ID NUMBERS

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

For additional information on ID numbers refers to
1-2 ID NUMBER in SECTION I.

FM/AM SIGNAL GENERATOR

VP-8174A

SAFETY PRECAUTIONS

GENERAL

This instrument has been designed and tested to ensure reasonable personal protection and protection of the surrounding area against damage, and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the instrument in a safe condition.

BEFORE SUPPLYING POWER

Verify that the instrument is set to suit the available mains voltage and that the correct fuse is installed.

PROTECTIVE EARTH

The protective earth of the instrument must be connected to the earth before connecting the instrument to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cable is essential for safe operation.
The plug shall only be inserted into a socket outlet provided with a protective earth contact.
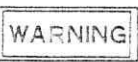
SAFETY SYMBOLS

⚠ Instruction manual symbol : The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual for safety.

⚡ High voltage symbol : Dangerous voltage exceeding 1 kV is indicated by this symbol.

⏚ Protective earth terminal.

WARNING The WARNING sign is a heading of the requirement(s) that should be observed to avoid personal or fire hazards.

CAUTION The CAUTION sign leads the precaution(s) that should be observed to avoid damage or destruction of the instrument.

POWER SOURCE

This instrument is intended to operate from a mains supply that will not be more than 250 volts rms.
For suitable voltage selection, see the INSTALLATION paragraph in this manual.

HAZARD ARISING FROM LOSS OF GROUND

The protective action must not be negated by the use of an extension cord without protective conductor.
If this instrument is to be energized via an autotransformer for voltage reduction make sure the common terminals is connected to the earth terminal of the power source.

DAMAGE IN TRANSPORT OR STORAGE

Whenever it is likely that protection has been impaired, for example as a result of damage caused by abnormal stresses in transport or storage, the instrument shall be made inoperative and be secured against any unintended operation.

USE OF PROPER FUSE

Use only the fuse of correct type, voltage rating and current rating as specified in the INSTALLATION paragraph in this manual.

REMOVAL OF COVERS

Removal of covers is likely to expose live parts although reasonable precautions have been taken in the design of the instrument to shield such parts. The instrument shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the instrument shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a qualified personnel who is aware of the hazard involved.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate the instrument in an explosive atmosphere.

CONTENTS

SECTION VIII MAINTENANCE

SECTION I
GENERAL

1-1   Introduction

This instruction manual contains the following sections:

(1)   Section I - General

Provides a general description of this Signal Generator.

(2)   Section II - Specifications

Describes the specifications of this Signal Generator.

(3)   Section III - Installation

Provides instructions related to safety, electrical, and mechanical preparations.

Be sure to read this section before using this Signal Generator.

(4)   Section IV - Operation

Explains in detail the operation procedures for each function of this Signal Generator.

(5)   Section V - Overview of GP-IB

Provides general information of the GP-IB standard.

(6)   Section VI - GP-IB interface

Describes in detail how to operate the VP-8174A by using the GP-IB interface.

(7)   Section VII - External control interface

Describes remote-controllable functions and their operations.

(8)   Section VIII - Maintenance

A brief description of preventive maintenance.

1-2   ID Number

This instrument has a ten-character ID number. The first seven characters are assigned uniquely for each product. The last three figures comprise the ID suffix which is the same for all identical products and changes only when a change is made. All correspondence with the factory or representatives concerning this instrument should include the complete ten-character ID number.

The contents of this manual apply directly to products numbered with the same ID number suffix(es) as noted under the title of ID NUMBERS on the first page of the manual.

1-3   Description

The VP-8174A is a standard signal generator which generates CW, FM and AM signals in the frequency range of 100 kHz to 110 MHz. It also has a built-in stereo modulator based on the FM stereo broadcasting system.

Frequencies between 30 and 110 MHz are generated through direct fundamental oscillation and those between 100 kHz to 29.9999 MHz are through heterodyne down-conversion. Every frequency genererated is synchronized with the reference crystal oscillator and is settable with resolutions of 100 Hz in 100 kHz to 30 MHz range and 1 kHz in 30 to 110 MHz range. The ΔF function directly reads increment and decrement (detuning frequencies) from the reference frequency.

The output amplitude can be set in 1 dB increment between -19 to 99 dB.

The generator provides FM and AM modulation by using internal or external modulation signals. Stereo modulation is also available by the built-in composite stereo signal generator based on the FM stereo broadcasting system. The built-in generator allows an easy selection of a modulation mode on the operation panel.

The VP-8174A has two types of preset functions: the assorted preset that stores and recalls up to 100 sets of parameters (frequency, modulation, and output amplitude) and the independent preset that stores and recalls up to four output amplitude alone. The setting is made with the numeric input keys and the MODIFY knob. Battery backup is provided so that the settings are retained even after the power has been turned off.

For remote control, the GP-IB interface and a unique EXT CONTROL I/O function are provided.

These features make the VP-8174A not only a highly efficient instrument which streamlines the production and inspection of high-performance FM-AM receivers, transmitters, elements, parts, and other components, but also a good general purpose signal generator for use in maintenance, research, and development applications.

1-4   Stereo System

(1)   Stereo broadcasting

FM broadcasting is generally based on the suppressed carrier AM-FM system as shown in Fig. 1-1. The system has been approved by the FCC (Federal Communications Commission), EBU (European Broadcasting Union). In Japan, it has been recommended by the Radio Wave Committee of the Ministry of Posts and Telecommunications. The SCA (Subsidiary Communications Authorization) channel indicated by the dotted lines in Fig. 1-1 is specified by the FCC, while they have been excluded by the EBU. In Japan the channel is termed secondary subchannel.

The VP-8174A functions both as a stereo modulator shown enclosed in the dotted line and a standard signal generator.

(2)   Modulation mode

The stereo modulator section provides one out of the four modulation modes (a) to (d) below by single modulating signal.
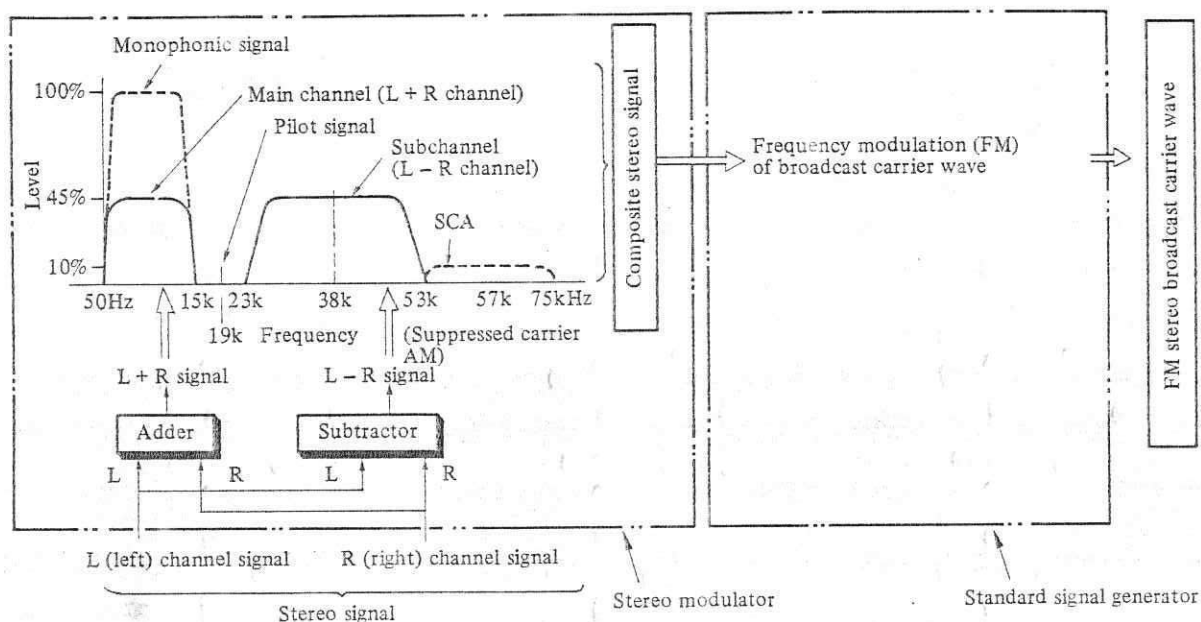
Fig. 1-1 FM Stereo Broad casting

(a)   L=R mode

A composite stereo signal obtained by applying the identical test tone signals in the same phase to both the L and R terminals in Fig. 1-1. The signal is composed of the main channel signal and the pilot signal components only.

(b)   L mode

A composite stereo signal obtained by applying a test tone signal only to the L terminal in Fig. 1-1. The signal is composed of the main and sub channel components of the same level and the pilot signal component.

If demodulated through a stereo receiver, the signal is obtained in the L channel only.

(c)   R mode

A composite stereo signal obtained by applying a test tone signal only to the R terminal in Fig. 1-1. The signal composition is the same as that in the L mode with L and R reversed.

If demodulated through a stereo receiver, the signal is obtained in the R channel only.

(d)   L=-R mode

A composite signal obtained by applying the identical test tone signals in the opposite phase to the L and R terminals. The signal is composed of the sub-channel signal and pilot signal component only.

As test tone signals for the above four modes, the internal 400 Hz/1 kHz sine wave or external 50 Hz to 15 kHz signal are available.

(3) Modulation factor, pilot level

The VP-8174A indicates the FM stereo modulation factor and pilot level independently of each other.

