Instruction Manual

ＭＳＧ－２５６０Ｂ

FM STANDARD SIGNAL GENERATOR

Precautions for Use

1. The operating temperature range of the MSG-2560B is 0～40℃.
   Therefore, avoid using it at temperatures below 0℃ or on top of heat-producing equipment.
2. Avoid the following types of locations which can cause mechanical, chemical, or other failures in the MSG-2560B
   - Locations subject to direct sunlight.
   - Locations subject to high temperatures and humidity.
   - Locations subject to high dust levels.
   - Locations subject to excessive vibration.
   - Locations subject to strong electromagnetic fields.
3. The MSG-2560B is provided with a VOLTAGE SELECTOR (see the figure of the rear view panel) which enables selection of the line power voltage as 100/115/215/230VAC ±10%, 50/60Hz.
   When changing the AC line voltage, always verify that the VOLTAGE SELECTOR has been set to the proper AC line voltage. When changing this VOLTAGE SELECTOR, always turn the POWER switch OFF (extended position) before doing so.
4. A 30-minute warmup period should be allowed for the MSG-2560B.
5. If the OUTPUT cable connected to the OUTPUT connector is connected to a circuit having a voltage of 3.5Vp-p or greater, there is a danger of burning out the resistors in the output attenuator. This, therefore, should be avoided.

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1 OUTLINE

1.1 General Description

The MSG-2560B is an FM-AM signal generator which covers the 100kHz～110MHz range. It is ideal for both FM and AM broadcast receiver measurements and features a recall function and numerical entry function which enhance ease of operation.

The output level is －19～99dBμ (0.11μVrms～89mVrms) and this may be varied in 1dB steps, all settings being made digitally. It is possible to store four independent levels and recall them as required.

0～99.5kHz FM modulation and 0～60% AM modulation are possible.

Ease of operation is ensured by center-type recall (100 memory point) function increment keys, a fine adjustment control and a ⊿ (delta) f key.

Numerical entry keys are provided to enable the storage of any desired frequency, output, and modulation level, and the fine adjustment control provides the familiar analog feel of conventional signal generators. The ⊿ display is extremely useful in deviation measurements.

Remote control is performed by coding of key operations and fine controls. Input of clock pulses and remote control signals is made at a 14-pin connector provided on the rear panel, and several signal lines are provided to enable further functional expansion.

1.2 Features

- All operations are microprocessor controlled and set values are digitally displayed for extremely easy operation.
- All panel operations may be stored in memory (up to 100 points) and recalled when necessary.
- 6-Digit digital setting of frequency is possible and a PLL provides high stability.
- A cursor may be moved to any frequency digit to provide continuous incremental control and ⊿f display is also possible.
- Stepping of frequency, output level, and modulation is possible.

- The output level may be varied over the wide range of －19～99dBμ (open circuit) in 1dB steps using a 2-digit digital setting and four independent levels may be stored in memory.
- 22.5kHz and 75kHz FM as well as 30% AM modulation may be selected by preset keys.
- Front panel controls may be remotely controlled.

1.3 Accessories

Item	Model	Qty.	Remarks
Output cable	MC-2051-B	1	50 BNC connector terminated
Fuses		2	1A or 0.5A
Instruction manual		1	

2 SPECIFICATIONS

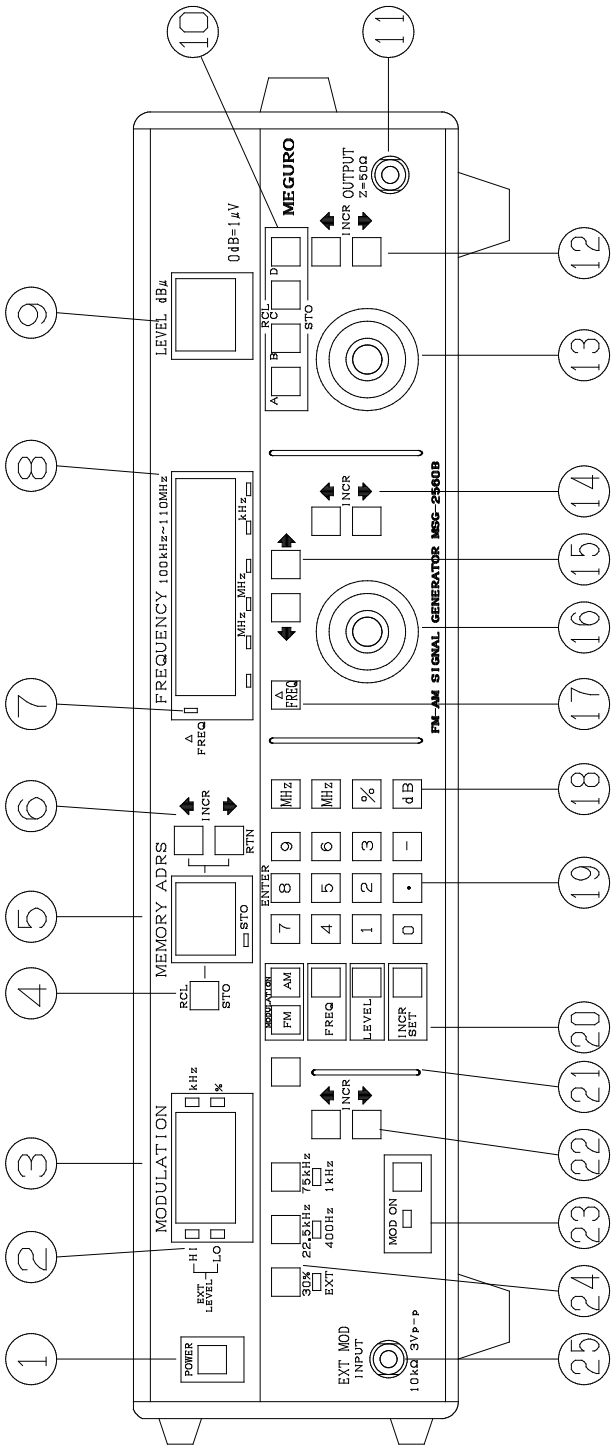
Frequency	
Range	100kHz～110MHz
Display	6-Digit digital display Incremental with ⊿f function
Accuracy	$\pm 5 \times 10^{-5}$
Setting	Value ENTER and INCREMENT keys and cursor and increment knobs
Output	
Level range	－19～99dBμ, open circuit (0.11μVrms～89mVrms)
Display	2-Digit display with a 1dB resolution
Accuracy	0～99dBμ ： ±1.0dB －19～0dBμ ： ±2.0dB
Flatness	400kHz～110MHz： ±1dB 100kHz～400kHz： ±1.5dB
Memory	4 Independent storable/recallable memories
Signal source impedance	50Ω, VSWR less than 1.2
Leakage protection	No effect on output level performance
Spurious output	less than －30dB (2nd order)
Residual modulation	For an 80Hz～20kHz modulation bandwidth: FM Components：17Hz or less S/N：Over 73dB for a 75kHz deviation AM Components：Less than 0.03% S/N：60dB or greater for 30% modulation
Setting	Value ENTER and INCREMENT keys and cursor and increment knobs
Modulation	Both internal and external modulation for FM and AM. Simultaneous FM-AM modulation is not possible.
(FM)	
Frequency deviation	0～99.5kHz, 1～110MHz Less than 1MHz：Carrier frequency x 10%
Display	3-Digit display (lowest digit in 0.5kHz steps)
Accuracy	±10% of maximum indicated value

Internal modulation frequencies	400Hz, 1kHz ±3%
External modulation	
Frequency characteristics	20Hz～100kHz ±1dB (1kHz reference) 50dB or better separation at 1kHz
Input impedance	Approx. 10kΩ, unbalanced
Input voltage	3Vpeak ±2% zone
Distortion	With a modulation frequency of 1kHz, a demodulation bandwidth of 80Hz～20kHz, and a 75kHz deviation: 0.05% or less at 10.7MHz and 65～110MHz, and 0.1% or less at other frequencies
Setting	Value ENTER, INCREMENT and 25.5kHz and 75kHz preset keys.
(AM)	
Modulation range	0～60%
Display	3-Digit display, lowest digit in 0.5% steps
Accuracy	±5% of modulation
Internal modulation frequencies	400Hz and 1kHz ±3%
External modulation	
Frequency characteristics	20Hz～10kHz ±1dB (1kHz reference) (400kHz～110MHz)
Input impedance	Approx. 10kΩ, unbalanced
Input voltage	3Vpeak ±2% zone
Distortion	The demodulation bandwidth of 20Hz ～ 20kHz, modulation frequency of 1kHz and 30% modulation: 0.5% or less at 400kHz～30MHz and 1.5% or less at other frequencies.
Setting	Value ENTER, INCREMENT and 30% preset key
Remote control	Recall of stored frequencies, output levels, and modulation as well as incrementing of stored frequency and output level (continuous adjustment) Modulation on/off control
Dummy antenna switching output	Frequency ≧ 35MHz : 1 (5V max, 50mA) Frequency < 35MHz 0

Battery backup	Provided internally
Power supply	100/115/215/230VAC ±10%, 50/60Hz Approx. 30VA (switched by a power supply switch on the rear panel)
Maximum dimensions	Approx. 430(W)×115(H)×295(D)mm
Weight	Approx. 8kg
Operating temp. range	0～40℃
Accessories	
Output cable (MC-2051-B)	This output cable is used to connect the device under measurement to the OUTPUT connector. It has a 50Ω characteristic impedance, is 80cm long and is terminated in BNC connectors.

3 OUTER APPEARANCE AND OPERATIONAL DESCRIPTION

3.1 Front Panel Layout



① POWER

AC Line power on/off switch.

② EXT.LEVEL HI,LO

Display of external modulation input level. Normal modulation is obtained when both HI and LO are extinguished.

③ MODULATION : 3-Digit display which indicates the FM and AM modulation index.

kHz : FM Frequency deviation in kHz. Minimum step size of 0.5kHz.

% : AM Nodulation index in %. Minimum step size 0.5%.

④ RCL ENTER Key : Line recall.

BL STO ENTER Key : STORES a line.

BL STO ↑ : Increments the stored column.

RCL ・ : These keys clear the recalled line and column, at which point the ENTER keys can be used to select any line and point the ENTER keys can be used to select any line and column for recall.

BL STO ・ : These keys clear the store line and column, at which point the ENTER keys can be used to store the set value.

⑤ MEMORY ADRS

Display of line number (00～99) of the matrix arranged memory.

⑥ ↑ : Increments recalled column.

↓ : Decrements recalled column.

⑦ ⊿FREQ

Lights when frequency deviation is displayed.

⑧ FREQUENCY

Display of frequency and frequency deviation.

⑨ LEVEL

RF Output level display.

⑩ STO RCL

Four independent preset points Memory keys.

⑪ OUTPUT

RF Signal output connector －19～＋99dBμ (open circuit)

Signal source impedance : 50Ω

⑫ ↑ INCR ↓

These keys increment or decrement the set value and may be used as repeat keys as well.

⑬ Increment Knob

Varies the RF output at the cursor position.

⑭ ↑ INCR. ↓

These keys increment or decrement the set value and may be used as repeat keys as well.

⑮ ← →

Cursor movement keys.

⑯ Increment Knob

This knob is used to vary the digits at the cursor position and above.

⑰ ⊿FREQ

Indicates frequency deviation.

⑱ MHz, kHz, %, dB

Unit entry keys.

⑲ ENTER

Numerical entry keys.

⑳ FREQ. : Frequency setting key.

LEVEL : RF Output level setting key.

FM : Fm Deviation setting key.

AM : Am Modulation index setting key.

- BL

  This key is used to operate functions together with other keys in flue letters.

- ↑ INCR ↓

  These keys increment or decrement the FM/AM modulation index.

- MOD. ON

  Modulation on/off key.

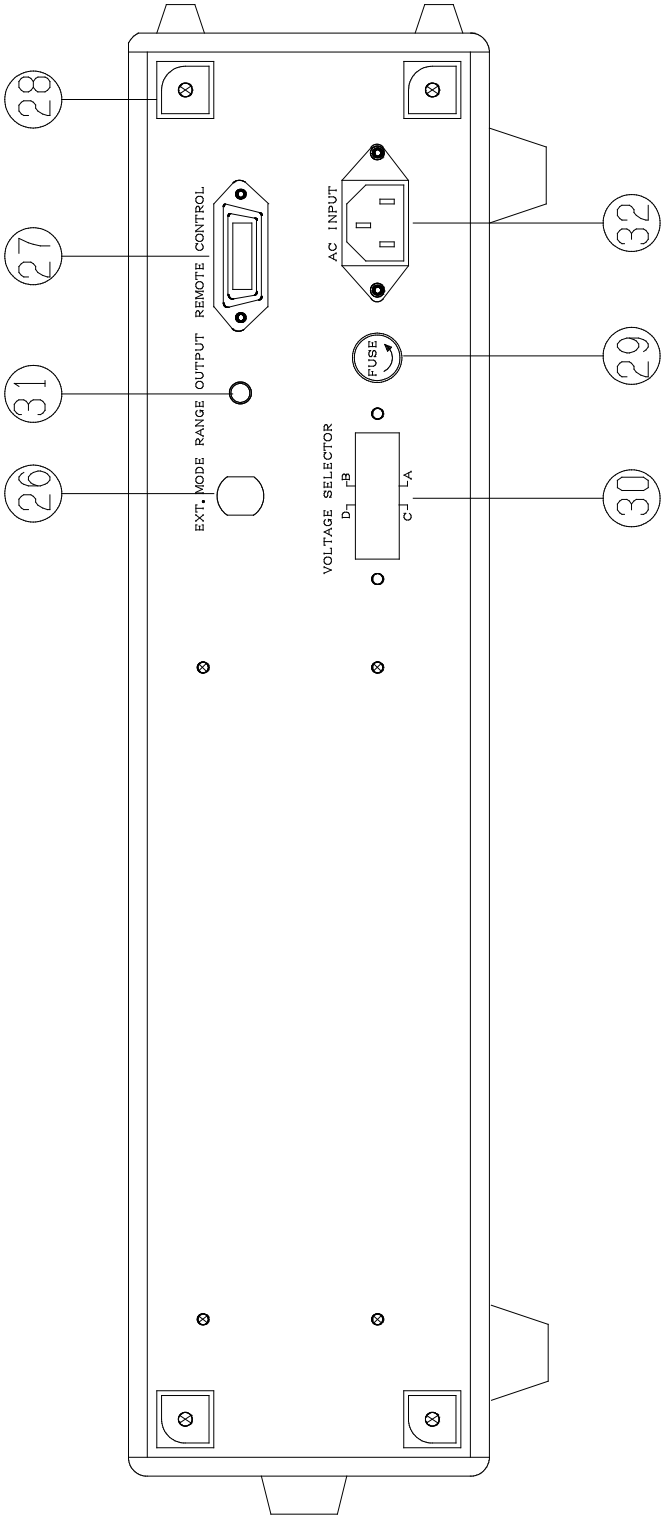
- EXT. 400Hz, 1kHz

  Internal/external switching of FM and AM modulation.

