal output option is installed.

** Not initialized by pressing the Preset key or entering the *RST command.

## <Measuring Instrument Control Functions>

| | |
|---|---|
| Knob Hold (Knob operation) | Normal (Knob operation) |
| Display On/Off | On |
| Panel Lock | Unlock |

# Appendix D Performance Test Report Form

Test Location _____

Report No. _____
Date _____
Test Officer _____

Instrument Name MG3681A digital modulation signal generator
Serial No. _____

Ambient Temperature _____ °C

Power Frequency _____ Hz

Relative Humidity _____ %

Remarks:

## Output Level Frequency Responses (Section 5.2.3)

| Setting | Result | |
|---|---|---|
| 1 MHz | ☐ OK | ☐ NG |
| 10 MHz | ☐ OK | ☐ NG |
| 100 MHz | ☐ OK | ☐ NG |
| 300 MHz | ☐ OK | ☐ NG |
| 600 MHz | ☐ OK | ☐ NG |
| 1000 MHz | ☐ OK | ☐ NG |
| 2000 MHz | ☐ OK | ☐ NG |
| 3000 MHz | ☐ OK | ☐ NG |

## Output Level Frequency Responses (Section 5.2.4)

| Setting | | Minimum Rating | Result | Maximum Rating | Measurement Uncertainty |
|---|---|---|---|---|---|
| Frequency | Output Level | | | | |
| 1 MHz | 0 dBm | −1.0 dBm | | +1.0 dBm | ±0.4 dB |
| 10 MHz | | −1.0 dBm | | +1.0 dBm | |
| 100 MHz | | −1.0 dBm | | +1.0 dBm | |
| 300 MHz | | −1.0 dBm | | +1.0 dBm | |
| 600 MHz | | −1.0 dBm | | +1.0 dBm | |
| 1000 MHz | | −1.0 dBm | | +1.0 dBm | |
| 1500 MHz | | −1.0 dBm | | +1.0 dBm | |
| 2000 MHz | | −1.0 dBm | | +1.0 dBm | |
| 2500 MHz | | −1.0 dBm | | +1.0 dBm | |
| 3000 MHz | | −1.0 dBm | | +1.0 dBm | |

## Output Level Accuracy (Section 5.2.5)

| Output Level Setting | Minimum Rating | Result | | | | | Maximum Rating | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|---|
| | | 10 MHz | 100 MHz | 300 MHz | 600 MHz | 1000 MHz | | |
| +13 dBm | −1.0 dB | | | | | | +1.0 dB | |
| +10 dBm | −1.0 dB | | | | | | +1.0 dB | |
| +5 dBm | −1.0 dB | | | | | | +1.0 dB | |
| 0 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −5 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −10 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −15 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −20 dBm | −1.0 dB | | | | | | +1.0 dB | ±0.3 dB |
| −30 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −40 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −50 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −60 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −70 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −80 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −90 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −100 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −110 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −120 dBm | −1.0 dB | | | | | | +1.0 dB | |
| −130 dBm | −2.0 dB | | | | | | +2.0 dB | ±1.0 dB |
| −140 dBm | −2.0 dB | | | | | | +2.0 dB | |

| Output Level Setting | Minimum Rating | Result | | | | | Maximum Rating | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|---|
| | | 1500 MHz | 2000 MHz | 2500 MHz | 3000 MHz | | | |
| +13 dBm | −2.0 dB | | | | | | +2.0 dB | |
| +10 dBm | −2.0 dB | | | | | | +2.0 dB | |
| +5 dBm | −2.0 dB | | | | | | +2.0 dB | |
| 0 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −5 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −10 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −15 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −20 dBm | −2.0 dB | | | | | | +2.0 dB | ±1.0 dB |
| −30 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −40 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −50 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −60 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −70 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −80 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −90 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −100 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −110 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −120 dBm | −2.0 dB | | | | | | +2.0 dB | |
| −130 dBm | −3.0 dB | | | | | | +3.0 dB | ±1.5 dB |
| −140 dBm | −3.0 dB | | | | | | +3.0 dB | |

## Harmonic Spurious Output (Section 5.2.6)

| Settings | | Result | | Maximum Rating | Measurement Uncertainty |
|---|---|---|---|---|---|
| Frequency | Output level | 2nd harmonics | 3rd harmonics | | |
| 1 MHz | 0 dBm | | | −30 dBc | ±3.0 dB |
| 10 MHz | | | | −30 dBc | |
| 100 MHz | | | | −30 dBc | |
| 300 MHz | | | | −30 dBc | |
| 600 MHz | | | | −30 dBc | |
| 1000 MHz | | | | −30 dBc | |
| 1500 MHz | | | | −30 dBc | |
| 2000 MHz | | | | −30 dBc | |
| 2500 MHz | | | | −30 dBc | |
| 3000 MHz | | | | −30 dBc | |