In the modulation factor indication, only the FM deviation component caused by the main and subchannel components of the composite signal is shown with the pilot level ignored. In the pilot level indication, only the FM deviation component by the pilot signal is shown with the modulation indication level for the composite signal ignored. The FM stereo modulation factor and pilot level cannot be indicated at the same time.

The stereo modulation factor is expressed as; 100% = 67.5 kHz deviation. Setting can be made in the range 0 to 133% in 1% steps.

The pilot level is expressed as; 10% = 7.5 kHz deviation. Setting can be made in the range 0 to 15% in 1% steps.

(4) SCA (Suppressed Carrier AM) input

The VP-8174A has an SCA input terminal. When a signal is applied to this terminal, the RF output signal is modulated independently of the modulation operation of the generator. Do not therefore apply any signal to the SCA terminal unless the SCA signal is required. A 0.56 Vp-p SCA input signal produces the FM deviation of 7.5 kHz. Keep this value during the SCA application, since the instrument has no indication for SCA.

(5) Composite signal output

The VP-8174A has a COMP OUTPUT terminal from which the composite stereo signal can be acquired. Output level is about 5 Vp-p when the modulation factor is 100% and the pilot level is 10%. Since the output level changes with the RF frequency setting, keep the RF frequency at a certain level when using the composite stereo signal alone.

SECTION II
SPECIFICATIONS

Designation	Performance	Conditions or Remarks
RF FREQUENCY		
Range	0.1 to 110MHz	
Normal display	0.1000 to 29.9999MHz	
	30.000 to 110.000MHz	
Δ F display	-0.9999 to 0.9999MHz	Within the range of 0.1 to 29.9999MHz
	-0.999 to 0.999MHz	Within the range of 30 to 110MHz
Resolution	100 Hz	RF<30MHz
	1 kHz	RF$\geq$30MHz
Accuracy	$\pm(5 \times 10^{-5} +1\ \text{count})$	
Aging rate	$\pm 5 \times 10^{-6}$/week	After 48 hours warm-up
Temprature characteristics	$\pm 5 \times 10^{-6}$	10 to 35°C
RF OUTPUT		
Range	-10 to 99dB EMF	0dB EMF = 1μV
Display range	-19 to 99dB	
Resolution	1dB	
Reference level	99dB EMF	
Accuracy	±1dB	
Attenuator accuracy	±1.5dB	$\geq$0dB EMF
	±2dB	<0dB EMF
Output impedance	50 Ω	
VSWR	<1.2	$\leq$66dB EMF
Spurious output		
Harmonics	$\leq$-30dBc	
Non-harmonically related	None	RF$\geq$30MHz
	$\leq$-30dBc	RF<30MHz
	$\leq$-40dBc	RF<30MHz and measured in the frequency range below 30MHz

Specifications

Designation	Performance	Conditions or Remarks
RF OUTPUT (Cont'd)		
Residual modulation (S/N)		
FM component	≥76dB ≥73dB	76MHz≦RF≦108MHz All range As S/N relative to 75kHz deviation, with post-detection BW of 50Hz to 15kHz and with 50μs de-emphasis (exclude beat components close to RF 16,20 and 26.7MHz)
AM component	≥55dB	As S/N relative to 30% AM with post-detection BW of 50Hz to 15kHz (exclude beat components close to RF 16,20 and 26.7MHz)
MODULATION		
Internal modulation frequency	400Hz, 1kHz within ±3%	
External modulation input impedance	Approx. 10kΩ	
External modulation input level required	Approx. 3Vp-p	
Display range/resolution		
AM depth	0 to 60%/1%	
FM deviation	0 to 99.5kHz/0.5kHz	
FM stereo	0 to 133%/1%	
Pilot level	0 to 15%/1%	
Accuracy		
AM depth	±(0.08 of reading +2)%	
FM deviation	±(0.08 of reading + 0.5)kHz	
FM stereo	±(0.08 of reading + 0.5)%	
Pilot level	±(0.08 of reading +1)%	

Designation	Performance	Conditions or Remarks
MODULATION (Cont'd)		
Amplitude modulation		
Modulation depth	0 to 60%	
Distortion	$\leq$ 0.5%	$0.15 \leq$ RF<30MHz
	$\leq$ 1.5%	RF$\geq$30MHz
		At 30% AM, with 1kHz rate and
		with post-detection BW of
		50Hz to 15kHz
		(exclude beat components
		close to RF 16,20 and 26.7MHz)
Frequency response	20Hz to 10kHz within$\pm$1dB	with reference to 1kHz
Incidental FM	$\leq$ 150Hz	$1 \leq$ RF<30MHz
	$\leq$ 300Hz	$30 \leq$ RF$\leq$108MHz
		At 30% AM, with 1kHz rate
Frequency modulation		
Frequency deviation	0 to 99.5kHz	
Distortion	$\leq$ 0.05%	RF 10.7$\pm$1MHz and 76 to
		108MHz
	$\leq$ 0.1%	RF$\geq$0.2MHz
		At 75kHz deviation, with 1kHz
		rate and with post-detection
		BW of 50Hz to 15kHz and with
		50μs de-emphasis (exclude
		beat components close to RF
		16,20 and 26.7MHz)
Frequency response	20Hz to 80kHz within$\pm$1dB	with reference to 1kHz
Incidental AM	$\leq$ 0.5%	RF 10.7$\pm$1MHz and 76MHz
		to 108MHz
		At 75kHz deviation, with
		1kHz rate

Designation	Performance	Conditions or Remarks
MODULATION (Cont'd)		
FM stereo modulation		RF$\geq$76MHz
Stereo mode	Four modes (L=R,L,R,L=-R) by internal or external single tone	
Modulation factor	0 to 100%	100%=67.5kHz deviation
Stereo separation	$\geq$55dB	400Hz$\leq$AF$\leq$1kHz
	$\geq$40dB	50Hz$\leq$AF$\leq$15kHz
Frequency response	50Hz to 15kHz within$\pm$1dB	with reference to 1kHz
Pilot signal		
Frequency	19kHz $\pm$ 1Hz	
Level/resolution	0 to 15%/1%	1%=0.75kHz deviation
SCA input		
Level required	Approx. 0.56Vp-p	10% FM=7.5kHz deviation
Frequency response	20 to 75kHz within $\pm$1dB	with reference to 57kHz
PRESET FUNCTION		
Number of memory registers		
Assorted preset	100:memory address 00 to 99	
Independent amplitude preset	4:amplitude preset keys a to d	
Item to be stored to assorted preset at a time	1) Frequency 2) Amplitude 3) Modulation setups (AM/FM/FM stereo/PILOT) 4) Mod. signal ON/OFF 5) PILOT ON/OFF 6) Internal 400Hz/1kHz 7) Mod. source INT/EXT 8) FM mode selection (MONO/L=R/L/R/L=-R) 9) Function keys selection (FREQ/AMPTD/FM/AM/PILOT) 10) Ext. control signal	

Designation	Performance	Conditions or Remarks
EXT CONTROL I/O INTERFACE	1) Sequential memory recall 2) Direct memory recall 3) Modify control 4) Control signal output 5) Memory copy 6) Memory list output 7) Data read	Operable only by GP-IB
GP-IB INTERFACE	SH1, AH1, T7, L3, SR4, RL1 PP0, DC1, DT0, C0	Has basic taker/listener, talk only/listen only, remote/local, device clear functions.
OTHERS 　Leakage	Will not interface with measurement of 1μV	
Power requirements 　　Main voltages	100V: 90 to 112V 120V: 106 to 132V 220V: 196 to 244V 240V: 214 to 250V	
Main frequency	50/60Hz	
Power consumption	30VA or less	
Ambient temperature and humidity (R.H.)		
Limit range of guaranteed performances	10 to 35°C, 85% or less	
Limit range of operation	0 to 40°C, 90% or less	
Storage and transportation	-20 to 70°C, 90% or less	
Dimensions	426mm(W), 99mm(H), 250mm(D)	excluding legs, knobs, etc.
Mass	Approx. 3 kg	

Specifications

Designation	Performance	Conditions or Remarks
ACCESSORIES FURNISHED	Output cable (VQ-027C) .. 1 Power cable .... 1 Spare fuse .... 1 GP-IB connector cap .... 1 Instruction manual 1	

SECTION III
INSTALLATION

3-1 Power Requirements

The model VP-8174A can be operated from any power source supplying 100V, 120V, 220V and 240V (nominal values), 50 or 60Hz. Power consumption is less than 30VA.

WARNING

Before connecting AC power to the instrument, be sure it is set for the proper mains voltage and is properly fused as indicated on the rear panel. (See the figure below).

Voltage selection switches (shown set for 100V)

NOMINAL	RANGE
100V	90 - 112V
120V	106 - 132V
220V	196 - 244V
240V	214 - 250V
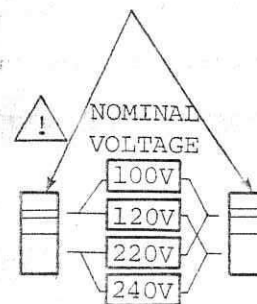
3-2 Mains Voltage Selection

Refer to the figure above. Set the NOMINAL VOLTAGE switches to the setting (100V, 120V, 220V or 240V) that corresponds to the mains voltage to be used. The voltage must be within the range noted at the left side of the switches.