- EXT. MOD. Input

  External modulation input connector.

3.2 Rear Panel Layout



- EXT. MOD. INPUT

  It is possible to locate the panel external modulation input connector in this position (before shipment of the unit).
- REMOTE CONTROL

  This connector is provided to enable remote control of front panel key operations. It enables control of all panel functions.
- Cord Hangers

  Keep the power cord held when the MSG-2560B is carried or not in use.
- FUSE

  AC Line fuse. The proper fuse rating should be used for the voltage supplied.
- VOLTAGE SELECTOR

  This is the AC line voltage selector.

  The plug is inserted so that the arrow points to the desired AC line voltage.
- RANGE OUTPUT (RCA-Type Pin Connector)

  For a carrier frequency in the range 35～110MHz, the output is '1' with an output voltage of 5V (50mA current, maximum).

  In the range 100kHz～34.9999MHz, the output is '0'. Thus, this signal can be used a car radio dummy antenna and output impedance switching control signal.
- ACINPUT

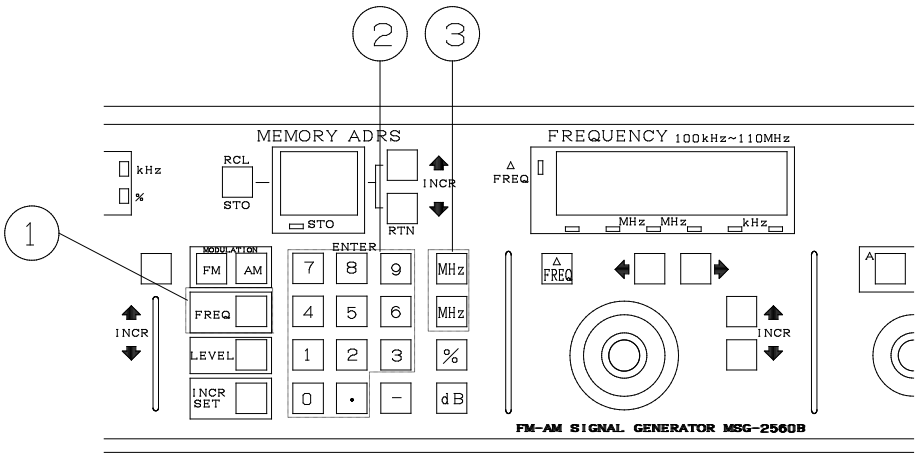
  AC Power input connector.

4 OPERATION

First, connect the power cable to a line power source of the proper voltage and press the POWER switch. When power is applied, the display that appears is the same as when the power was turned OFF.

4.1 Setting of Frequency

4.1.1 Inputting Values Directly Using the ENTER Keys



First press the FREQ key, then input the frequency setting using the ENTER keys (0～9, ・). Key operations are performed in the 1 2 3 sequence shown in the figure above. When doing this, up to 7 digits will be accepted, anything exceeding that being ignored.

If a mistake is made while pressing the ENTER keys, push the FREQ key once more, then push the value ENTER keys and finally the MHz or kHz unit key to complete the unit setting input. If the wrong unit key is pressed, it is not necessary to return to the FREQ key. Correction can be made using the ENTER keys and correct unit key (MHz or kHz)

(Example 1)

Setting the frequency to 12.3456MHz. In the setting sequence below, X indicates any arbitrary display and indicates a blank display digit.

Key operation	FREQUENCY Display	
FREQ.	×××. ×××	Same as before
1	1・・ ・・・	
2	12・ ・・・	
・	12. ・・・・	
3	12. 3・・・	
4	12. 34・・	
5	12. 345・	
6	12. 3456	
MHz	12. 345. 6	

(Example 2)

Inputting a frequency of 10MHz

Key operation	FREQUENCY Display
	12. 345. 6
FREQ.	12. 345. 6
1	1・ ・・・ ・
0	10 ・・・ ・
MHz	10. 000. 0

(Example 3)

Setting the frequency to 85.7MHz and making an error in this setting.

Key operation	FREQUENCY Display
FREQ	１０．０００．０
8	８・　・・・　・
6　6 pressed instead of 5	８６　・・・　・
FREQ.	１０．０００．０

As long as neither MHz nor kHz is pressed, the frequency display will remain unchanged.

8	８・　・・・・
5	８５　・・・・
・	８５．・・・・
7	８５．７・・・
MHz	８５．７００

(Example 4)

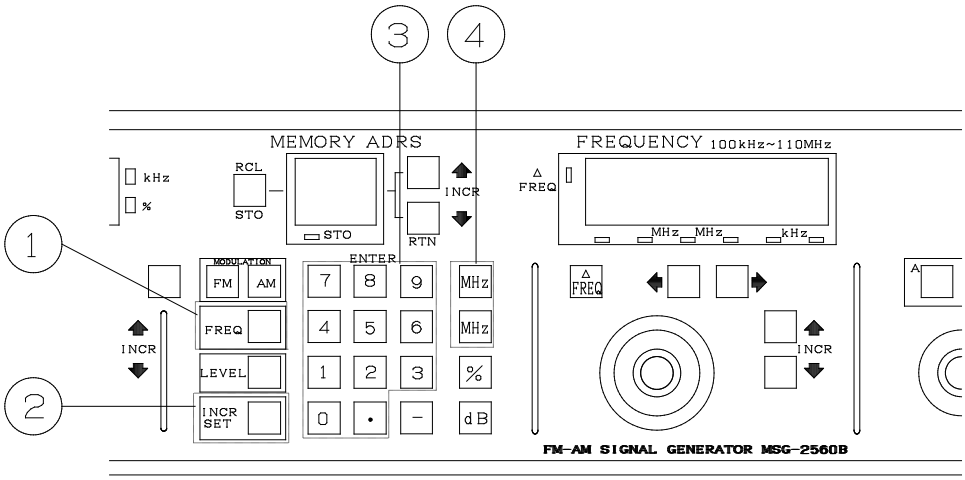
Setting a frequency of 1MHz and erroneously inputting 11MHz.

Key operation	FREQUENCY Display
FREQ.	・８５．７００
1	１・・　・・・
1	１１・　・・・
MHz	１１．０００．０
1	１・　・・・　・
MHz	１．０００．０

As shown above, if an error is made during the entry of a numerical value and the FREQ key is pressed as well as the units key, it is possible to eliminate the pressing of the FREQ key.

4.1.2 FREQ. INCR Setting

The FREQ INCR INCR keys may be set to any arbitrary step size (minimum size being 100Hz), thus enabling the increase and decrease of frequency setting. When performing this setting, the position of the cursor in the FREQUENCY display has no significance.



As shown in the figure above, the setting should be made in the sequence 1 2 3 4.

(Example)

Setting the FREQ INCR to 9kHz.

Key operation	FREQUENCY Display
FREQ	・１．００００
INCR. SET	・１．０００００
9	９・　・・・・
kHz	・１．０００００
INCR. (Pressed once)	・１．００９０

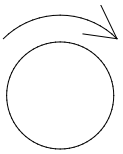
To continuously increase or decrease frequency in 9kHz steps, press the INCR and keys, respectively, continuously to execute a repeated step of frequency.

4.1.3 Using the Increment Knob

The increment knob is used to increase and decrease the digit of the FREQUENCY display over which the cursor is located.

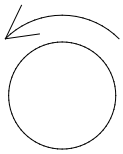
(Example 1)

Changing from 100MHz to 100.02MHz (indicates the cursor position.)

Key operation		FREQUENCY Display
		１００．０００
←	Press once	１００．０００
	Turn the increment knob 2 steps CW	１００．０２０

(Example 2)

Changing from 100.02MHz to 98.02MHz.

Key operation		FREQUENCY Display
		１００．０２０
←	Press once	１００．０２０
	Turn the increment knob 2 steps CCW	・９８．０２０

When using the increment knob, it is not necessary to press the MHz or kHz keys.

4.1.4 Using the ⊿FREQ Frequency Deviation Key

This function is used to view the frequency change and is extremely useful in such measurements as those of the bandwidth of a receiver.
The display will indicate the results of calculations as follows.

- Fo is the frequency displayed immediately prior to pressing the ⊿ FREQ key.
- F is the frequency change displayed after pressing the ⊿FREQ key and then either the FREQ INCR key or turning the increment knob.
  ⊿FREQ=F－Fo
  Therefore, if F=1MHz and F=98.5MHz, ⊿FREQ=－1.5MHz, when the FREQ is pressed, the FREQ indicator of the ⊿FREQ display will light.

(Example)
Assume a currently displayed frequency of 100MHz.

Key Operation	FREQUENCY Display
	１００．０００……Fo
FREQ.	・・・　・・０
INCR. SET	・・・　・・０
1	１・・　・・・
MHz	・・・　・・０
INCR.↓	－・１．０００
Turn increment knob 5 steps CCW.	－・１．５００

⊿FREQ indicator will light and the display will read －1.5MHz.

To cancel the ⊿FREQ function, press the ⊿FREQ key once more.

FREQ ・９８．５００……F

If the INCR ↑ ↓ keys are pressed continuously, the function will repeat continuously, changing the frequency in 1MHz steps.

In this example, before pressing the INCR SET key, if LEVEL, FM and AM keys or key other than the ⊿FREQ key are set, incrementing will not be possible.

Therefore, before pressing the ⊿FREQ key, the step should be set using the FREQ and INCR SET keys.

4.1.5 Other Key Settings

(a) MAX INCR. Key

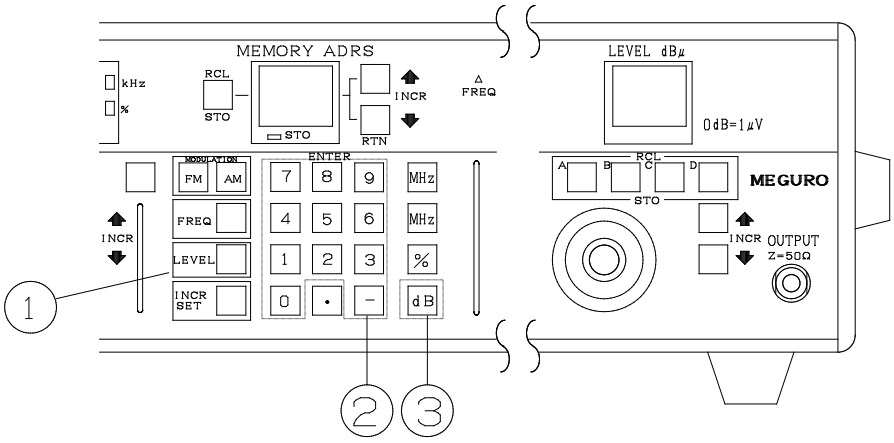
When the BL key (unmarked blue key) is pressed simultaneously with the MAX key, the maximum settable frequency (110MHz) is displayed.

(b) MIN INCR. Key

When the BL key is pressed simultaneously with the MIN key, the minimum settable frequency step value (0.1Hz) is displayed.

4.2 Setting of Output Level

4.2.1 Direct Numerical Input Using the ENTER Keys



Pressing the LEVEL key and then the ENTER numerical keys (0～9, －), the desired numerical value may be input.

Input is made in the sequence 1 2 3, as shown above.

During a key input sequence, if any key other than those encircled with ⬚ is pressed, the numerical value immediately prior to pressing the LEVEL key will be displayed.

When the numerical input is completed, press the dB key, and the correct display will appear in the LEVEL display.

(Example 1)

Setting a level of 7dB

Key Operation	LEVEL Display	
LEVEL	××	Same as before
7	7 ·	
dB	· 7	

(Example 2)

Setting a level of －5dB.

Key Operation	LEVEL Display
LEVEL	・7
－	－・
5	－5
dB	－5

This key need not be pressed when continuous settings are made.

(Example 3)

Making an error while setting a level of 12dB.