## Amplitude Modulation Frequency Responses (Section 5.2.7)

| Settings | | Maximum Rating | Result | | | Maximum Rating | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|
| Frequency | Output level | | 1 kHz AM 30% / 80% | 3 kHz AM 30% / 80% | 10 kHz AM 30% / 80% | | |
| 0.4 MHz | 0 dBm | −1.5 dB | 0dB / 0dB | / − | − / − | +1.5 dB | ±0.2 dB |
| 2 MHz | | | 0dB / 0dB | / | / | | |
| 10 MHz | | | 0dB / 0dB | / | / | | |
| 100 MHz | | | 0dB / 0dB | / | / | | |
| 600 MHz | | | 0dB / 0dB | / | / | | |
| 1000 MHz | | | 0dB / 0dB | / | / | | |
| 2000 MHz | | | 0dB / 0dB | / | / | | |
| 3000 MHz | | | 0dB / 0dB | / | / | | |

## Frequency Modulation Frequency Responses (Section 5.2.8)

| Settings | | Minimum Rating | Result | | | | Maximum Rating | Measurement Uncertainty |
|---|---|---|---|---|---|---|---|---|
| Frequency | Output level | | 1 kHz FM 5k / 100k | 3 kHz FM 5k / 100k | 10 kHz FM 5k / 100k | 20 kHz FM 5k / 100k | | |
| 10 MHz | 0 dBm | −1 dB | 0dB / 0dB | / | / | / | +1 dB | ±0.2 dB |
| 100 MHz | | | 0dB / 0dB | / | / | / | | |
| 600 MHz | | | 0dB / 0dB | / | / | / | | |
| 1000 MHz | | | 0dB / 0dB | / | / | / | | |
| 2000 MHz | | | 0dB / 0dB | / | / | / | | |
| 3000 MHz | | | 0dB / 0dB | / | / | / | | |

## Phase Modulation Frequency Responses (Section 5.2.9)

| Settings | | Minimum | Result | | | | Maximum | Measurement |
|---|---|---|---|---|---|---|---|---|
| Frequency | Output level | Rating | 1 kHz<br>ϕM 1rad / 5rad | 3 kHz<br>ϕM 1rad / 5rad | 10 kHz<br>ϕM 1rad / 5rad | 20 kHz<br>ϕM 1rad / 5rad | Rating | Uncertainty |
| 10 MHz | 0 dBm | −1 dB | 0dB / 0dB | / | / | / | +1 dB | ±0.2 dB |
| 100 MHz | | | 0dB / 0dB | / | / | / | | |
| 600 MHz | | | 0dB / 0dB | / | / | / | | |
| 1000 MHz | | | 0dB / 0dB | / | / | / | | |
| 2000 MHz | | | 0dB / 0dB | / | / | / | | |
| 3000 MHz | | | 0dB / 0dB | / | / | / | | |

## Vector Modulation Frequency Responses (Section 5.2.10)

| Settings | | | Minimum | Result | | Maximum | Measurement |
|---|---|---|---|---|---|---|---|
| Frequency | Output level | I/Q Frequency | Rating | LSB | USB | Rating | Uncertainty |
| 100 MHz | 0 dBm | 1 kHz | – | 0 dB | 0 dB | – | ±0.2 dB |
| | | 15 MHz | −2 dB | | | +2 dB | |
| | | 30 MHz | −3 dB | | | +3 dB | |
| 600 MHz | | 1kHz | – | 0 dB | 0 dB | – | |
| | | 15 MHz | −2 dB | | | +2 dB | |
| | | 30 MHz | −3 dB | | | +3 dB | |
| 1000 MHz | | 1 kHz | – | 0 dB | 0 dB | – | |
| | | 15 MHz | −2 dB | | | +2 dB | |
| | | 30 MHz | −3 dB | | | +3 dB | |
| 2000 MHz | | 1 kHz | – | 0 dB | 0 dB | – | |
| | | 15 MHz | −2 dB | | | +2 dB | |
| | | 30 MHz | −3 dB | | | +3 dB | |
| 3000 MHz | | 1 kHz | – | 0 dB | 0 dB | – | |
| | | 15 MHz | −2 dB | | | +2 dB | |
| | | 30 MHz | −3 dB | | | +3 dB | |

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