3-3 Fuse

Verify the proper fuse is installed in the fuse holder. Ratings of the fuse are noted on the rear panel and listed below.
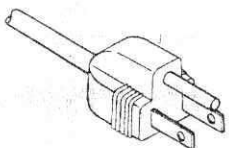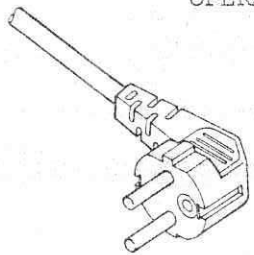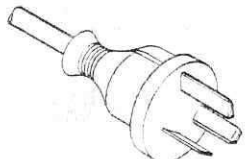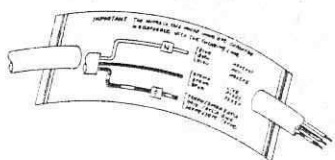
Nominal voltage	Fuse
100V	250V 500 mA (T)
120V	
220V	250V 250 mA (T)
240V	

┌──────────── WARNING ────────────┐

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

└─────────────────────────────────┘

3-4   Power Cable

The VP-8174A is equipped with a detachable power cable assembly. The type of the
plug shipped with each instrument depends on the country of destination. The figure below
illustrates the power cables available with Panasonic part numbers.

125V OPERATION	250V OPERATION
33-76B-2M	99-81-2M
250V OPERATION	250V OPERATION
418-481-2M	76W004

3-5   Interconnection with Other Equipment

Plug the power cable into a properly wired receptacle before connecting the instrument to other equipment.

The interconnections are made with BNC connectors and rear panel connectors. No hazardous voltage will appear on any pin of these connectors.

The 36-pin connector should only be connected to the remote control unit prepared specifically for this instrument. Use the VQ-023H10 dedicated cable for connecting the instrument and a printer (for memory list output function) or for connecting two sets of the VP-8174A (for memory transfer function). Otherwise it may result in failure.

-| CAUTION |-

Do not apply an external voltage of 3V or higher to the RF output connector. The maximum power capacity in internal circuit is 0.2W.

3-6   Mounting on the Bench

The instrument cabinet has plastic feet and a fold-away tilt stand. The tilt stand raises the front of the instrument for easier operation of the front panel controls.

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

3-7   Rack Mounting

The VP-8174A may be rack mounted by using the Rack Mount Kit H100 (Part number VQ-069H10). The kit contains two rack flanges, four screes and conversion instructions. It will fit 480 mm wide racks conforming JIS C 6010.

3-8   Backup Battery

The memory backup battery of this instrument is a non-rechargeable lithium battery. Note that the lithium battery should be treated as follows:

(1)   The battery life is five years or more in a normal operating environment. Backing up will be deteriorated after the battery life expires, so contact your nearest Panasonic representative for immediate replacement.

(2)   Do not remove or short-circuit the battery and never throw it into a fire.

3-9   Preparation

(1)   Allow a warm-up period of at least 15 minutes before measurement.

(2)   Ambient temperature

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

SECTION IV
OPERATION

4-1 General

This section describes the operation procedures for the VP-8174A.

The basic operations of a standard signal generator are classified into three types; adjusting the generated RF carrier frequency to the value required for measurement (frequency control), adjusting the amplitude of the RF output signal (output amplitude control), and setting the state of the output signal--modulated/unmodulated, modulation type, modulating frequency, and modulation degree-according to the application (modulation functions).

In addition to these basic functions, the VP-8174A allows assorted preset and independent output amplitude preset. The assorted preset can be remote-controlled with the external control function.

This section contains an outline of specific functions and definitions followed by a description of the front and rear panels. Then the basic operations an the assorted and independent preset operations are explained.

While the assorted preset function is the one generally used for actual measurements, the basic operations are often required for preset operation or for preset modification after recall.

1. Basic operation for frequency control   (paragraph 4-5)
2. Basic operation for output amplitude control   (paragraph 4-6)
3. Basic operation for modulation control   (paragraph 4-7)
4. Basic operation for amplitude modulation (AM)   (paragraph 4-8)
5. Basic operation for monophonic FM   (paragraph 4-9)
6. Basic operation for FM stereo modulation   (paragraph 4-10)
7. External modulation operation   (paragraph 4-11)
8. Assorted preset operation   (paragraph 4-12)
9. Independent output amplitude preset operation   (paragraph 4-13)

The GP-IB interface function is explained in Section V and Section VI, and the external control interface function is explained in Section VII.

4-2   Specific Functions and Term Definitions

(1)   Assorted preset

This function allows the user to store the current panel settings--carrier frequency,output amplitude, and modulation functions--and recall them later with one simple operation. The VP-8174A holds up to 100 such sets. Since modifying a recall set is generally easier than resetting everything, this is the function that is used for most purposes.

(2)   Independent output amplitude preset

This auxiliary function simplifies output amplitude setting. Four frequently used output amplitude may be stored and recalled as required independently of the assorted preset function.

(3) Δ F Display

This function automatically calculates the detuning frequency, the difference between the actual output frequency and the current reference frequency.

(4)   Modulation display

In the monophonic FM mode, the modulation is expressed in frequency deviation (kHz). In the stereophonic FM mode, the modulation is expressed as FM factor (%) with frequency deviation of 67.5 kHz as 100%.

--- NOTE ---

Backup Function for the Front Panel settings

When the power is turned on, the front panel settings automatically return to the ones in effect when the power was last disconnected.

4-3   Front Panel Feature

The front panel layout of the VP-8174A appears at the end of this manual. In this figure, parts are numbered ① through ㊵ . Their names and functions are briefly summarized below:

① POWER switch (Push-button)

Turns the mains power on and off.

② MEMORY ADDRESS readout

Displays a 2-digit memory address for the assorted preset data.

③ EXT INPUT annunciators HI/LO

Adjusting aid for setting the level of an external modulation source. The lights indicate that the input level is excessive (HI) or insufficient (LO) for calibrated modulation display.

④ PILOT SIGNAL LEVEL light

Turns on when the 19 kHz pilot signal level is indicated in ⑤ .

⑤ MODULATION readout

Indicates monophonic FM deviation (kHz), FM stereo modulation (%), AM depth (%) and 19 kHz pilot signal level (%).

⑥ kHz/% display lights

Indicate the mode by turning the light as follows:

Mode	Indication light
Monophonic FM	kHz FM (MONO)
Stereophonic FM ⎤	% FM (STEREO)
Pilot signal ⎦	
AM	% AM

⑦ ⊿F display light

Turns on when the ⊿F frequency is indicated.

⑧ FREQUENCY readout

Displays the generated frequency in six numeric digits. The decimal point are fixed at MHz position. When I/O mode light ⑨ is turned on, the mode setting codes of the external control and GP-IB interfaces are indicated.

⑨ I/O MODE light

Turns on to accept the condition setting for the external control and GP-IB interfaces.

⑩ AMPLITUDE readout

Displays the output amplitude as a 2-digit value preceded by a minus sign (if necessary).

⑪ RF OUTPUT connector

Supplies an RF output signal through the BNC receptacle.

SET keys a b c d

⑬ DIGIT SELECTOR keys

Used to specify the digit of the value (such as frequency, output amplitude, monophonic FM deviation, FM stereo modulation factor, AM depth, pilot signal level or ΔF) to be changed.

⑭ MODIFY knob

Increments or decrements the frequency, output amplitude, ΔF, monophonic FM deviation, FM stereo modulation factor, AM depth, or pilot signal level.

⑮ ENTER key

Registers the frequency, output amplitude, modulation degree, pilot signal level, or output independent preset displayed by DATA key ⑯. The light flashes while entering numbers and turns off when the key is pressed after entering data. If the key is left unpressed, the light automatically turns off to return the instrument to the state before the registration. The key is also used for setting the mode of the external control and GP-IB interfaces.

⑯ DATA keys

Numeric keys 0 to 9, decimal point and minus sign (-) keys to enter frequencies, output amplitude, modulation factors, memory address numbers and mode setting codes of the external control and GP-IB interfaces.

If SHIFT key ㉙ is pressed together with the keys, DATA keys "1", "2", and "3" work as follows:

"1" PORT 1: Sets the external output signal data for the external control interface at PORT 1.

"2" PORT 2: Sets the external output signal data for the external control interface at PORT 2.

"3" DRIVE: sets the transition frequency of the relay drive output.

⑰ FREQ/ΔF ON/OFF key

Selects "FREQ" function or turns ΔF ON/OFF by the SHIFT key.

⑱ AMPTD key

Sets the output amplitude.

⑲ FM/PILOT key

Sets the monophonic FM deviation and stereophonic FM factor (FM), or sets the pilot signal level (PILOT) by the SHIFT key.

⑳ AM key

Sets the AM depth.

㉑ RCL key

Recalls the stored assorted preset data.

㉒ STO key

...reset and independent preset data.

㉓ PILOT ON/OFF key

Selects the pilot signal ON/OFF alternately.

㉔ 1 kHz/400 Hz key

Switches the internal modulation frequency between 1 kHz and 400 Hz.

㉕ SIGNAL ON/OFF key

Switches between the modulated signal ON and OFF. Effective for both the internal and external modulation.

㉖ EXT/INT key

Selects either the external modulation signal or internal modulation signal.

㉗ FM MODE keys

Five keys to select an FM modulation type. The leftmost key is for monaural modulation, and the other four keys are for L=R, L, R, L=-R mode. Selecting AM key ⑳ turns off the lights of these keys. If FM/PILOT key ⑲ is then selected, the state just before pressing AM key ⑳ returns on the CRT.