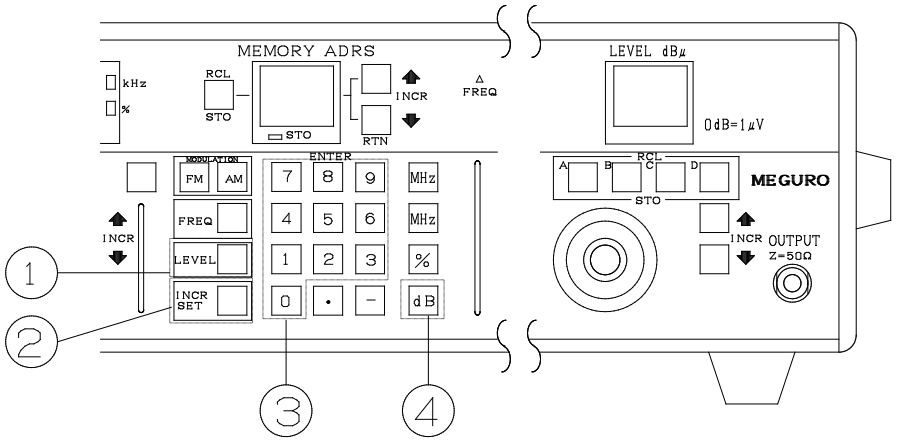
Key Operation	LEVEL Display
LEVEL	－5
1	1・
3	13
LEVEL	－5
1	1・
2	12
dB	12

If a numerical setting error has been made and the dB key has been pressed input is possible using the numerical value ENTER keys.

When levels are set that are outside the minimum and maximum values possible, the display will return to its previous value.

4.2.2 Using the LEVEL INCR. Setting

The LEVEL INCR. INCR. ↓ ↑ keys may be set to any arbitrary step size (minimum: 1dB), enabling the output level to be increased and decreased.



The input setting is made in the sequence 1 2 3 4, as shown above.

(Example)

Setting the LEVEL INCR. to 2dB.

Key Operation		LEVEL Display
LEVEL		− 5
INCR. SET		− 5
2		2 ·
dB		− 5
INCR.	Press	− 3
	Once	

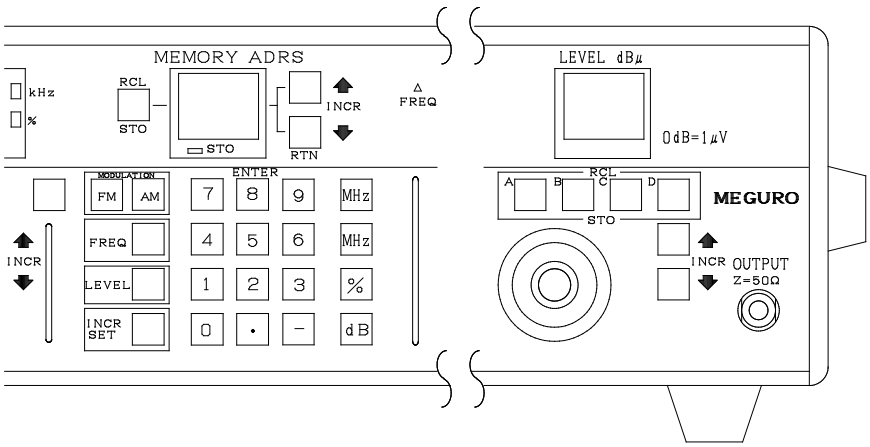
To continuously change the level in 2dB steps, press the INCR ↑ ↓ to affect a repeated function.

In addition, if the BL key is pressed simultaneously wit the MAX key, the maximum settable level will be displayed, and if the BL and MIN keys are pressed simultaneously, the minimum settable level will be displayed.

4.2.3 Using the Increment Knob

The increment knob may be used to increase and decrease the output level with a minimum step size of 1dB. When turned clockwise, it increases the level and when turned counter-clockwise, it decreases the level.

4.2.4 Using the Four Independent Memories



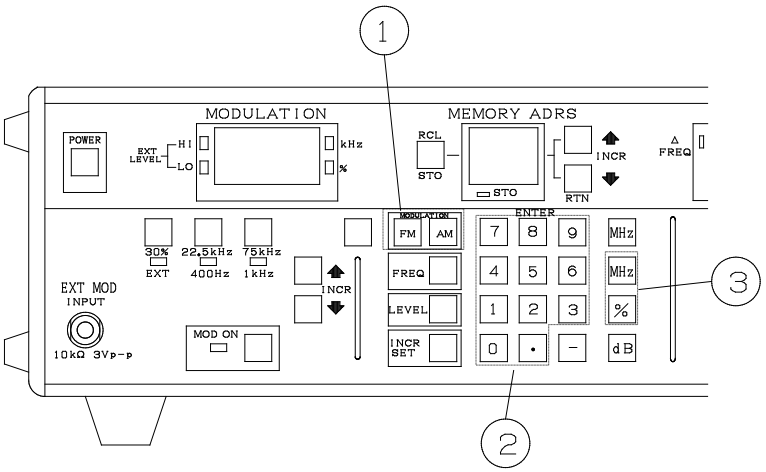
The four keys (A～D) shown in the above figure are independent from the main memory (see Section 4.4) and correspond to memory assignable to output levels only.

To store, press the blue key and one of the A～D keys, in this sequence.

It is possible to store the presently displayed output level of any key A～D. Essentially, the memory address becomes one of the A～D keys and, to recall, one of these keys is pressed.

Note that these four memories have no effect whatsoever on the main memory.

4.3 Setting of Modulation



4.3.1 Inputting Using the Numerical Keys

Input is made in the sequence 1 2 3, as shown above.

First, the MODULATION FM or AM key is pressed.

When this is done, the currently set modulation is displayed, along with units, on the MODULATION display.

Next, the numerical ENTER keys (0～9, ・) are used to set the desired input value. When the desired input value is completely entered, press the kHz key for FM modulation or the % for AM modulation and the modulation will be displayed, along with units, on the MODULATION display.

While any value may be input using the numerical keys (0～9, ・), both FM and AM have a maximum of 99.5 and minimum of 0.5. Therefore, when the kHz and % keys are pressed, inputs in the range ××.0～××.4 will be changed to ××.0, while inputs in the range ××.5～××.9 will be changed to ××.5 before actually being entered.

(Example 1)

Setting the FM modulation to 67.5kHz.

Key Operation	MODULATION Display
	1kHz
FM	××. ×……Previously set value
6	6・ ・
7	6 7 ・
・	6 7. ・
5	6 7. 5
	1kHz
kHz	6 7. 6

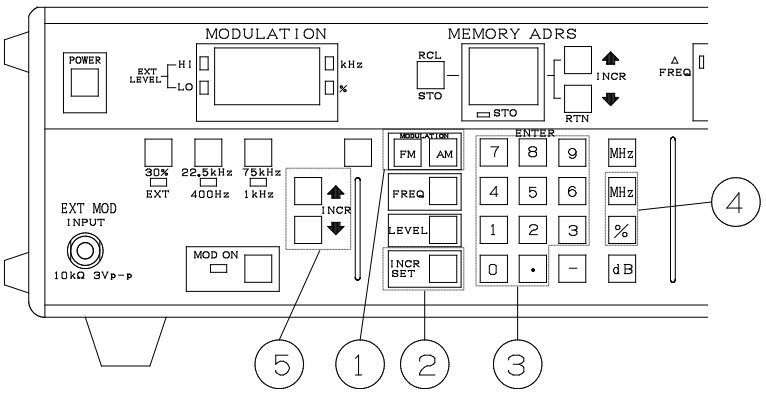
(Example 2)

Now, set 30% AM modulation.

Key Operation	MODULATION Display
AM	××. ×……Previously set value
	1%
3	3・ ・
0	3 0 ・
%	3 0. 0
	1%

4.3.2 Using MODULATION INCR.

By pressing the INCREMENT ↑ ↓ keys, the modulation index may be increased and decreased by a previously set step value. If the key is pressed continuously, a repeated increment is affected.



Setting is made in the sequence 1 2 3 4 5, as shown above.

(Example 1)

Setting FM INCR. to 2.5kHz.

Key Operation	MODULATION Display
	1kHz
FM	7 5. 0
INCR. SET	7 5. 0
2	2・ ・
・	2. ・
5	2. 5・
	1kHz
kHz	7 5. 0

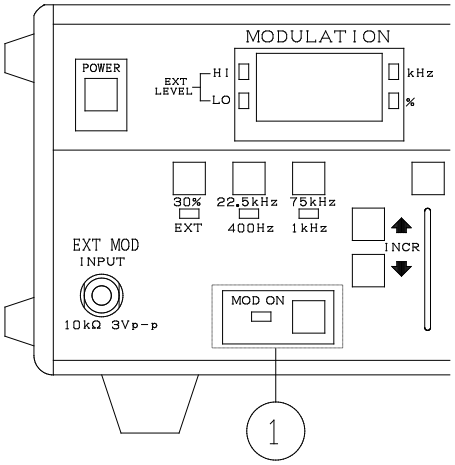
(Example 2)

Setting FM INCR. to change the FM deviation to 67.5kHz.

Key Operation	MODULATION Display 1kHz
INCR.	７２．５
INCR.	７０．０
INCR.	６７．５

Each time the INCR. ↓ key is pressed, the value set using the INCR. SET is increased or decreased. This is the same for AM INCR.

4.3.3 Setting the Modulation Source



When the modulation source selection keys are pressed, the associated LED lights.

The key 1 turns the modulation on/off. Each time it is pressed, the on/off modes are alternately selected.

(Example 1)

Change from internal 400Hz FM modulation to 75kHz deviation.

Key Operation	－ 400kHz Lights
400Hz	1kHz
FM	××．×
7	7・ ・
5	75 ・
	1kHz
kHz	75．0

(Example 2)

Turning modulation OFF.

Key 1 is pressed, and the LED goes out, indicating the OFF condition.

At this time, the display appears as follows.

1kHz

0．0

4.3.4 Connecting the External Modulation Signal Source

(a) Connect an AF signal source to the EXT. MOD. INPUT connector and press the EXT. key.

(b) The AF signal source level should be adjusted so that both the EXT. LEVEL HI and LO indicators on the MODULATION display are extinguished.

If the AF signal source level is excessively low, the LO indicator will light and if the level is excessively high, the HI indicator will light.

Note that changing the level of modulation does not require changing the level of the AF signal source.

4.3.5 Using the Blue Key

(a) Pressing BL 22.5kHz selects 22.5kHz FM modulation.

(b) Pressing BL 75kHz selects 75kHz FM modulation.

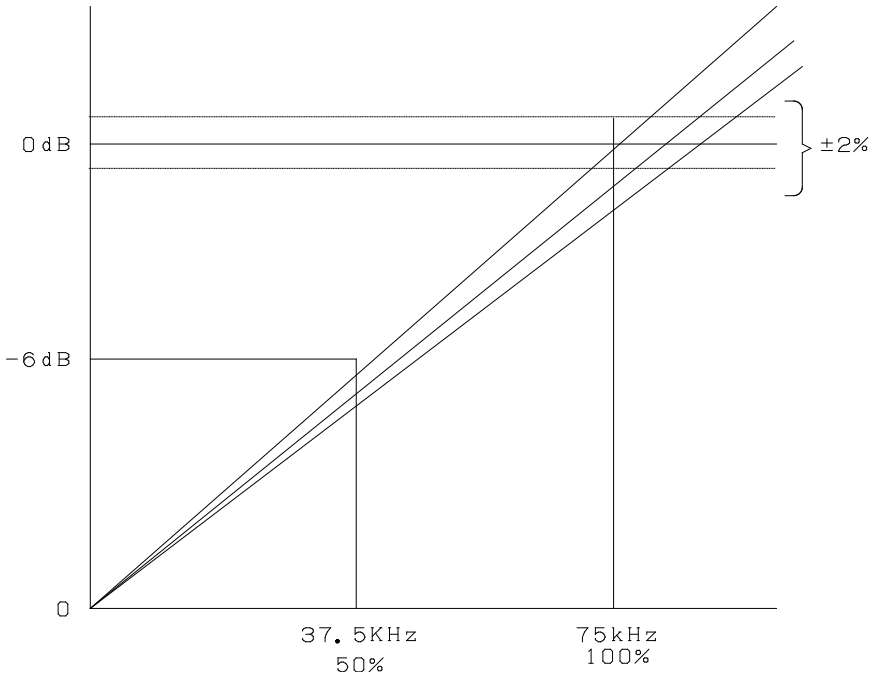
(c) Pressing BL 30% selects 30% AM modulation.

(d) Pressing BL MAX displays the maximum setting value (99.5).

(e) Pressing BL MIN displays the minimum setting value (0.5).

4.3.6 Setting the Stereo Signal Source

(a) Description of Setting Range



The above figure indicates the modulation input level relationships.

If the input level is adjusted to within the HI-LO range, the setting value error will be ±2%. Using this HI-LO level as references, the modulation is digitally set internally. This HI-LO range used peak values for both single and complex waveforms and, as shown in the level. For example, if the input level is set in the range between HI and LO, after setting the display to 75kHz deviation, if the input level is attenuated －6dB, with a display of 75kHz=100%, the deviation will be 37.5kHz=50%. In this condition, while the LO 1amp will light, normal modulation will be achieved.

Also, if the input level is set in the range between HI and LO, the HI and LO 1amps will go out.

However, there are cases in which switching the MAIN, LEFT, RIGHT, and SUB of the stereo signal source will cause the HI and LO 1amps to light alternately.

Since the HI-LO range is extremely narrow, these 1amps may light alternately, however, this does not indicate an excessive error and does not pose a problem.