㉘ MEMORY keys

Recalls the memory address for assorted preset on memory address readout ②. [↑] denotes "UP" key, [↓] the "DOWN" key and [CLR] the "CLEAR" key.

Using the SHIFT key together with these keys enables the following operation.

I/O MODE: Sets the mode for the external control and GP-IB interfaces.

COPY: Transfers the contents of the assorted preset and independent preset memories.

LIST: Outputs to the printer the contents of the assorted preset memories.

㉙ SHIFT key

Changes the key function of FUNCTION keys ⑰ and ⑲ , MEMORY keys ㉘ and DATA keys "1", "2", and "3".

㉚ EXT INPUT connector

BNC receptacle to apply external modulation signals.

㊳ LOCAL key

Switches the generator from the remote control mode by GP-IB to the local mode.

㊴ REMOTE light

Turns on when the generator is in the remote control mode by GP-IB.

4-4   Rear Panel Feature

㉛ DRIVE OUTPUT connector

RCA-type pin jack for relay driving output that inverses the polarity at a certain point of RF output frequency.

㉜ COMP OUTPUT connector

BNC receptacle for monitoring internal FM composite signals.

㉝ SCA INPUT connector

BNC receptacle for applying external modulation SCA signals.

㉞ EXT CONTROL I/O connector

36-pin connector for the external control signal input/output and for recalling, transferring, or printing out of the assorted preset memory contents by remote control.

㉟ NOMINAL VOLTAGE switch

Selects mains voltage to suit local AC supply.

㊱ MAINS INPUT connector

Accepts the power cable.

㊲ FUSE holder

Holds the mains input fuse.

㊵ GP-IB connector

24-pin connector for GP-IB connection.

4-5   Basic Operation for Frequency Control

Basic operations include entering the required frequency directly through the numeric input (DATA) keys, modification of the setting with the MODIFY knob and introducing the incremental frequency control with the ⊿F function.

(1)   Direct reading of six-digit frequency display

The FREQUENCY display covers the 0.1000 to 110.000 MHz range and indicates the entered value as six numeric digits. There is a fixed decimal point indicating MHz.

Resolution will be different according to the frequency ranges as follows:

(a)   100 Hz resolution for 0.1000 to 29.9999 MHz range

(b)   1 kHz resolution for 30.000 to 110.000 MHz range

(2)   Direct frequency setting with the DATA keys

(a)   Press FREQ key ⑰ .

(b)   Enter the required frequency with DATA keys ⑯ . The light of ENTER key ⑮ starts flashing to prompt registration of the displayed value. While the light flashes, the output frequency remains unchanged from the previous setting.

(c)   Press ENTER key ⑮ . The ENTER light goes out to indicate that the new data has been registered. Now the newly set frequency output is available.

-------------------------------NOTE-------------------------------

1.   The readout accepts values outside the specified display range, but pressing the ENTER key returns the display to the previous value.

2.   To correct an error made during the numeric key input, press the FREQ key a second time and restart.

3.   If an integer frequency has been entered, the display automatically fills the decimal places with zeroes.

4.   Pressing the FREQ key in paragraph 4-5, (2)-(a) does not show any light indication. Confirm that the frequency is set by the flashing of the ENTER key in the next step.

Example 1: Setting a frequency of 102.345 MHz
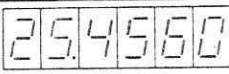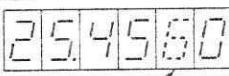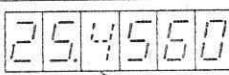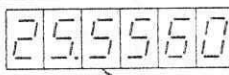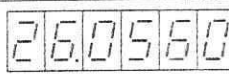
Step	Keystroke	FREQUENCY readout	ENTER key
1	FUNCTION FREQ key	Current value	○ Off
2	1 key	/	● Flashing
3	0 key	/ 0	
4	2 key	/ 0 2	
5	• key	/ 0 2.	
6	3 key	/ 0 2.3	
7	4 key	/ 0 2.34	
8	5 key	/ 0 2.345	
9	ENTER ○	/ 0 2.345	○ Off

(3)   Setting with the MODIFY knob

The setting can also be altered with MODIFY knob ⑭ :

(a)   Press FREQ key ⑰ of the FUNCTION keys. FREQUENCY readout ⑧ remains to read the previous frequency setting (25.4560 MHz for the following Example 2).

(b)   Press either of DIGIT SELECTOR keys ⑬ . One of the digits on FREQUENCY readout ⑧ will start to flash. This digit may then be altered with the MODIFY knob.

(c)   The flashing may be shifted to an adjoining digit with DIGIT SELECTOR keys ⑬ ⬅ or ➡.

(d)   Rotating MODIFY knob ⑭ . Stops the flashing, but the current readout can be incremented or decremented. The newly indicated frequency output is available.

Example 2: Altering the output frequency from 25.4560 to 26.0560 MHz

Step	Operation	FREQUENCY readout
1	Press the FUNCTION FREQ key.	$\boxed{25.4560}$ Current value
2	Press either the ← key or → key.	$\boxed{25.4560}$ This digit was assigned last time.
3	Press the ← key twice.	$\boxed{25.4560}$ Flashing
4	Rotate the MODIFY knob CW (↻) one step	$\boxed{25.5560}$ The digit will change from "4" to "5" and stop flashing.
5	Rotate the MODIFY knob CW (↻) five steps.	$\boxed{26.0560}$

─────── NOTE ───────

The digits that can be modified are as follows:

Where frequency <30 MHz, lower 5 digits

Where frequency ≥30 MHz, lower 4 digits.

(4) ⊿F function by MODIFY knob

(a) Specify the desired reference frequency while ⊿F display light ⑦ is turned off.

(b) Press SHIFT key ㉙ making the light in the key on.

(c) Prest FREQ/⊿F ON/OFF key ⑰ . This turns the SHIFT key light off and ⊿F display light ⑦ on. FREQUENCY readout ⑧ then shows "0.000" or "0.0000".

(d) Press either one of DIGIT SELECTOR keys ⑬ . Then a digit in the number shown by FREQUENCY readout ⑧ starts flashing. The flashing digit can be modified by the MODIFY knob.

(e) The flashing can be shifted to another digit by the [←] or [→] key.

(f) Rotating MODIFY knob ⑭ stops the flashing and now the number currently displayed can be incremented or decremented. The newly displayed frequency value represents the increments or decrements from the reference frequency.

(g) To release the ⊿F function, press SHIFT key ㉙ turning its light on. Then press FREQ key ⑰ . The shift key and ⊿F display light then go off.

Example 3: Lowering frequency by 0.450 MHz with the MODIFY knob

Step	Operation	FREQUENCY readout	⊿ F light
1	Pecify the reference frequency.	1 00.000	○ Off
2	Press the SHIFT ○ key making the light on.	1 00.000	
3	Press the ⊿F ON/OFF FREQ key.	0.000	● On
4	Press the ← key or → key.	0.000 This digit was assigned last time.	
5	Press the ← key once.	0.000 Flashing	
6	Rotate the MODIFY knob CCW (○) one step.	− 0.010 Stop the flashing	
7	Rotate the MODIFY knob CCW (○) forty-four steps.	− 0.450	
8	Press the SHIFT ○ key making the light on.	− 0.450	
9	Press the ⊿F ON/OFF FREQ key.	99.550	○ Off

┌──────────────────────── NOTES ────────────────────────┐

1. ⊿F function covers the detuning range as follows:

    (a)   Where 0.1000 to 29.999 MHz, ±0.9999 MHz.

    (b)   Where 30.00 to 110.000 MHz, ±0.999 MHz

    (c)   Positive values do not have a plus sign.

2. Note that the ⊿F function displays only the difference between the actual
    frequency and the current reference frequency while ⊿F display light ⑦ is on.
    The actual frequency is displayed only when the ⊿F display light is off.

└──┘

(5)   ⊿F Function by the DATA keys

 (a)   Specify the desired reference frequency while ⊿F display light ⑦ is turned off.

 (b)   Press SHIFT key ㉙ making the light on.

 (c)   Press FREQ/ ⊿F ON/OFF key ⑰ . This will turns the SHIFT key light off and
       ⊿F display light ⑦ on.

       FREQUENCY readout ⑧ then shows "0.000" or "0.0000". The selectable
       frequency range will be as follows:

Product value	Selectable range
0.000	±0.999
0.0000	±0.9999

 (d)   Enter and display the required frequency value with DATA keys ⑯ .
       ENTER key ⑮ flashes to prompt setting.

 (e)   Press ENTER key ⑮ making the light off. The newly displayed frequency
       value represents the increments or decrements from the reference frequency.

 (f)   To release the ⊿F function, press SHIFT key ㉙ making the light on. Then
       press FREQ key ⑰ . This turns the SHIFT key and ⊿F display lights off.

Example 4: Lowering the output frequency by 0.450 MHz with the DATA keys

Step	Operation	FREQUENCY readout	⊿F light
1	Specify the reference frequency.	100.000	○ Off
2	SHIFT ○ key	100.000	
3	⊿F ON/OFF FREQ	0.000	● On
4	— key	$-$	
5	0 key	-0	
6	• key	$-0.$	
7	4 key	-0.4	
8	5 key	-0.45	
9	ENTER ○ key	-0.450	
10	SHIFT ○ key	-0.450	
11	⊿F ON/OFF FREQ key	99.550	○ Off

(6)   Program code for GP-IB

Header code	Data code	Description
FR	0.10000 to 29.9999 30.000 to 110.000	Sets within the range of 0.1 to 110 MHz.

Example for setting frequency of 82.5 MHz.

FR 82.5
      └──── Data code
└──── Header code

4-6   Basic Operation for Output Amplitude Control

Basic operations include entering the required output amplitude directly through the numeric input (DATA) keys, and modification of the setting with the MODIFY knob.

(1)   Direct reading of two-digit output amplitude display

The two-digit AMPLITUDE display covers the -19 to 99dB range in dB EMF unit.

The operation is guaranteed within the range of -10 to 99dB.

(2)   Setting output amplitude with the DATA keys

(a)   Press AMPTD key ⑱ of the FUNCTION keys to select the output amplitude setting.

(b)   Enter and display the required output amplitude with DATA keys ⑯. ENTER key ⑮ flashes to prompt the registration of the new setting. While the light flashes, the output amplitude of the instrument remains unchanged from the previous setting.

(c)   Press ENTER key ⑮ to register the displayed value.

The flashing light turns off and the newly set output amplitude is available.

———————————————————— NOTE ————————————————————

1.   The AMPLITUDE readout ⑩ does not accept any numerals beyond the display range entered with the DATA keys.

2.   To correct the wrong value entered with the DATA keys, press the AMPTD key again to reenter.

3.   The AMPTD key pressed as explained in (2)-(a) above does not turn any indication light on. Confirm the operation by the flashing of the ENTER key mentioned in (2)-(b).

Example 5: Setting 12dB

Step	Keystroke	AMPLITUD readout	ENTER key
1	FUNCTION AMPTD key	Current value.	○ Off
2	1 key	1	● Flashing
3	2 key	12	
4	ENTER key	12	○ Off

(3) Altering output amplitude with the MODIFY knob

The setting can also be altered with MODIFY knob ⑭ :

(a) Press AMPTED key ⑱ of the FUNCTION keys. AMPLITUDE readout ⑩ remains to read the current output amplitude setting.

(b) Press either of DIGIT SELECTOR keys ⑬ . One of the digits on AMPLITUDE readout ⑩ will start to flash. This digit may then be altered with MODIFY knob ⑭ .

(c) The flashing may be shifted to an adjoining digit with DIGIT SELECTOR keys ⑬ ⬅ or ➡ .

(d) Rotate MODIFY knob ⑭ to raise or lower the current digit reading. The digit will stop flashing, and the newly displayed output level is available.

(e) Output amplitude setting range

The output amplitude ranges from -19 to 99dB. No matter how much MODIFY knob ⑭ is rotated, the display will not read beyond these limits.

Example 6: Altering output amplitude with the MODIFY knob

Step	Operation	AMPLITUDE readout
1	Press the AMPTD key.	$1\ 0$ Current value
2	Press the ⬅ key or ➡ key.	$1\ 0$ This digit was assigned last time.
3	Rotate the MODIFY knob CW (⟳) for five steps.	$1\ 5$ Displays "5", flashing stops.
4	Press the ⬅ key twice.	$1\ 5$ Flashing
5	Rotate the MODIFY knob CW (⟳) for two steps.	$3\ 5$ Displays "3", flashing stops.

(4) Program code for GP-IB

Header code	Data code	Description
AP or LE	-19 to 99	Setting of -19 to 99 dB EMF

Example for setting output amplitude of -12 dB

AP -12

4-7 Basic Operation for Modulation Control

(1) Output signals

Table 4-1 shows the types of output signals of the VP-8174A.

Table 4-1 Type of output signals

		Output signal
CW (Unmodulated continuous wave)		Within the range of 0.1 to 110 MHz
AM (amplitude modulation)	AM INT	AM wave by the internal 400 Hz or 1 kHz sine wave.
	AM EXT	AM wave by an external signal within the range of 20 Hz to 10 kHz.
FM (frequency modulation)	FM INT	FM wave by the internal 400 Hz or 1 kHz sine wave.
	FM EXT	FM wave by an external signal within the range of 20 Hz to 80 kHz.
FM-stereo modulation	FM INT	FM stereo modulation wave by the internal 400 Hz or 1kHz sine wave.
	FM EXT	FM stereo modulation wave by an external signal within range of 50 Hz to 15 kHz.

(2) Selecting CW (unmodulated continuous wave)

Turn off SIGNAL ON/OFF key ㉕ and PILOT ON/OFF key ㉓ of the MOD keys, making the lights off. CW can be obtained without regard to any key operation relating to modulation, external signal connection, and indicated modulation factor.

(3) Program code fo GP-IB

Header code	Data code	Description
MO	0 1	Modulatior OFF Modulatior ON
PL	OF ON	Pilot OFF Pilot ON

Example for selecting CW

```
MO0    PLOF
              └────── Data code
          └────────── Header code
     └──────────────── Data code
 └───────────────────── Header code
```
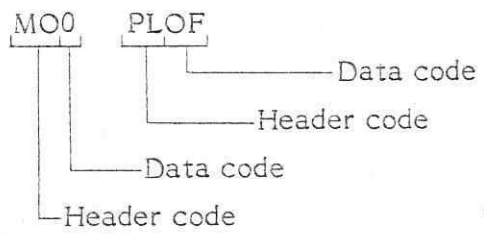
4-8 Basic Operation for Amplitude Modulation (AM)

The basic operation includes AM depth setting with numerals, and its modification with the MODIFY knob.

(1) Selecting AM

Follow the procedure below to obtain an AM wave.

(a) Press AM key ㉒ of the FUNCTION keys.

(b) Select either internal or external modulation by EXT/INT key ㉖. Read the following description for internal modulation and refer to paragraph 4-11 for external modulation.

---- NOTE ----

Pressing MOD SIGNAL key ㉕ to off (light off) turns the output signal into CW. This, however, does not change the AM depth shown in MODULATION readout ⑤.

(2) Direct reading of AM depth

The modulation set value is displayed in MODULATION readout ⑤ in a two-digit number. The unit is % as shown by the % AM light of kHz/% display lights ⑥ turned on. The setting range is 0 to 60% in 1% steps.

(3) Setting AM depth with the DATA keys.
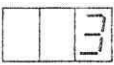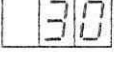
Given below is the procedure for setting AM depth by internal modulation. Example 7 shows an example setting of 30% AM.

(a) Select ON of SIGNAL ON/OFF key ㉕ of the MOD keys making the light on.

(b) Select INT (internal modulation) of EXT/INT key ㉖ of MOD keys making the light off.

(c) Select either 1 kHz or 400 Hz of 1 kHz/400 Hz key ㉔ making the light on or off.

(d) Press AM key ㉒ of FUNCTION keys. This turns the % AM light of kHz/% display lights ⑥ on.

(e) Enter the required modulation degree value with DATA keys ⑯. Then MODULATION readout ⑤ displays the set value making ENTER key ⑮ flash.

(f) Press ENTER key ⑮ to register the displayed value. The setting range is 0 to 60% in 1% steps. A value entered beyond the range will not be accepted but the previous value will remain valid.

───

┌─────────────────────────── NOTE ───────────────────────────┐
│   │
│   Setting AM depth with DATA keys ⑯ automatically turns SIGNAL ON/OFF key │
│ ㉕ on.   │
│   │
└──┘

Example 7: Setting AM depth of 30%

Step	Operation	MODULATION readout
1	☀ ON SIGNAL / ● OFF [○] key : ON	Key light on
2	☀ EXT / ● INT [○] key : INT	Key light off
3	☀ 1kHz / ● 400Hz [○] key : 1 kHz	Key light on
4	Press FUNCTION key [AM]	
5	Press [3] key	⸢ 3 ⸥ AM depth readout ENTER [⦿] Key flashes
6	Press [0] key	⸢30⸥ AM depth readout
7	Press ENTER [○] key	⸢30⸥ AM depth readout ENTER [○] Key off

(4)   Modifying AM depth with MODIFY knob

Discussed here is the modification of AM depth by internal modulation. Example 8
shows an example modification from 10% AM to 55% AM.

(a)   Press AM key ⑳ . The % AM light of kHz/% display lights ⑥ turns on and
MODULATION readout ⑤ shows the current modulation degree.

(b)   Press either one of DIGIT SELECTOR keys ⑬ . This will start to flash the
number displayed in a digit of MODULATION readout ⑤ . The flashing
indicates that the digit can be modified with MODIFY knob ⑭ .

(c)   The flashing can be shifted with the [←] or [→] key of DIGIT SELECTOR keys
⑬ .

(d)   Rotating MODIFY knob ⑭ stops the flashing and the indicated number can be
incremented or decremented. The renewed value is the AM depth available.

(e) Setting limit

The AM depth setting range is 0 to 60%. Even though MODIFY knob ⑭ may be kept rotating, the value indicated on the readout will not exceed the range.

Example 8: Modifying AM depth with MODIFY knob

Step	Operation	MODULATION readout
1	Press AM key	`1 0` Current set value
2	Press ← or → key	`1 0` Digit previously in use flashes
3	Rotate the MODIFY knob (○) by 5 steps	`1 5` Displays "5", stops flashing
4	Press ← key twice	`1 5` Flashes
5	Rotate the MODIFY knob (○) by 4 steps	`5 5` Displays "5", stops flashing

(5) Program code for GP-IB

Header code	Data code	Description
AM		Selects AM
AM	0 to 60	AM depth of 0 to 60%

Example for setting 30% AM

A M 3 0
└── Data code
└── Header code

4-9 Basic Operation for Monophonic FM

The basic operation includes frequency deviation setting with numerals, and its modification with the MODIFY knob.