(b) Setting the MSG-211FS Ⅱ

1. Turn the COMPOSITE LEVEL clockwise to the maximum position.
2. Set the OUTPUT SIGNAL MAIN & SUB to OFF and PILOT to ON. Set the PILOT LEVEL adjustment to 10%.
3. Set the OUTPUT SIGNAL MAIN & SUB to ON and set the PILOT to OFF.
4. For an internal input, set AF IN OR INT. and set PRE-EMPHASIS ON, if required.
5. Set the INTERNAL MODULATOR to, for example, 1kHz and with the OUTPUT SIGNAL as MAIN, adjust the INTERNAL MODULATOR LEVEL control to 90%.
6. Connector the OUTPUT of the MSG-211FS Ⅱ to the EXT. MOD. INPUT of the MSG-2560B using a low-capacitance cable.
7. Set the OUTPUT SIGNAL PILOT to ON and adjust the COMPOSITE LEVEL knob to within the EXT. MOD. HI-LO range of the MSG-2560B. When doing this, although the meter indication on the MSG-211FS Ⅱ will become small, the ratio does not change, and no problem will occur.
8. Set the deviation of the MSG-2560B to 75kHz=100%. This will set MAIN=90%, PILOT=10%, for a total of 100%.
9. Switch between MAIN, LEFT, RIGHT and SUB on the MSG-211FS Ⅱ to obtain stereo characteristics.
10. In steps 1～9, if the OUTPUT SIGNAL is set to ON and the PILOT is set to OFF, the EXT. MOD. LO 1amp of the MSG-2560B will light, and MAIN will be 90%, while PILOT will be 0%.
11. In steps 1～9 if the AM IN ATT 30% of the MSG-211FS Ⅱ is pressed, although the MSG-2560B display remains as 75kHz, the EXT. MOD. LO 1amp will light and, at 30% modulation, MAIN=20.25kHz and PILOT=7.5kHz.

(c) Setting the MSG-211G

1. Set PILOT to ON and FUNCTION and M&S to OFF.
2. Use the PILOT LEVEL trimmer to set the PILOT LEVEL to 10%.
3. Set FUNCTION MAIN and, to use internal input, set AF INT.
4. Set AF IN ATT to OFF and the INTERNAL MODULATOR to 1kHz. Adjust the LEVEL knob to 90%.
5. Connect the OUTPUT of the MSG-211G to the EXT. MOD. INPUT of the MSG-2560B, using a low-capacitance cable.
6. Set PILOT to ON and adjust the COMPOSITE LEVEL knob to within the EXT. MOD. HI-LO range of the MSG-2560B.
7. Set the deviation of the MSG-2560B to 75kHz=100%.
   This will set MAIN=90%, PILOT =10%, for a total of 100%.
8. Switch between MAIN, LEFT, RIGHT and SUB on the MSG-211G to obtain stereo characteristics.
9. Also, in the MONO position, a setting of 75kHz=100% is also possible.
10. In step 1～8, if the PILOT of the MSG-211G is set to OFF, the EXT. MOD. LO 1amp of the MSG-2560B will light and MAIN=90%, and PILOT=0%.
11. In steps 1～8, if the AF IN ATT 30% of the MSG-211G is pressed, although the MSG-2560B display remains as 75kHz, the EXT. MOD. LO 1amp will light and, at 30% modulation, MAIN=20.25kHz and PILOT=7.5kHz.

(d) Setting the MSG-2101

1. Set PILOT to ON and set FUNCTION to OFF.
2. Use the PILOT LEVEL trimmer to set the PILOT LEVEL to 10%.
3. Set PILOT to OFF and, with FUNCTION as MAIN, to use internal input set INT. MOD. to 1000Hz and adjust the LEVEL knob to 90%.
4. Connect the COMPOSITE OUTPUT of the MSG-2101 to the EXT. MOD. INPUT of the MSG-2560B, using a low-capacitance cable.
5. Set PILOT to ON and adjust the COMPOSITE LEVEL knob to within the EXT. MOD. HI-LO range of the MSG-2560B.
6. Set the deviation of the MSG-2560B to 75kHz=100%.
   This will set MAIN=90%, PILOT=10%, for a total of 100%.
7. Switch between MAIN, LEFT, RIGHT and SUB on the MSG-2101 to obtain stereo characteristics.
8. Also, in the MONO position, a setting of 75kHz=100% is also possible.
9. In step 1～7, if the PILOT of the MSG-2101 is set to OFF, the EXT. MOD LO 1amp of the MSG-2560B will light and MAIN=90%, and PILOT=0%.
10. In steps 1～7, if the MSG-2101 PILOT is set to OFF, with FUNCTION as MAIN, if the INT. MOD. LEVEL is set to 30%, the MSG-2560B display will remain as 75kHz, the EXT. MOD. LO 1amp will light, and with 30% modulation MAIN=20.25kHz and PILOT=7.5kHz.

4.4 Using Memory

4.4.1 Memory Recall

Memory is arranged in a matrix configuration. Essentially, this consists of lines 0～9 vertically and columns 0～9 horizontally, for a total of 100 points. The memory arrangement is shown below.

MEMORY ADRS. LED

００	０１	０２	０３	０４	０５	０６	０７	０８	０９
１０									・
２０									・
３０									・
４０									・
５０									・
６０									・
７０									・
８０									・
９０	・	・	・	・	・	・	・	・	９９

The basic recall operation is performed by calling the line number using the RCL and ENTER numerical keys and calling the step numbers (columns) in sequence using the key. To recall any row and column number, use the RCL key and the ENTER key group key to clear the currently displayed row and column, enabling any specification to be made for the previously displayed row and column numbers.
In the examples given below, the frequency, output, modulation index, and other settings are made as described in Section 4.1～4.3, and stored into memory following the procedure given in Section 4.4.2.

(Example 1)

Recalling the address (1) (0)

	MEMORY ADRS	
RCL key, ENTER 1 key	(1)	(0)

(Example 2)

Recalling address (4) (3)

Press the ENTER 4 key and the MEMORY ADRS key three times.

	(4)	(3)

(Example 3)

Recalling address (8)(5).

Press the ENTER 8 key and the MEMORY ADRS key five times.

	(8)	(5)

When performing the recall operation continuously, after pressing the RCL key once, it is not necessary to press again.

(b) Using the to recall any address.

(Example 4)

Recalling address (5)(6) directly.

Pressing the RCL and ENTER・key extinguishes the LED.

The ENTER keys are pressed to enter the address (5) (6).

	(5)	(6)

Next, recall (7) (8).

Use the ENTER・key and the LED will go out.

Press the ENTER keys to enter (7)(8).

	(7)	(8)

When recalling continuously, after the RCL key is pressed one time, it is not necessary to press it again.

4.4.2 Storing Into Memory

As described in Section 4.4.1 on the recall method, the memory is arranged in a matrix configuration, enabling virtually all panel functions to be stored in memory. Note, however, that the frequency, output, the various modulation increment steps, and the ⊿FREQ functions may not be stored in memory.

The basic store operation consists of setting the frequency, output, modulation index, mode and other information and pressing BL, STO, ENTER numerical keys and finally the MEMORY UP key to the desired step number.

Also, the BL, STO, and ENTER・keys may be used to extinguish the MEMORY ADRS. LED display, after which a 2-digit numerical value is input using the ENTER keys, enabling the direct input of column and row numbers.

(Example 1)

Storing a frequency of 1MHz, the cursor kHz digit, an output level of 99dBμ, a modulation of INT 1kHz 30% AM into address (1) (0).

1 Key Operation	FREQUENCY Display
FREQ	××××××
1	1・・・・・
	↖ Cursor
MHz	・1．0000
is pressed	・1．0000
3 times	

The INCR. ↑ ↓ and the increment knob may also be used to set the frequency.

2 Key Operation	LEVEL Display
LEVEL	××
9	9・
9	99
dB	99

The INCR. ↑ ↓ and four preset points may be used to set the output also.

3 Key Operation	MODULATION Display
BL	×××
30%	30．01%
1kHz	30．01

The ENTER, INCR. ↑ ↓ and modulation mode keys may also be used to set the modulation level and mode.

With the above setting, the BL, STO, and 1 ENTER keys are used to store into address (1) (0).

Next, let us store a different item into address (1) (3).

		MEMORY ADDRESS	STEP NUMBER Display
1	Press RCL 1 two times.	(1)	(2)
2	Set the frequency, output, modulation and other information		
3	Press the BL STO keys.	(1)	(3)

Storage into memory address (1) (3) is made at step 2.

(Example 2)

Storing into memory address (4) (5).

1 Set the frequency, output, modulation and other information.

2 Press the BL, STO, and ENTER ・ keys; the LED will go out.

3 Use the ENTER keys to input address (4) (5) and store the conditions set at step 1.

(Notes)

1. For continuous storage, it is possible to eliminate pressing the BL, STO, and ENTER・keys.
2. The RTN key described in Section 4.4.3 may not be used for storing using direct storage.

4.4.3 Storing Into Memory Without Using All Steps (RTN Key)

(Example)

Assume that storage in the sequence (1)(0)→(1)(1)→(1)(2)→(1)(3)→(1)(0)→(1)(1) is to be performed.

Key Operations	MEMORY ADDRESS	STEP NUMBER Display	
RCL 1 (3 times)	(1)	(3)	
BL STO RTN	(1)	(4)	The return command is input.

(Method)

RCL 1	(1)	(0)	1st Memory
	(1)	(1)	2nd Memory
	(1)	(2)	3rd Memory
	(1)	(3)	4th Memory
	(1)	(0)	Return to 1st memory

(Canceling the RTN Key)

Press RCL 1	(1)	(3)
Press BL STO keys	(1)	(4)
	.	.
	.	.
	.	.
	.	.
	.	.
Press 5times.	(1)	(9)

The address is incremented as shown above.

4.4.4 Recalling More Than 10 Steps

Normal recall is of 10 steps at a time (00～09, 10～19, …90～99). The following procedure, however, can be used to increment memory in 10 step units.

With the MEMORY display at (09), (19), … or such values up to (89), to proceed with continuous memory storage (BLUE, STO, MEMORY), it is possible to recall the next 10 steps.

(Example)

Recalling memory steps (30) (49) continuously.

Key operation	MEMORY Display	
×	39	Previous display
BLUE	39	
STO	39	STO LED Light
MEMORY	40	STO LED goes out

The recall operation is as follows.

(30)→(31)→…→(39)→(40)→(41)→…→(49)

(Canceling Method)

To clear the MEMORY display, set the memory to (09), (19), … or (89) and press the key sequence BLUE, STO, RTN.

(Example)

To return the condition at which continuous storage in memory (30)～(49) to storage in memory (30)～(39) and (40)～(49), the following procedure is performed.

Key operation	MEMORY Display	
×	39	Previous display
BLUE	39	
STO	39	STO LED Light
RTN	30	STO LED goes out

5 OUTPUT IMPEDANCE AND USING THE DUMMY ANTENNA

5.1 RANGE OUTPUT Pin Connector

With the carrier frequency in the range 35.000～110MHz, a '1' output (5V the current of 50mA, maximum) is available, and with a carrier frequency in the range 100kHz～34.999.9, the output is '0'.

This signal can be used as a control signal for a car radio dummy antenna (MO-2952, MO-2952A) or output impedance switch (MO-2953A, MO-2952A).

The 50mA output current available is intended to enable the drive of two reed relays.

5.2 MO-2951 Band Splitting Filter

Using a combination of a highpass filter and a lowpass filter, the output signal is divided.

There is no need to use the RANGE OUTPUT control signal of the MSG-2560B.

An example of use of this Band Splitting Filter are shown in Fig. 1 and outer views of the Band Splitting Filter are shown in Fig. 2 (page 44).

This Band Splitting Filter operates without errors in the range below 30MHz and in the range 75～110MHz, the errors occurring outside these ranges being shown in Fig. 3 on page 45.

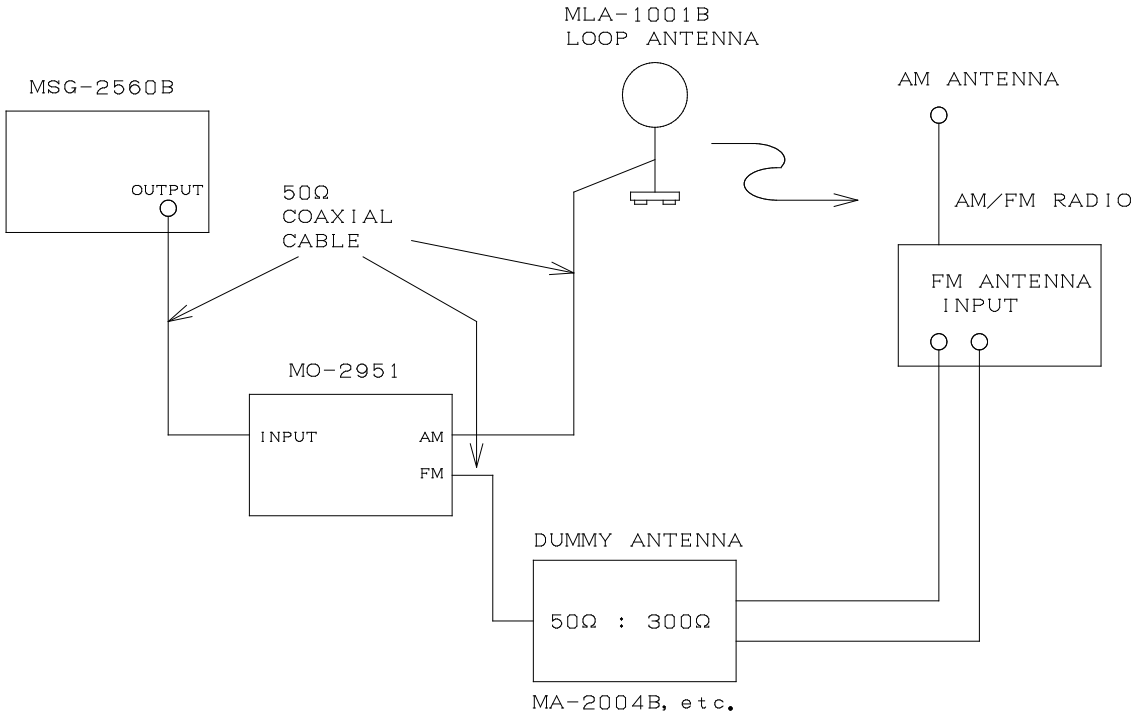


Fig. 1

MO-2951 Band Splitting Filter Specifications

Input frequency range	DC～130MHz
Input/output impedance	50Ω (BNC-J connector)
VSWR Input/output	1.2 or lower
Output frequency range	AM: DC～30MHz
	FM: 75～130MHz
Insertion loss	0.5dB or less

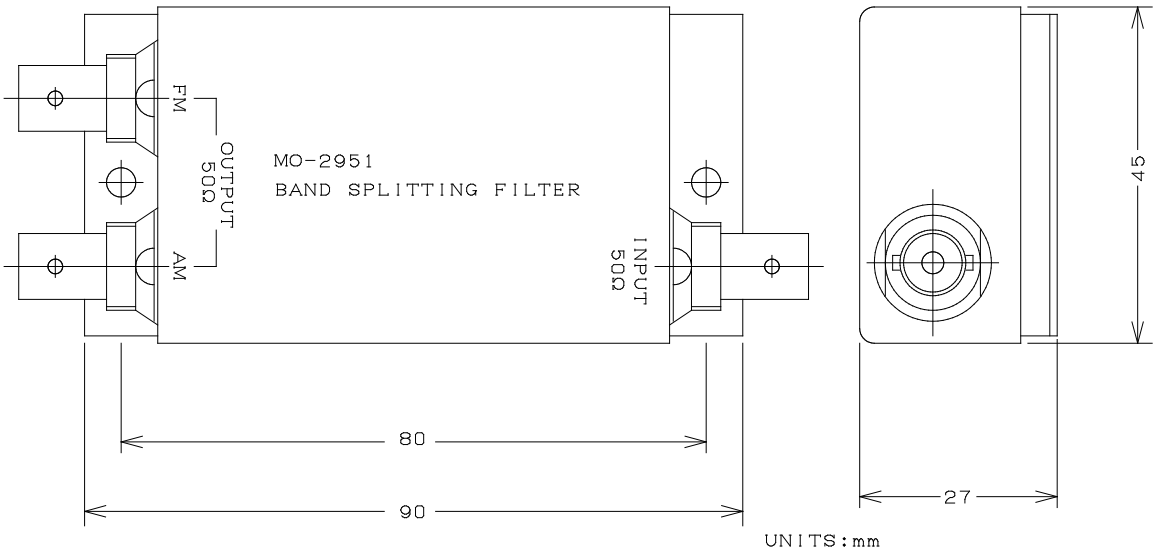


Fig. 2

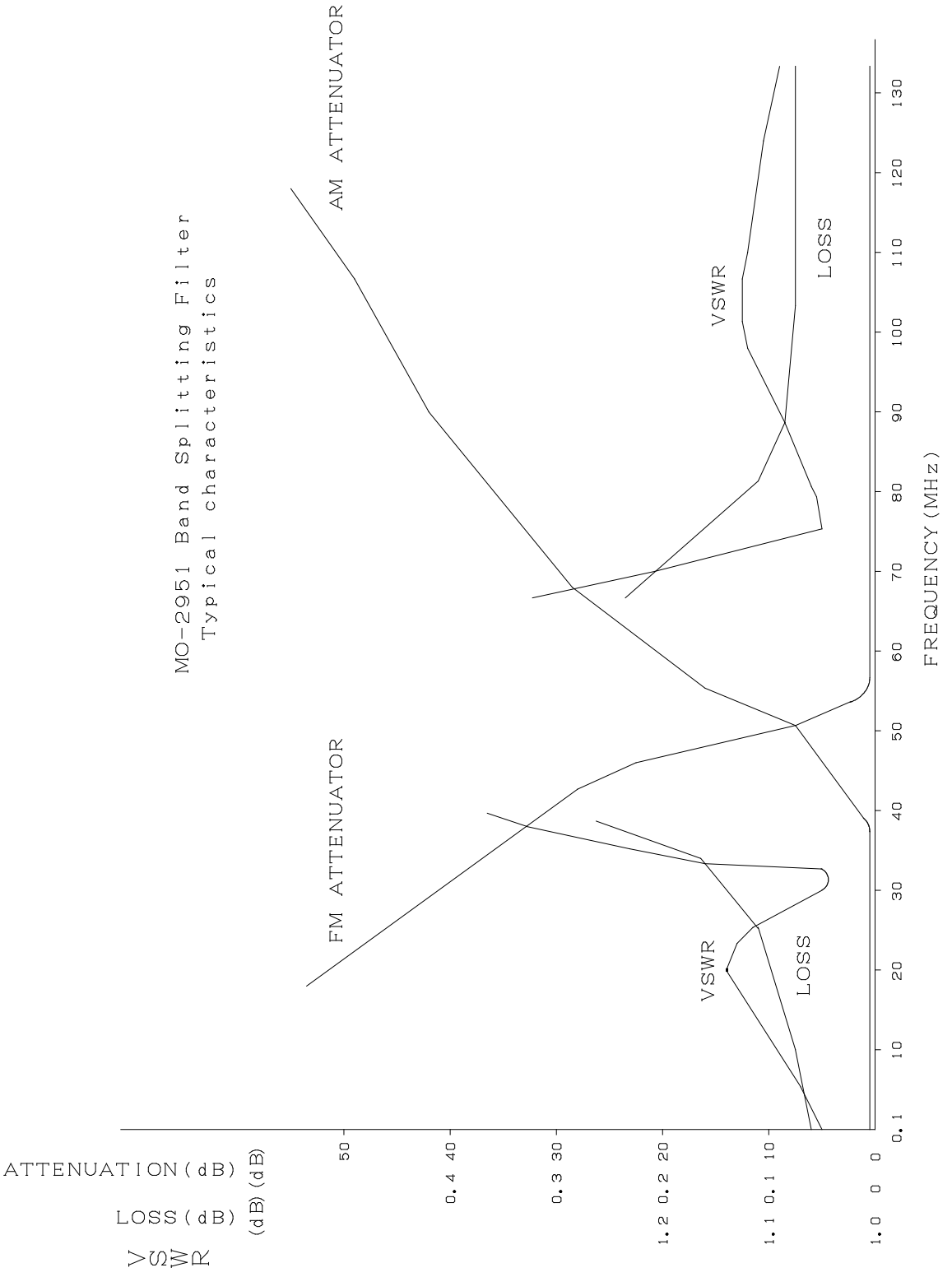

MO-2951 Band Splitting Filter
Typical characteristics
FM ATTENUATOR
AM ATTENUATOR
VSWR
LOSS
VSWR
LOSS
ATTENUATION(dB)
LOSS(dB)
VSWR
(dB)(dB)
FREQUENCY(MHz)
50
40
30
20
10
0
0.1
0.2
0.3
0.4
1.2
1.1
1.0
0.1
10
20
30
40
50
60
70
80
90
100
110
120
130

Fig. 3

5.3 MO-2952 Car Radio Dummy Antenna

This dummy antenna is for use as a load antenna in testing of car radios. It conforms to JIS standard C6102-1978 and is controlled by the 0V and 5V levels output at the RANGE OUTPUT of the rear panel of the MSG-2560B.

MO-2952…… 50Ω AM and 75Ω FM output loads
MO-2952A…… 75Ω open circuit output for both AM and FM

The method of use is shown in Fig. 4, the circuit diagrams in Fig. 5 and Fig. 7 (pages 47 and 49), while the outer views are shown in Fig. 6 (page 47) and Fig. 8 (page 49).

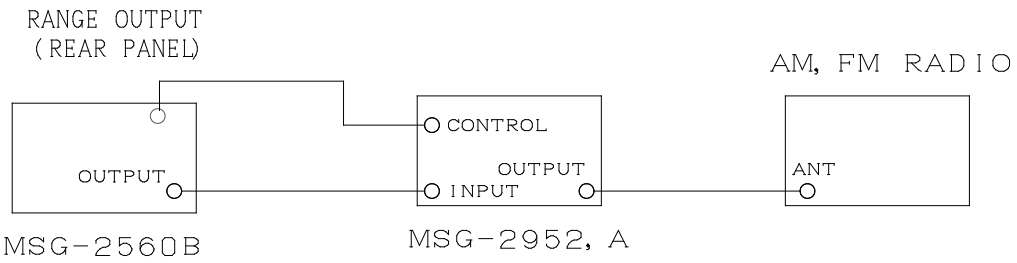


Fig. 4

5.3.1 MO-2952 Car Radio Dummy Antenna (Load Terminated Type)

Input frequency range	50kHz～200MHz
Input impedance	50Ω (BNC-J connector)
VSWR	1.2 or less
Output	AM: 0V
	FM Car radio dummy: 75Ω
Control signal	AM: 0V
	FM: 5V (50mA or less)
Control connector	Audio pin connector, RCA type (provide)

5.3.2 Dummy Antenna Circuit Diagram

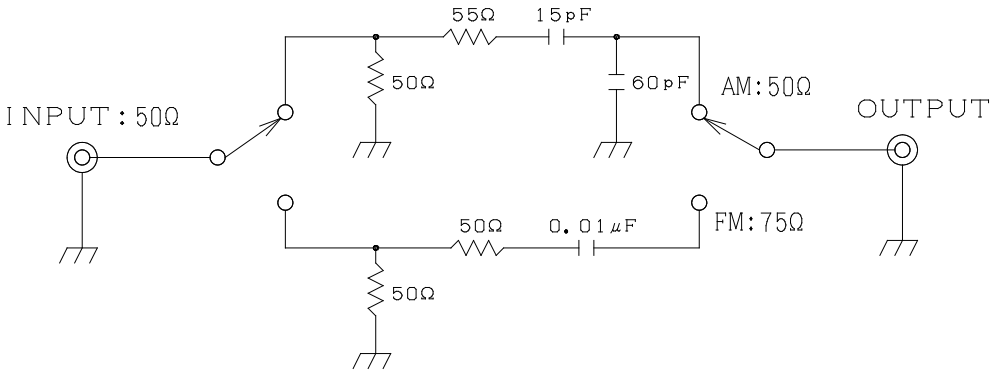


Fig. 5

(Note)

Of the 60pF AM car radio dummy antenna load capacitance, 30pF is accounted for by stray capacitance within the unit.

The load capacitance should be adjusted to 60pF, including the car radio dummy antenna cable capacitance.

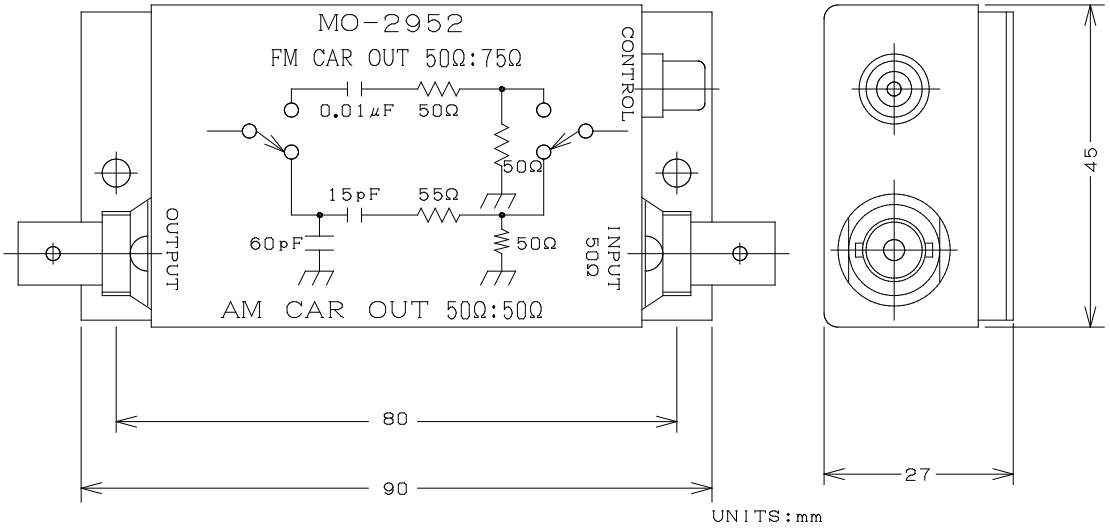


Fig. 6

5.3.3 MO-2952A Car Radio Dummy Antenna (Open Circuit Terminated)

Input frequency range	50kHz～200MHz
Input impedance	50Ω (BNC-J connector)
VSWR	1.2 or less
Output	AM Car radio dummy: 75Ω
	FM Car radio dummy: 75Ω
Control signal	AM: 0V
	FM: 5V (50mA or less)
Control connector	Audio pin connector, RCA type (provide)

5.3.4 Dummy Antenna Circuit Diagram

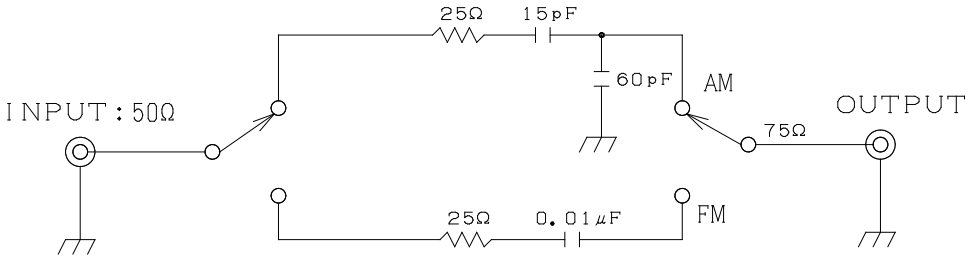


Fig. 7

(Note)

Of the 60pF AM car radio dummy antenna load capacitance, 30pF is accounted for by stray capacitance within the unit.