(1) Selecting FM

Follow the procedure below to obtain a monophonic FM wave.

(a) Press FM key ⑲ of the FUNCTION keys.

(b) Press the MONO key of FM MODE keys ㉗ .

(c) Select either the external or internal modulation with EXT/INT key ㉖ . For the internal modulation read the following explanation. For the external modulation, read paragraph 4-11.

------- NOTE -------

Pressing SIGNAL ON/OFF key ㉕ to off (light off) turns the output signal into CW. This, however, does not change the frequency deviation shown in MODULATION readout ⑤ .

(2) Direct reading of FM deviation

The set value of FM deviation in a two-digit numeral is indicated in MODULATION readout ⑤ . The unit is kHz as shown by the kHz FM (MONO) light of kHz/% display lights ⑥ turned on. The setting range is 0 to 99.5 kHz in 0.5 kHz steps.

(3) Setting FM deviation with the DATA keys

The following is the procedure for setting FM deviation by internal modulation. Example 9 shows an example setting of 75 kHz FM deviation.

(a) Press SIGNAL ON/OFF key ㉕ of the MOD keys making the light on.

(b) Select INT of EXT/INT key ㉖ of MOD keys making the light off.

(c) Select 1 kHz or 400 Hz of 1 kHz/400 Hz key ㉔ of MOD keys making the light on or off.

(d) Press FM key ⑲ of FUNCTION keys and then the MONO key of FM MODE keys ㉗ . This will turn on the light in the MONO key and kHz FM (MONO) light of kHz/% display lights ⑥ .

(e) Enter the required frequency deviation value with DATA keys ⑯ . The set value will be displayed in MODULATION readout ⑤ and ENTER key ⑮ starts flashing.

(f) Press ENTER key ⑮ to register the displayed value. The setting range for frequency deviation is 0.0 to 99.5 kHz in 0.5 kHz steps. A value entered beyond the range will not be accepted but the previous value will remain valid.

┌─────────────────────────── NOTE ───────────────────────────┐

Setting FM deviation with DATA keys ⑯ automatically turns the MOD SIGNAL
key on.

└───┘

Example 9: Setting FM deviation of 75 kHz

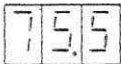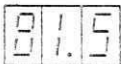| Step	Operation	MODULATION readout
1	☼ ON / ● OFF SIGNAL [○] key : ON	Key light on
2	☼ EXT / ● INT [○] key : INT	Key light off
3	☼ 1kHz / ● 400Hz [○] key : 1kHz	Key light on
4	Press FUNCTION key [FM]	
5	Press FM MODE key [○] MONO	[●] MONO Key light on kHz FM(MONO) light on
6	Press [7] key	[7] FM deviation readout ENTER [●] key flashes
7	Press [5] key	[75] FM deviation readout
8	Press ENTER [○] key	[75.0] FM deviation readout ENTER [○] key off
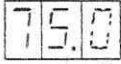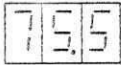
(4)   Modification of FM deviation with the MODIFY knob

The following describes the modification of FM deviation by internal modulation. The
FM deviation can be modified within the range of 0 to 99.5 kHz. Example 10 shows an
example modification from 75 kHz deviation to 81.5 kHz.

(a)   Press FM key ⑲ of FUNCTION keys and then the MONO key of MODE keys
⑳ . This will turn on the light in the MONO key and kHz FM (MONO) of
kHz/% display lights ⑥ . Modulation readout ⑤ shows the current deviation.

(b)   Press either one of DIGIT SELECTOR keys ⑬ . This will start to flash the number displayed in a digit of MODULATION readout ⑤ . The flashing indicates that the digit can be modified with MODIFY knob ⑭ .

(c)   The flashing can be switched between the lower two digits with the ⎡←⎤ and ⎡→⎤ keys.

(d)   Rotating MODIFY knob ⑭ stops the flashing and the indicated number can be incremented or decremented. The renewed value is the FM deviation available.

(e)   Setting limit

   The FM deviation setting range is 0 to 99.5 kHz. Even though MODIFY knob ⑭ may be kept rotating, the value indicated on the readout will not exceed the range.

Example 10: Modifying FM deviation with MODIFY knob

Step	Operation	MODULATION readout	
1	Press FUNCTION key ⎡FM⎤		
2	Press FM MODE key ⎡○⎤ MONO	`75.0`	Current FM deviation set value ⎡●⎤ MONO key light on kHz FM(MONO) light on
3	Press ⎡←⎤ or ⎡→⎤ key	`75.0`	Digit previously in use flashes
4	Rotate the MODIFY knob CW (↻) by 5 steps	`75.5`	Displays "5", stops flashing
5	Press ⎡←⎤ key twice	`75.5`	Flashes
6	Rotate the MODIFY knob CW (↻) by 6 steps	`81.5`	Displays 81.5, stops flashing.

(5) Program code for GP-IB

Header code	Data code	Description
FM		Selects FM
MS	1	Monophonic FM mode
FM	0 to 99.5	0 to 99.5 deviation

Example for setting 80 kHz deviation

```
F M  M S 1  F M 8 0
                  └── Data code
              └── Header code
          └── Data code
        └── Header code
  └── Header code
```
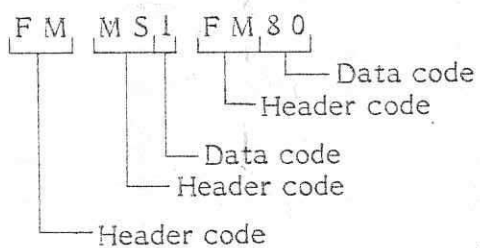
4-10 Basic Operation for FM Stereo Modulation

(1)   General

The VP-8174A provides an FM stereo modulation wave by a composite stereo signal. The following four stereo modulation modes (a) to (d) by a single modulating signal are available.

(a)   L=R mode

The composite stereo signal is composed of the main channel signal and pilot signal.

(b)   L mode

The composite stereo signal is composed of the main channel signal, subchannel signal and pilot signal. If the output signal in this mode is received by a stereo receiver, the modulating signal is reproduced in the L channel only.

(c)   R mode

The inverse of the L mode. It has the signal composition as same as the L mode. A stereo receiver can reproduce the modulating signal in the R channel only.

(d)   L=-R mode

The composite stereo signal is composed of the subchannel signal and pilot signal.

The basic operation regarding FM stereo modulation includes FM mode selection, FM stereo modulation factor setting and modification, pilot level setting and modification and, SCA modulation. Each operation is described as follows.

--- NOTES ---

The VP-8174A indicates the FM stereo modulation factor and pilot level independently of each other. The FM deviation by the main and subchannels of composite signal alone will be displayed for modulation factor indication independently of pilot level. The FM deviation by pilot level alone is displayed for pilot level indication independently of modulation factor. FM stereo modulation factor and pilot level cannot be displayed at the same time.

Stereo modulation by external L and R signals is not available. Pre-emphasis function is not provided, either.

(2)   FM mode selection

The following is the procedure for obtaining FM stereo modulation wave.

(a)   Press FM/PILOT key ⑲ of the FUNCTION keys.

(b)   Press a required key of FM MODE keys ㉗ . The light turns on to indicate that the mode is selected. Selecting the MONO key switches the mode to the monophonic FM.

(c)   Select either external or internal modulation with EXT/INT key ㉖ . See the following description for internal modulation and see paragraph 4-11 for external modulation.

(d)   Press SIGNAL ON/OFF key ㉕ making the light on.

(e)   Press PILOT ON/OFF key ㉓ making the light on.

NOTES
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1.   FM monophonic deviation (kHz) and FM stereo modulation factor (%) are set or modified in the same proportion at the same time.

2.   SIGNAL ON/OFF key ㉕ and PILOT ON/OFF key ㉓ functions operate independently of each other; SIGNAL ON/OFF key ㉕ is for turning on and off the modulation by the main and subchannel components of the composite stereo signal, while PILOT ON/OFF key ㉓ is for turning on and off the modulation by the pilot signal.

3.   Turning SIGNAL ON/OFF key ㉕ and PILOT ON/OFF key ㉓ off (light off) leaves the FM modulation factor or pilot level set value unchanged on MODULATION readout ⑤ .

(3)   Direct reading of modulation factor

Modulation factor set value is displayed in a three-digit number on MODULATION readout ⑤ . The unit is % as shown by the % FM (STEREO) light of kHz/% display lights ⑥ turned on. The FM stereo modulation factor is expressed as 100%=67.5 kHz deviation. Although the setting range is from 0 to 133% in 1% steps, the performances are guaranteed within the range up to 100%.

(4)   Setting FM stereo modulation factor with the DATA keys.
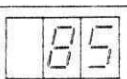
Example 11 is and example setting of 85% FM stereo.
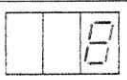
(a)   Select ON of SIGNAL ON/OFF key ㉕ of the MOD keys making the light on.

(b)   Select INT of EXT/INT key ㉖ of MOD keys ㉖ making the light on.

(c)   Select 1 kHz or 400 Hz of 1 kHz/400 key ㉔ turning the light on or off.

(d)   Press FM key ⑲ of the FUNCTION keys and then press one out of four STEREO keys (L=R, L, R, and L=-R) or the FM MODE keys ㉗ . This will turn on the light in the selected STEREO key and % FM (STEREO) light of kHz/% indication lights ⑥ .