The load capacitance should be adjusted to 60pF, including the car radio dummy antenna cable capacitance.

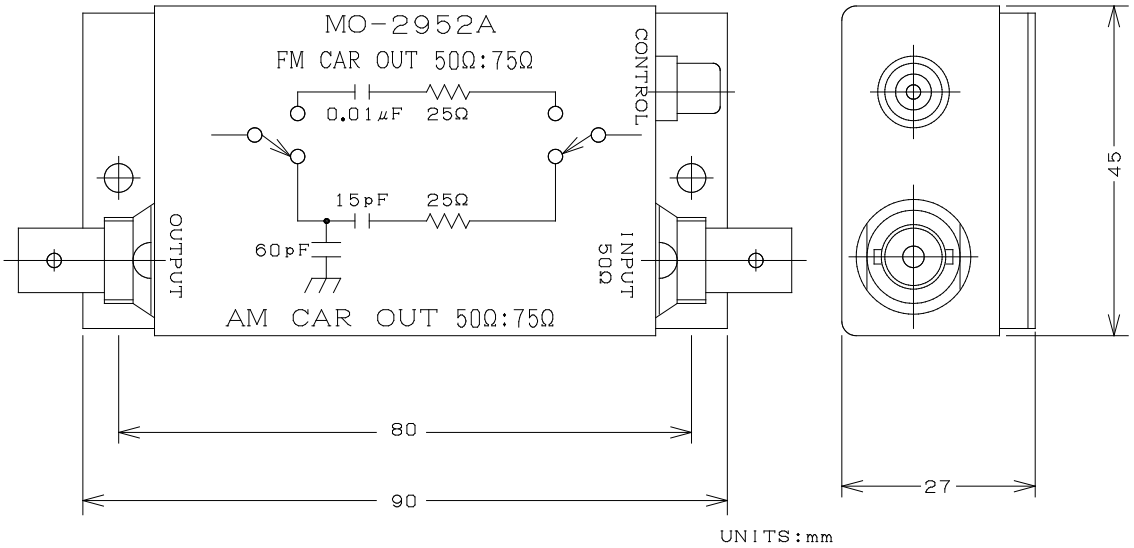


Fig. 8

5.4 MO-2953A and －2953B Output and Impedance Switches

The MO-2953A uses a test loop for AM and a 50:300Ω dummy antenna for the FM band, while the MO-2953B uses a test loop for AM in the 75:300Ω dummy antenna for the FM band.

The method of use in shown in Fig. 9 and Fig. 10 (pages 50 and 51), while circuit diagrams are shown in Fig. 11 and Fig. 12 (page 53). The outer views are shown in Fig. 13 (page 54).

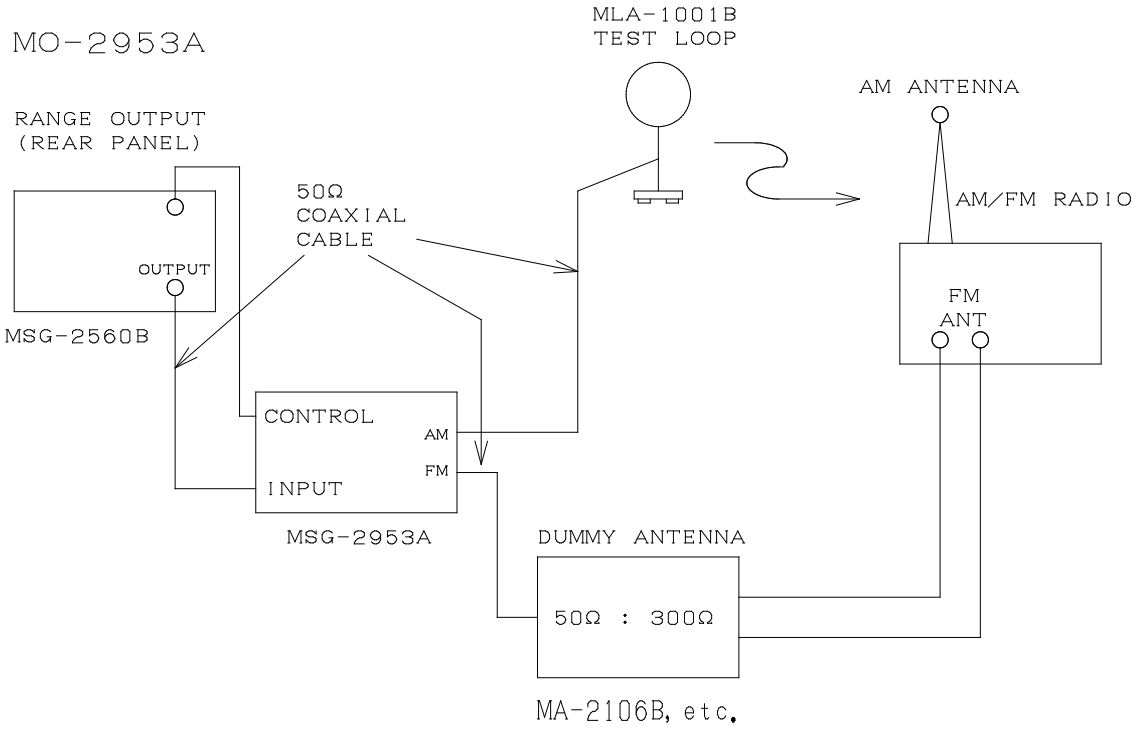


Fig. 9

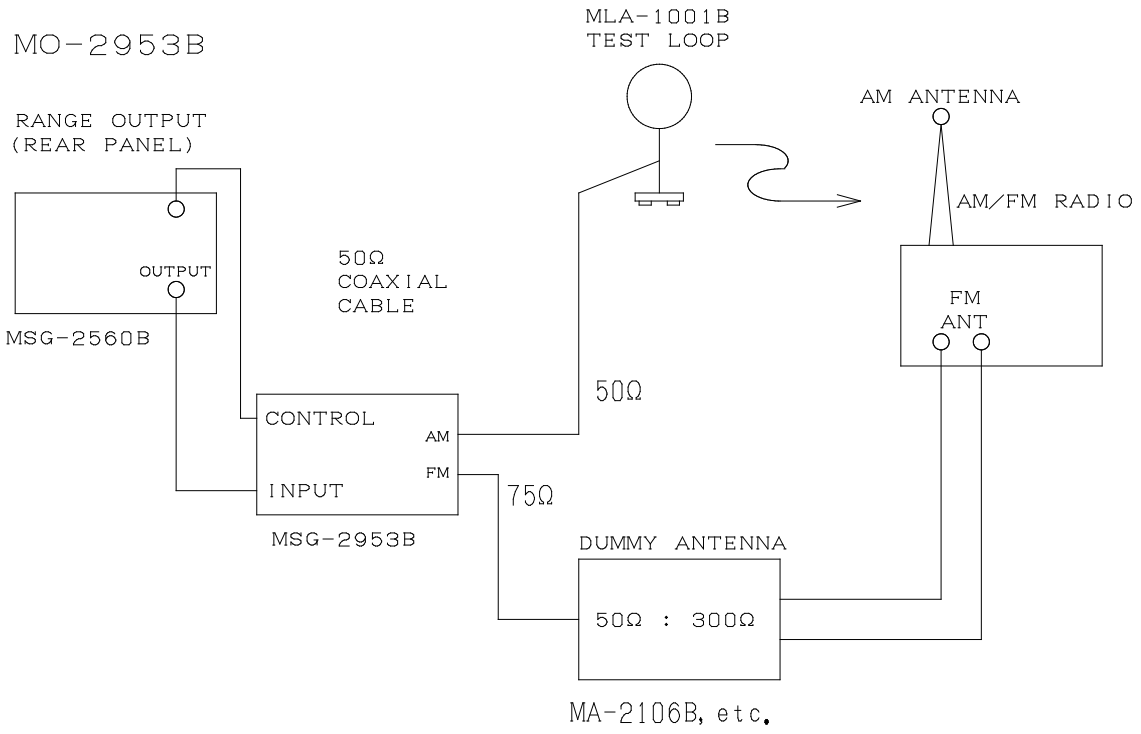

MO-2953B
MLA-1001B
TEST LOOP
AM ANTENNA
RANGE OUTPUT
(REAR PANEL)
AM/FM RADIO
OUTPUT
50Ω
COAXIAL
CABLE
FM
ANT
MSG-2560B
50Ω
CONTROL
AM
FM
INPUT
75Ω
MSG-2953B
DUMMY ANTENNA
50Ω : 300Ω
MA-2106B, etc.

Fig. 10

5.4.1 MO-2953A Output Switch and MO-2953B Output Impedance Switch Specifications

Input frequency range	DC～200MHz
Input impedance	50Ω (BNC-J connector)
VSWR	1.2 or less
Output	
MO-2953A	AM: 50Ω (for test loop)
	FM: 50Ω (for 50:300Ω dummy)
MO-2953B	AM: 50Ω (for test loop)
	FM: 75Ω (for 75:300Ω dummy)
Control signal	AM: 0V
	FM: 5V (50mA or less)
Control connector	Audio pin connector, RCA type (provide)

5.4.2 Output Switch and Impedance Switch Circuit Diagrams

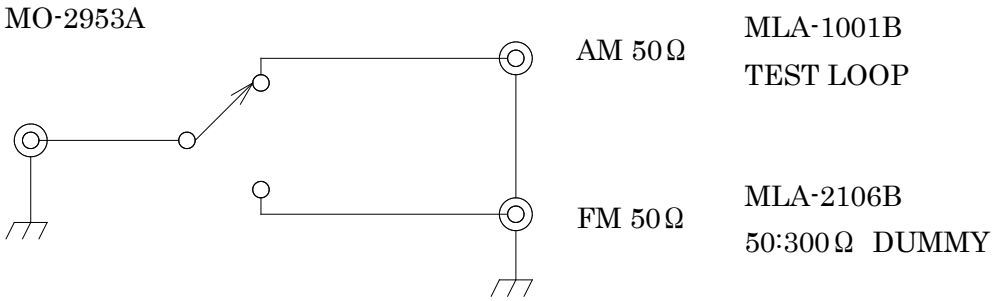


Fig. 11

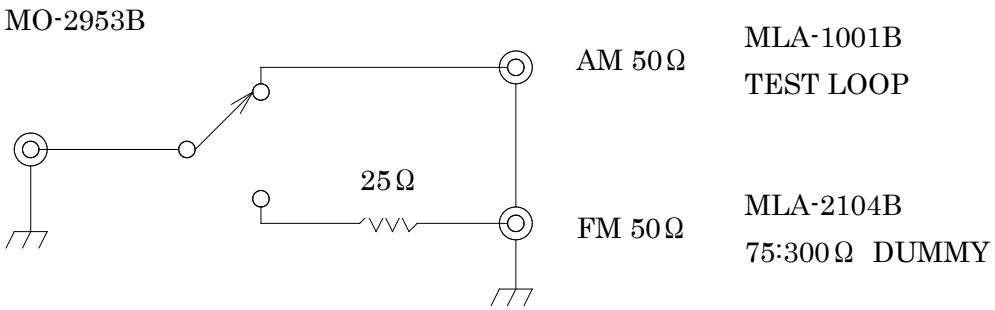


Fig. 12

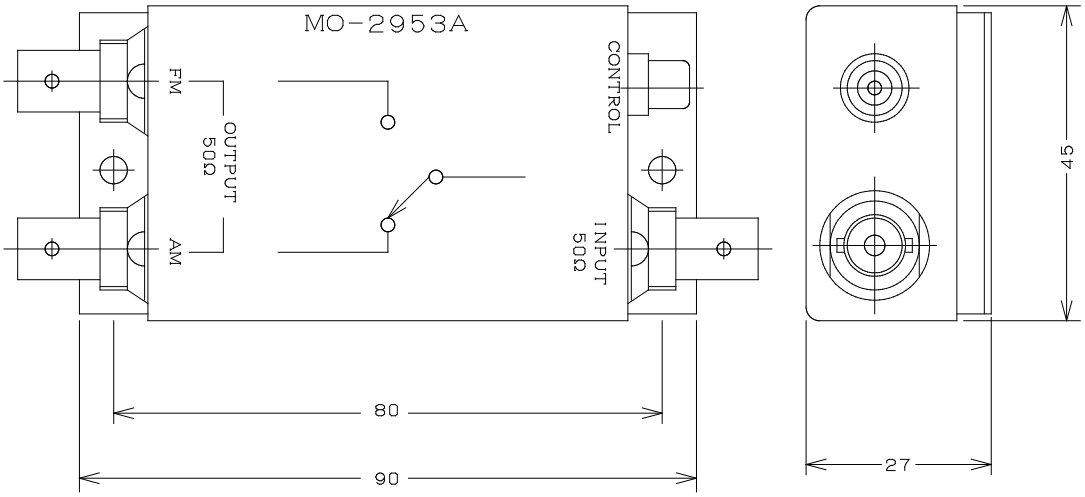


Fig. 13

(Note)

When using the MO-2951 or the MO-2953A/B, make connections as shown in Fig. 14. A 50:50Ω dummy for AM and a 50:300Ω unbalanced dummy antenna for the FM band may be connected to the FM/AM radio.

At point A, the FM band dummy balance is lost.

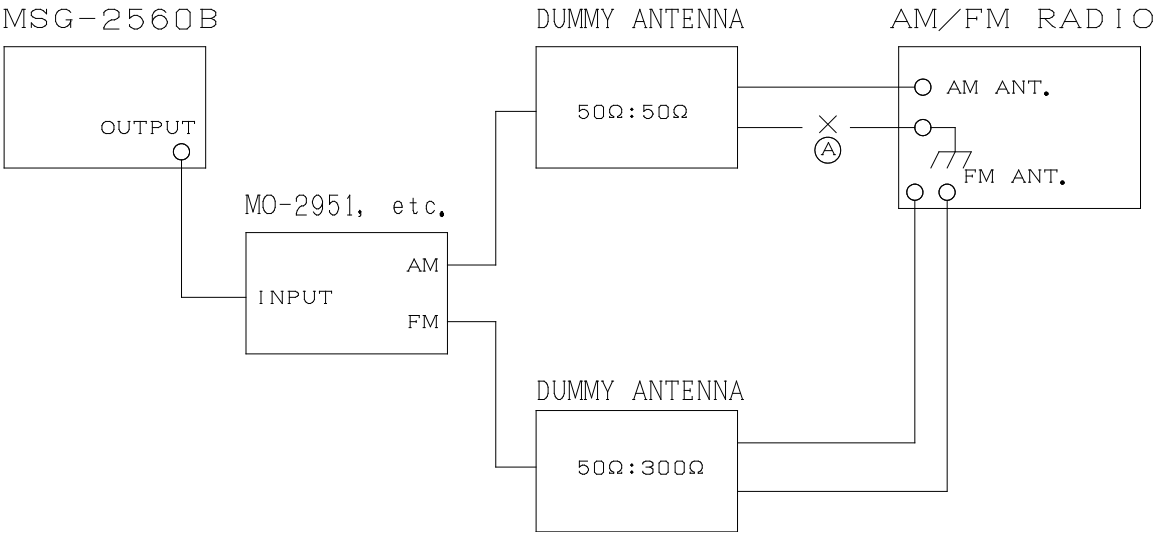


Fig. 14

6 REMOTE CONTROL

The MSG-2560B has a 14-pin connector used to enable remote control. The pin arrangement, as seen from the rear panel is as shown in Fig. 15.

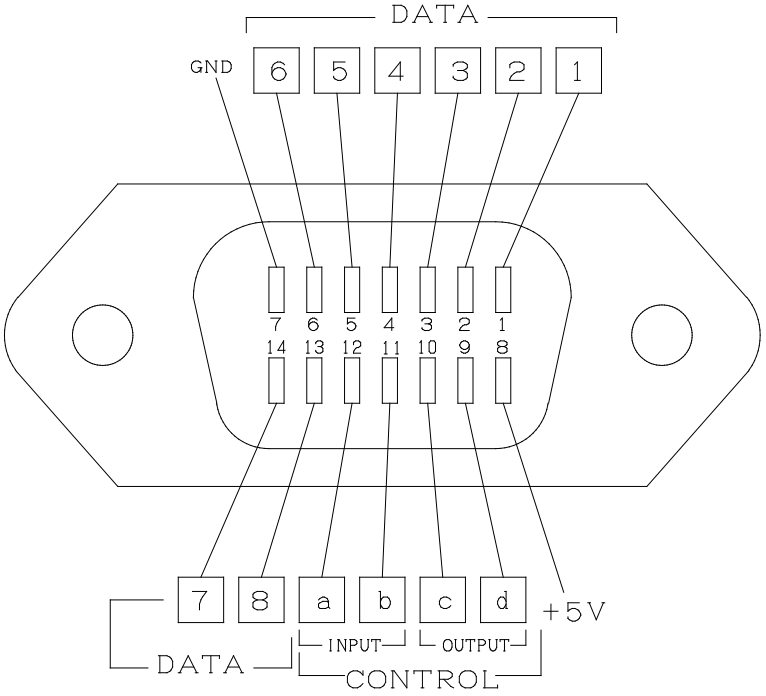


Fig. 15

・ DATA (Pins 1～6, 13 and 14)

The DATA pins form a bi-directional bus which enables input/output. The internal CPU bus drives the panel bus and the panel bus is connected to the remote control pins.

(Note)

Since the DATA pins form a bi-directional bus, if a '0' or '1' is directly connected to DATA lines 1・8, the generator will not operate.

- Input Control (Pins 11 and 12)
  - ・READ/WRITE Switching Output (Pin 12)

    For reading this pin outputs a '0', and for writing it outputs a '1'.
  - ・INTERRUPT Input (Pin 11)

    When set to '0', the remote control mode is temporarily enabled as a form of request from an external device.
- OUTPUT Control (Pins 9 and 10)
  - ・CLOCK Output (Pin 10)

    This clock signal provides the timing used for data output.
  - ・ADRS/DATA Switching Output (Pin 9)

    Address is specified by '1' and data is specified by '0'.
- ＋5V Pin (pin 8)

  This is the power supply used for remote control. It provides a maximum current capacity of 100mA (LED up to approx. 2 digits).
- GND Pin (Pin 7)

6.1 Using External Remote Control

Since the data lines on the remote control connector comprise a bi-directional bus, when performing remote control, it is recommended that the additional circuit shown in Fig. 16 be used.

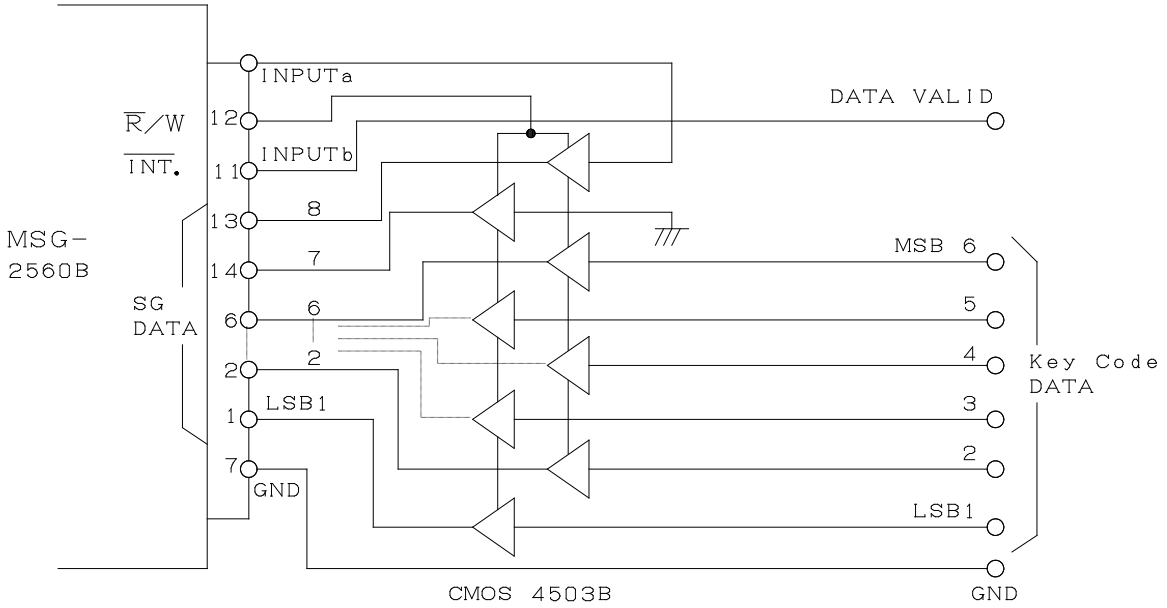


Fig. 16

There are eight data input bits at the external control connector. The 7th bit (pin 14) is held at '0' and the 8th bit (pin 13) is held at '1' through a CMOS 4503B device and data is transmitted.

Key code data (See Fig. 16) is applied at the key code DATA inputs shown in the table in accordance with the input data timing (see Fig. 17, page 58), data is sent by setting the DATA VALID pin to '0'.

6.1.1 Input Data Timing

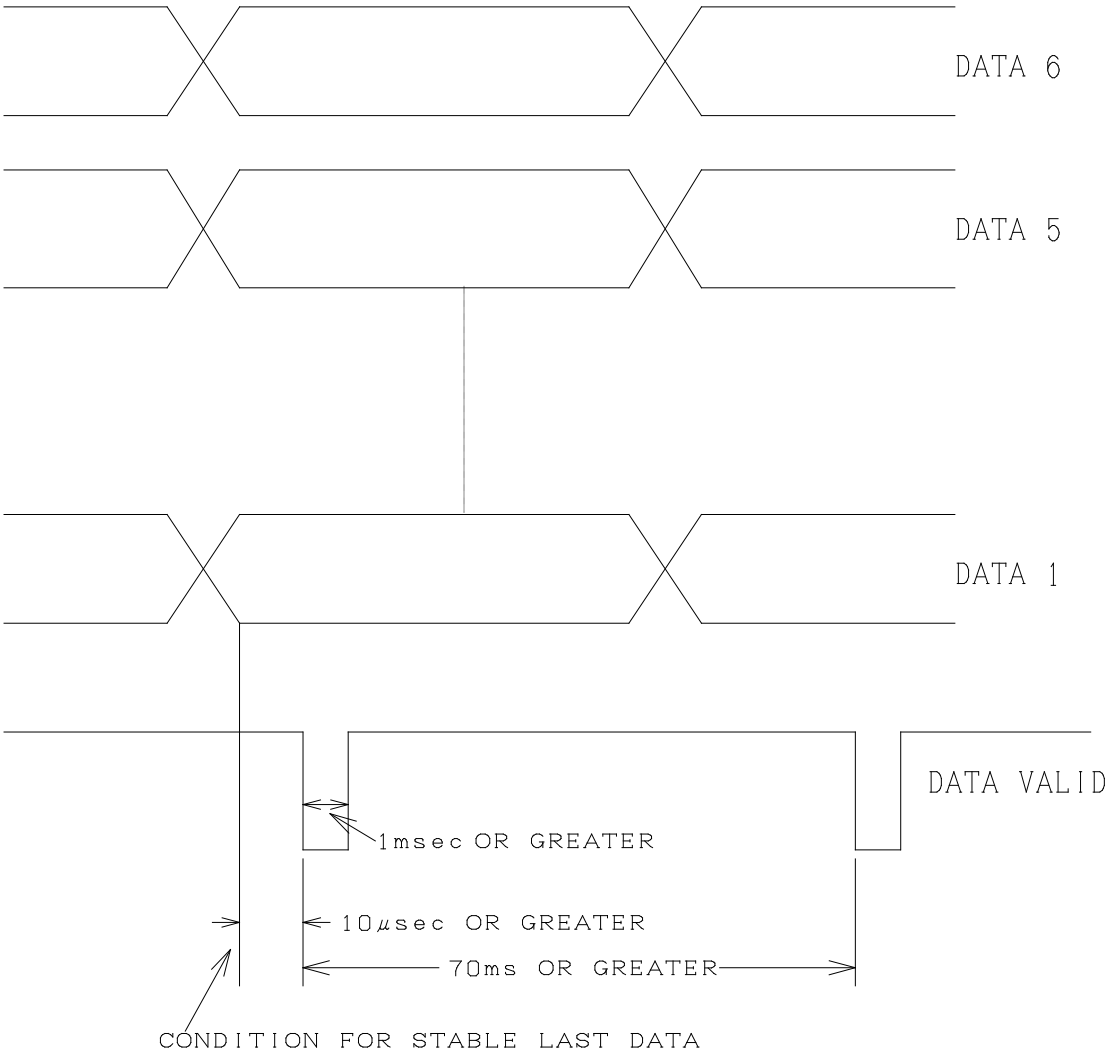


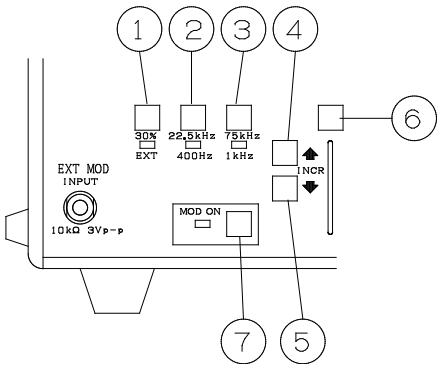
Fig. 17

As shown in Fig. 17, DATA 1～6 are set and a wait of 10 s or greater is held after the last data has stabilized, at which point the DATA VALID signal is held at '0' for 1ms or greater.

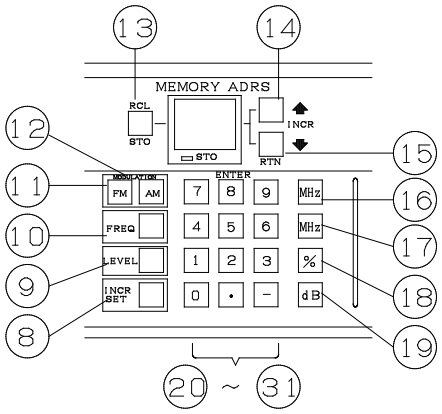
The next data and DATA VALID signal are sent at least 70ms after the previous data.

6.1.2 Panel Key Code Table

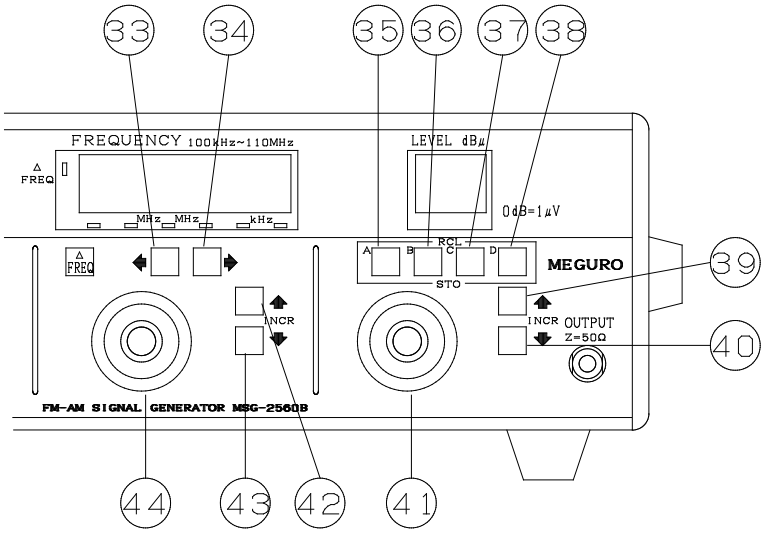
The front panel keys are all coded to correspond with codes as shown in the table below. By sending DATA VALID, the same operation is possible as pressing the corresponding panel key.