(e)   Enter the required stereo modulation value with DATA keys ⑯ . The entered value will be displayed on MODULATION readout ⑤ and ENTER key ⑮ will start flashing.

(f) Press ENTER key ⑮ to register the displayed value. The modulation factor setting range is from 0 to 133% in 1% steps. A value entered beyond the range will not be accepted but the previous value remains valid. Note that the performances are guaranteed within the range up to 100%.

NOTE

Setting FM stereo modulation with DATA keys ⑯ automatically turns the MOD SIGNAL key on.

Example 11: Setting FM stereo modulation factor of 85%

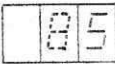| Step	Operation	MODULATION readout
1	☀ ON SIGNAL · OFF [○] key : ON	Key light on
2	☀ EXT · INT [○] key : INT	Key light off
3	☀ 1 kHz · 400 Hz [○] key : 1kHz	Key light on
4	Press FUNCTION key [FM]	
5	Press FM MODE key [L=R ○]	Key light on %FM(STEREO) light on
6	Press [8] key	8 Modulation factor readout
7	Press [5] key	85 Modulation factor readout
8	Press [ENTER ○] key	ENTER [○] key light off

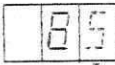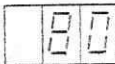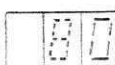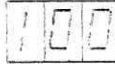(5) Modifying FM stereo modulation factor with MODIFY knob
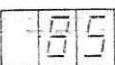
FM stereo modulation factor can be modified within the range of 0 to 133%.

The following describes the procedure for modifying FM stereo modulation factor by internal modulation. Example 12 is an example modification of FM stereo modulation factor from 85% to 100%.

(a) Press FM key ⑲ of the FUNCTION keys and then press a required key out of four STEREO keys (L=R, L, R, and L=-R). This will turn on the selected FM MODE key and the % FM (stereo) of kHz/% indication lights ⑥. MODULATION readout ⑤ shows the current modulation factor.

(b) Press either one of DIGIT SELECTOR keys ⑬ .

This will start to flash the number displayed in a certain digit of MODULATION readout ⑤ . The flashing indicates that the digit can be modified with MODIFY knob ⑭ .

(c) The flashing can be switched between the lower two digits with the $[\leftarrow]$ and $[\rightarrow]$ keys.

(d) Rotating MODIFY knob ⑭ stops the flashing and the displayed number can be incremented or decremented. The renewed value is the FM stereo modulation available.

(e) Setting limit

The FM stereo modulation factor setting range is 0 to 133%. Even though MODIFY knob ⑭ may be kept rotating, the value indicated on the readout will not exceed the range.

Example 12: Modifying FM stereo modulation factor with MODIFY knob

Step	Operation	MODULATION readout
1	Press FUNCTION key [FM]	
2	Press FM MODE key [○] (L=R)	$\boxed{85}$ Current modulation factor set value [●] (L=R) key light on % FM (STEREO) light on
3	Press [←] or [→] key	$\boxed{85}$ Digit previously in use flashes
4	Press [→] key	$\boxed{85}$ Flashes
5	Press the MODIFY knob CCW (○) by 5 steps	$\boxed{80}$ Displays "0", stops flashing
6	Press [←] key twice	$\boxed{80}$ Flashes
7	Press the MODIFY knob CW (○) by 2 steps	$\boxed{100}$ Displays "100", stops flashing

(6)　Direct reading of pilot signal level

Pilot signal level set value is displayed in two-digit number on MODULATION readout ⑤. The unit is % as shown by the % FM (STEREO) light of kHz/% display lights ⑥ turned on. PILOT SIGNAL LEVEL light ④ also turns on to show that the MODULATION readout is used for pilot signal level indication.

Pilot level is displayed as: 10% = 7.5 kHz deviation

The setting range is 0 to 15% in 1% steps.

(7)　Setting pilot signal level with DATA keys
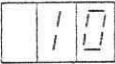
Example 13 is an example setting of 10% pilot level.

(a)　Press FM key ⑲ of the FUNCTION keys. Then press one out of four STEREO keys (L=R, L, R, L=-R) of FM MODE keys ㉗. This will turn on the lights of the selected STEREO key and % FM (STEREO) of kHz/% display lights ⑥.

(b)　Press PILOT ON/OFF key ㉓ of the MOD keys making the light on.

(c)　Press SHIFT key ㉙ making the light on.

(d)　Press FM/PILOT key ⑲ to turn on PILOT SIGNAL LEVEL light ④.

(e)　Enter the required pilot signal level value with DATA keys ⑯. The entered value will be displayed on MODULATION readout ⑤ and ENTER key ⑮ will start flashing.

(f)　Press ENTER key ⑮ to register the displayed value. The setting range is 0 to 15%. A value entered beyond the range will not be accepted but the previous value will remain valid.

─── NOTE ───

Setting pilot signal level with DATA keys automatically turns PILOT ON/OFF key ㉓ on.

Example 13: Setting pilot signal level of 10%

Step	Operation	MODULATION readout
1	Press FUNCTION key [FM]	
2	Press FM MODE key [○] L=R	[●] L=R key light on % FM (STEREO) light on
3	☼ ON / ● OFF PILOT [○] key : ON	Key light on
4	Press [○] SHIFT key	Key light on
5	Press FUNCTION key PILOT [FM]	[○] SHIFT key light off PILOT light on
6	Press [1] key	Pilot level readout [●] ENTER key flashes
7	Press [0] key	Pilot level readout
8	Press [○] ENTER key	[○] ENTER key light off

(8) Modifying pilot signal level with MODIFY knob

Example 14 shows an example modification
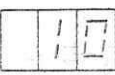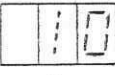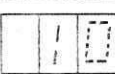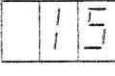
(a) Press FM key ⑲ of the FUNCTION keys. Then press one out of four STEREO keys (L=R, L, R, L=-R) of FM MODE keys ㉗. This will turn on the lights of the selected STEREO key and % FM (STEREO) of kHz/% display lights ⑥.

(b) Select ON of PILOT ON/OFF key ㉓ making the light on.

(c) Press SHIFT key ㉙ making the light on.

(d) Press FM/PILOT key ⑲ to turn on PILOT SIGNAL LEVEL light ④. MODULATION readout ⑤ shows the current pilot signal level.

(e) Press either one of DIGIT SELECTOR keys ⑬. This will start to flash the number displayed in a certain digit of MODULATION readout ⑤. The flashing indicates that the digit can be modified with MODIFY knob ⑭.

(f) The flashing can be shifted with the [←] or [→] key of DIGIT SELECTOR keys ⑬.

(g) Rotating MODIFY knob ⑭ stops the flashing and the displayed number can be incremented or decremented. The renewed value is the pilot signal level

(h) Setting limit

The pilot signal level setting range is 0 to 15%. Even though MODIFY knob ⑭ may be kept rotating, the value indicated on the readout will not exceed the range.

Example 14: Modifying pilot signal level with MODIFY knob

Step	Operation	MODULATION readout
1	Press FUNCTION key [FM]	
2	Press FM MODE key [○] L=R	[●] L=R key light on % FM(STEREO) light on
3	☀ ON / ● OFF PILOT [○] key : ON	key light on
4	Press [○] SHIFT key	key light on
5	Press FUNCTION key [FM] RILOT	[○] SHIFT key light off PILOT light on [1 0] Current pilot level set value
6	Press [←] or [→] key	[1 0] Digit previously in use flashes
7	Press [→] key	[1 0] Flashes
8	Press the MODIFY knob CW (↻) by 5 steps	[1 5] Displays "15", stop flashing

(9) SCA input

When the SCA signal is required to form a composite stereo signal, apply a 0.56 Vp-p signal to SCA INPUT connector ㉝ . SCA component corresponding to approximately 7.5 kHz deviation will be obtained.

> — NOTE —
>
> Applying a signal to SCA INPUT connector ㉝ modulates the RF output signal independently of the generator's modulation operation. Therefore do not apply any signal to the SCA INPUT connector unless the SCA signal is required.
>
> The input signal level of 0.56 Vp-p must be kept during the SCA application. Since the instrument has no indication for SCA.

(10) Composite signal output

The VP-8174A has COMP OUTPUT connector ㉜ from which a composite stereo signal is obtained. The output level is approximately 5 VP-p (600Ω termination) when the stereo modulation factor is 100% and the pilot signal level is 10%. Use this connector when the function as a stereo modulator alone is required.

> — NOTE —
>
> Output level of COMP OUTPUT connector ㉜ varies with the value set for the RF frequency. Therefore the RF frequency must be kept constant when using the composite stereo signal from this connector.