		Key Code Input Pin No.					
		6	5	4	3	2	1
Key No.	Description	MSB←Key Code →LSB					
1	EXT.MODULATION	0	1	1	0	0	0
2	INT. 400Hz	0	1	1	0	0	1
3	INT. 1000Hz	0	1	1	0	1	0
4	INCR. UP	1	0	0	0	0	0
5	INCR. DOWN	1	0	0	0	0	1
6	BLUE KEY	1	0	1	1	1	1
7	MOD. ON／OFF	1	0	0	1	0	1



Key No	Description	MSB ← Key Code → LSB					
8	ENTER INCR.SET.	1	0	1	1	0	0
9	ENTER LEVEL	1	0	1	0	0	1
10	ENTER FREQ.	1	0	1	0	0	0
11	ENTER FM	1	0	1	0	1	0
12	ENTER AM	1	0	1	0	1	1
13	MEMORY ADRS RCL／STO	1	0	1	1	0	1
14	MEMORY UP	1	0	1	1	1	0
15	MEMORY DOWN	0	1	0	1	0	1
16	ENTER MHz	1	1	1	1	0	0
17	ENTER kHz	1	1	1	1	0	1
18	ENTER %	1	1	1	1	1	0
19	ENTER dB	1	1	1	1	1	1
20	ENTER ・	1	1	1	0	1	0
21	ENTER 0	1	1	0	0	0	0
22	ENTER 1	1	1	0	0	0	1
23	ENTER 2	1	1	0	0	1	0
24	ENTER 3	1	1	0	0	1	1
25	ENTER 4	1	1	0	1	0	0
26	ENTER 5	1	1	0	1	0	1
27	ENTER 6	1	1	0	1	1	0
28	ENTER 7	1	1	0	1	1	1
29	ENTER 8	1	1	1	0	0	0
30	ENTER 9	1	1	1	0	0	1
31	ENTER －	1	1	1	0	1	1



Key No.	Description	MSB ← Key Code → LSB					
32	Δ FREQ.	0	0	1	1	1	1
33	CURSOR LEFT	0	0	1	0	0	0
34	CURSOR RIGHT	0	0	1	0	0	1
35	LEVEL RCL A	0	1	1	0	1	1
36	LEVEL RCL B	0	1	1	1	0	0
37	LEVEL RCL C	0	1	1	1	0	1
38	LEVEL RCL D	1	0	0	1	0	0
39	LEVEL INCR. UP	0	1	0	0	1	0
40	LEVEL INCR. DOWN	0	1	0	0	1	1
41	LEVEL KNOB UP	0	0	0	0	1	1
	LEVEL KNOB DOWN	0	0	0	1	0	0
42	FREQ. INCR. UP	0	0	1	0	1	0
43	FREQ. INCR. DOWN	0	0	1	0	1	1
44	FREQ. KNOB UP	0	0	0	0	0	0
	FREQ. KNOB DOWN	0	0	0	0	0	1

6.1.3 Example of External Control

External control will be explained by using the simple example of controlling externally the MEMORY UP key.

Referring to the panel key code table in Section 6.1.2, after 14, the MEMORY ADRS key data '101110' is applied to the key code data 1～6 (see Fig. 16, page 57) as shown in Fig. 18 and DATA VALID is connected.

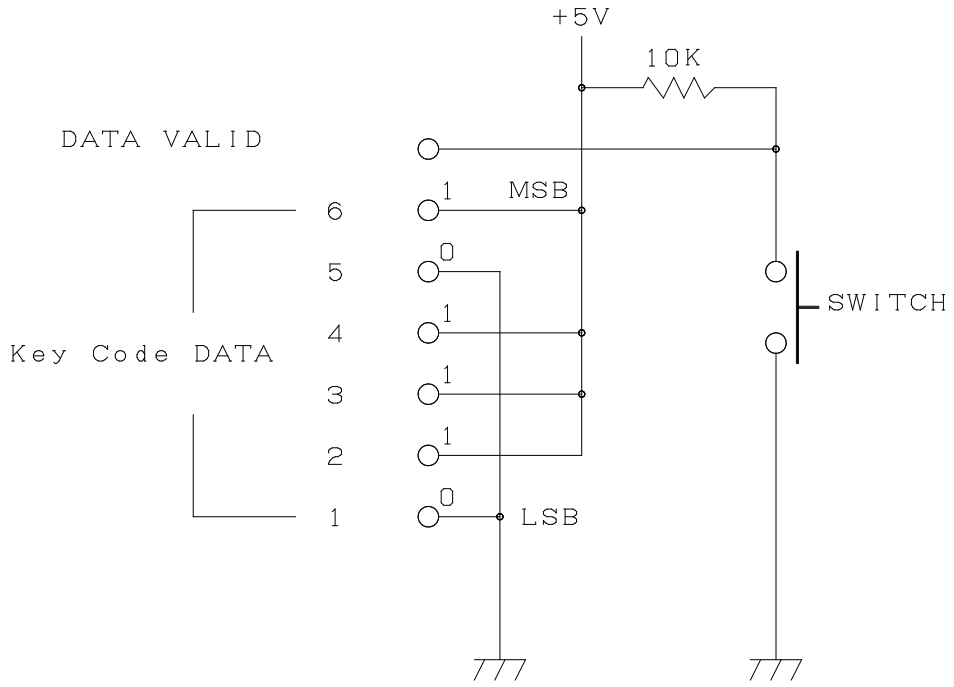


Fig. 18

Each time the switch shown in Fig. 18 is pressed, the STEP NUMBER display increments number 1 upward.

By changing the data to a different key code data, any single panel key may be externally controlled in the same manner.

6.1.4 Example of Setting the Frequency Using Remote Control

This example sets the frequency to 82.55MHz.

(1) Set the panel key code FREQ code of '101000', as shown in the key code table (page 59).
(2) Using the DATA VALID data timing (page 58) shown in the timing diagram, send this signal for 1ms or longer.
(3) As shown in Fig. 19, 82.5 is set according to the code table and the DATA VALID signal is sent for at 1east 1ms.

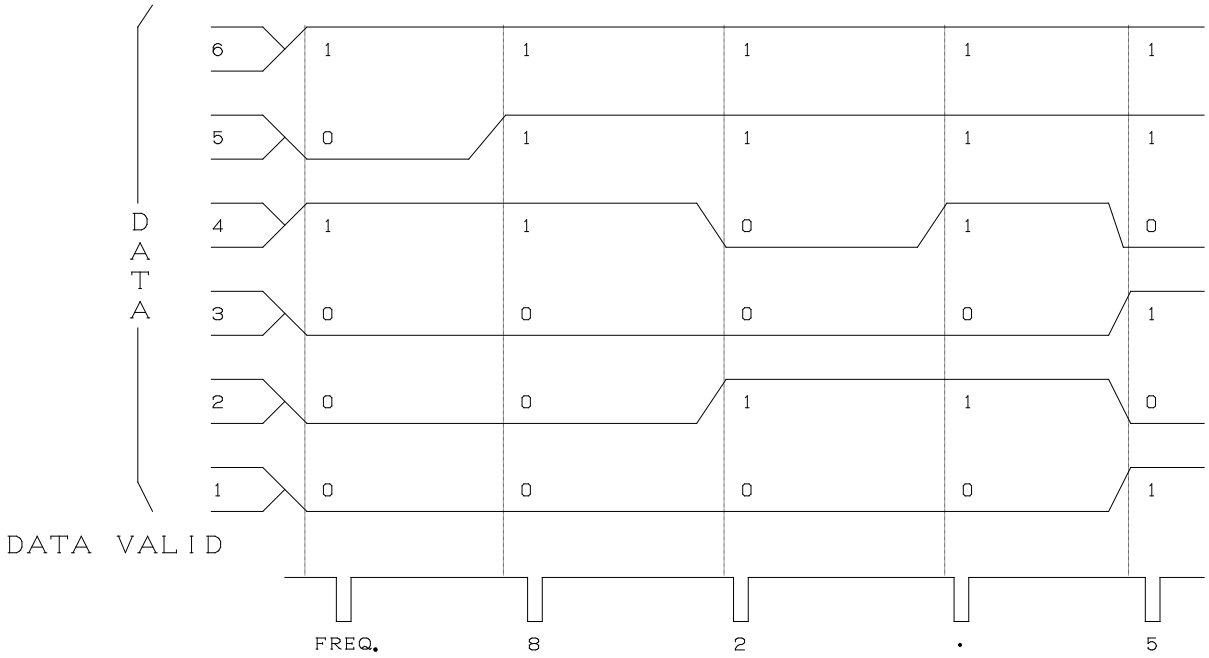


Fig. 19

(4) Now, in the same manner, the 5 data '110101' and DATA VALID are sent.
(5) Finally, the data '111100' for MHz and DATA VALID signal are sent, thus completing the data transfer.
(6) From the time the last MHz data '111100' and DATA VALID signal are sent, internal processing within the MSG-2560B begins, requiring approximately 60ms.

6.2 Outputting the Internal MEMROY ADRS Display Value

Fig. 20 illustrates this example.

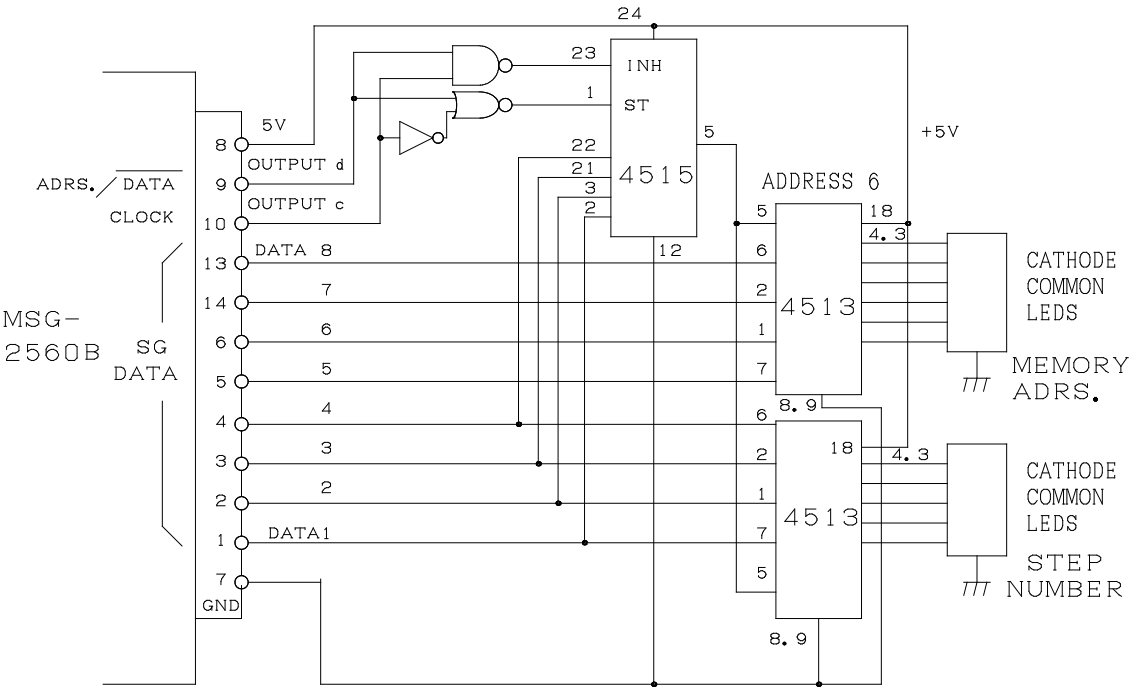


Fig. 20

Since the remote control pin comprises a bi-directional bus, it is possible to use a circuit such as shown in Fig. 20 to provide output, in the same manner for MEMORY ADRS. If a latch is used instead of the CMOS 4513, the MEMORY ADRS display may be used also as data.

If the circuit shown in Fig. 16 (page 57) and Fig. 20 are connected separately at the connector section, in addition to external remote control, it is possible to verify the MEMORY ADRS display as well as other data

7 BACKUP BATTERY

The MSG-2560B uses a battery to backup the memory, so that when the unit is not used for long periods, it may be possible for the backup batteries to discharge. A charging circuit is provided to ensure sufficient charge with the power applied to the mainframe.
The memory backup battery is greatly affected by ambient temperature, humidity, storage conditions and other factors.
It will retain approximately 90% of its capacity even after five years or so of use, however. While this should provide normal operation, if a failure occurs, Sanyo Denki CADNIC backup battery type N-SB3 should be used as a replacement.

Installation Position and Method of Replacement

If the top cover of the MSG-2560B is removed, four shielded cases are exposed to view. Of these, a CPU board is located within the left-side shielded case, the battery being located on this board, held with a band.
When exchanging this battery with a new one, the one screw on the left side is removed as well as the four screws on the shielded case cover. Rotate the shielded case CCW about the shaft passing from the front panel to the rear panel slightly to the left (as seen from the front) of center and remove the case. Pull out the PC board and replace the battery.
When battery replacement is completed, replace the shield case and, after restoring the five screws, turn the POWER switch ON, and, using the access hole at the top of the shielded case, press the initial setting pushbutton switch with a screwdriver or other instrument to initialize the CPU.