(11) Program code for GP-IB

Header code	Data code	Description
FM		Selects FM
MS	2 3 4 5	FM stereo L=R mode FM stereo L mode FM stereo R mode FM stereo L=-R mode
FM	0 to 133	0 to 133% stereo modulation factor
PL	0 to 15 ON OFF	0 to 15% pilot signal level Pilot signal ON Pilot signal OFF

Example for setting FM stereo modulation, L mode, stereo modulation factor of 95% and pilot signal level of 10%.

```
FM    MS 3    FM 95    PL 10
 |     |  |    |  |     |  |
 |     |  |    |  |     |  └── Data code
 |     |  |    |  |     └───── Header code
 |     |  |    |  └─────────── Data code
 |     |  |    └────────────── Header code
 |     |  └─────────────────── Data code
 |     └────────────────────── Header code
 └──────────────────────────── Header code
```
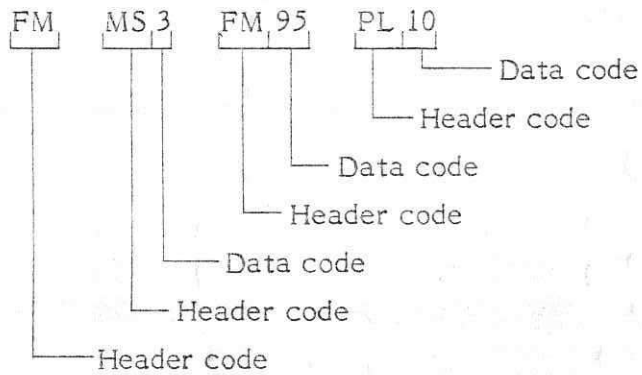
4-11 External modulation Operation

(1)   Indications regarding external modulation

   (a)   The light in EXT/INT key ㉖ of the MOD keys turns on.

   (b)   EXT INPUT annunciators HI/L0 ③ turns on or off. Other indications are as same as those for the modulation modes described in paragraphs 4-8, 4-9, and 4-10.

(2)   Procedure for external modulation

   (a)   Press SIGNAL ON/OFF key ㉕ of the MOD keys making the light on.

   (b)   Select EXT (external modulation) of EXT/INT key ㉖ of the MOD keys making the light on.

   (c)   Connect an external AF signal to EXT INPUT connector ㉚ . If the AF signal is larger than the reference level, HI of EXT INPUT annunciators HI/L0 ③ turns on. If the AF signal is smaller, L0 turns on.

       Adjust the output level of the external AF signal source so that both HI and L0 lights turn off. When both the lights are off, an external input signal maintains its input level within ± 2% of the required value for the display to be calibrated. This enables the direct readout of modulation degree. While either HI or L0 light is on, an actual modulation degree cannot be read from the display.

   (d)   Procedures for setting AM, FM, and FM STEREO modulation degree are as same as those for internal modulation described in paragraphs 4-8 to 4-10.

---- NOTES ----

Normal external modulation requires both HI and L0 lights to be turned off, but it may be allowed to have L0 light turned on, if necessary. The FM deviation changes linearly with the input level. For example, set the display to show 75 kHz deviation and reduce the AF input level by 20 dB. Then the FM deviation of output signal will be 7.5 kHz (=10%) while the display remains to show 75 kHz (=100%).
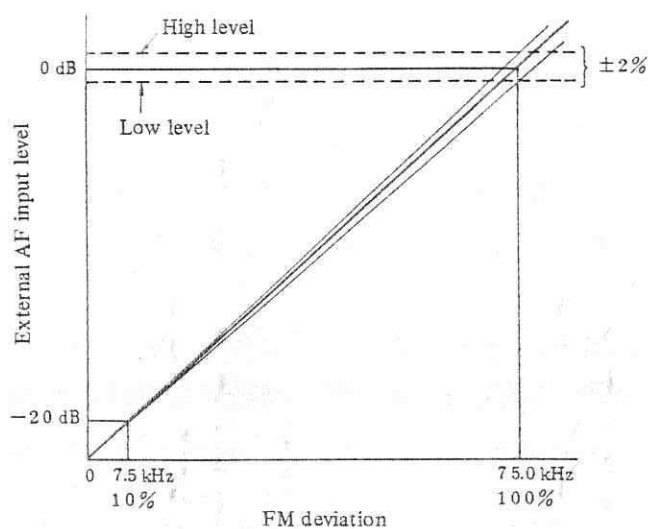
Fig. 4-1 Relationship between external AF input level and FM deviation setting

(3)   Program code for GP-IB

Header code	Data code	Description
TO	0 1 4	External modulation Internal 1 kHz modulation Internal 400 Hz modulation

Example for setting the external modulation

MO 1   TO 0

— Data code
— Header code
— Data code
— Header code

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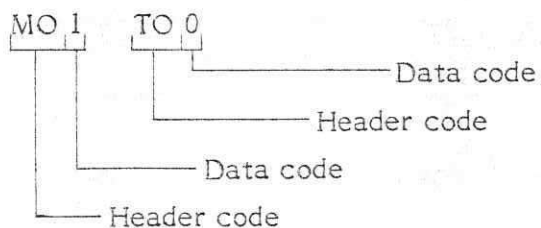
4-12 Assorted Preset Operation

(1) General

The assorted preset function of the VP-8174A stores up to 100 setups of frequency, output amplitude, modulation degree, modulation type, and ON/OFF setting in the memory for instant recall whenever required.

(a) Each setup consists of:

Frequency	0.1000 to 110.000 MHz		
Output amplitude	+19 to 99 dB EMF		
Modulation	AM	:	0 to 60%
	FM	:	0 to 99.5 kHz
	FM stereo	:	0 to 133%
	Pilot signal	:	0 to 15%
Modulation status	FUNCTION	:	AM, FM
	MOD	:	SIGNAL · ON/OFF
			EXT/INT
			1 kHz/400 Hz
			PILOT · ON/OFF
	FM MODE	:	MONO, L=R, L, R, L=-R

(b) Identification of 100 sets of preset data

Each set of assorted preset data is labeled with a 2-digit number on the MEMORY ADDRESS readout ②. The number, memory address from 00 to 99, is used to identify each set of preset data.

(2) Store operation

The procedure for data storage is shown below:

(a) Perform the panel operation to the desired setup and check each indication.

(b) Press STO key ㉒. ENTER key ⑮ flashes to prompt for numeric key input with DATA keys ⑯.

(c) Enter the required memory address with DATA keys ⑯.

(d) Press ENTER key ⑮. The key light goes out once the data has been stored.

For example, given below is the procedure for storing the data in the following table.

Item	Value/state to be stored
Memory address	12
Frequency	82.5 MHz
Output amplitude	78 dB EMF

Modulation
• Function
• MOD SIGNAL ON/OFF
            EXT/INT
            1 kHz/400 Hz
• FM MODE
• FREQUENCY DEVIATION
	
	FM
	ON
	INT
	1 kHz
	MONO
	75 kHz

Step	Procedure
1	Register the frequency of 82.5 MHz: • FUNCTION keys .... Press the FREQ key. • DATA keys .... Input 82.5. • ENTER key .... Press.
2	Register the output amplitude of 78 dB EMF: • FUNCTION keys .... Press the AMPTD key. • DATA keys .... Input 78. • ENTER key .... Press.

3	Register the modulation state:
	• FUNCTION keys .... Press the FM key.
	• MOD SIGNAL ON/OFF ..... Select ON.
	           EXT/INT .... Select INT.
	           1 kHz/400 Hz .... Select 1 kHz.
	• FM MODE .... select MONO.
	• DATA keys .... Input 75.
	• ENTER key .... Press.

4	Register 12 as the address number: • STO key .... Press. • DATA keys .... Input 12. • ENTER key .... Press.

(3) Single recall operation (Basic operation)

    (a)   Press the RCL key ㉑ . This starts ENTER key ⑮ to flash.

    (b)   Enter the two-digit number for the address to be recalled with the DATA keys ⑯ . The address will be shown on MEMORY ADDRESS readout ② and now the stored setting is recalled.

---- NOTES ----

1. To correct wrong input of numbers, press RCL key ㉑ or STO key ㉒ again to reenter.

2. Entering a two-digit address number automatically concludes the recall operation. The ENTER key does not have to be pressed. The ENTER key can be used as a substitute means for entering one-digit number without preceding zero. (Keystrokes 0 and 5 can be substituted by 5 and ENTER.)

(4) Setting the start and end address for sequential recall

It is also possible to restrict the range to sequentially recall the data stored between two preset start and end addresses.

The recall procedure will be found in the next paragraph (5).

(a) Press STO key ㉒. This starts ENTER key ⑮ to flash.

(b) After pressing the decimal point (.) key of DATA keys ⑯, enter a two-digit start address.

(c) After pressing the decimal point (.) key of DATA keys ⑯, enter a two-digit end address.

(d) Press ENTER key ⑮ to set the start and end addresses.
The start address will be indicated on MEMORY ADDRESS readout ②, with the decimal point of the unit's digit going on.

(e) To clear the start and end addresses, press STO key ㉒, the decimal point (.) key of DATA keys ⑯ twice, and then ENTER key ⑮. This causes the same effect as setting the start address to 00 and end address to 99.

---- NOTE ----

The start address must be smaller than the end address. They may be assigned in either order, but the Signal Generator always treats the smaller as the start address. Entering start 98 and end 02, for example, does not produce the sequence 98 → 99 → 00 → 01 → 02, but 02 → 03 → ..... 97 → 98.

(5) Sequential recall operation

(a) Press the ☐↑☐ key of MEMORY keys ㉘ to recall the address following the one currently indicated on MEMORY ADDRESS readout ②. If the ☐↑☐ key is pressed when the end address is indicated on the readout, the start address will be recalled. When the sequential recall state is cleared, address 00 is recalled after address 99.

(b) Press the ☐↓☐ key of MEMORY keys ㉘ to recall the address before the one currently indicated on MEMORY ADDRESS readout ②. If the ☐↓☐ key is pressed when the start address is indicated on the readout, the end address will be recalled. When the sequential recall state is cleared, address 99 is recalled after address 00.

(c) Press the CLR key of MEMORY keys ㉘ to recall the start address. When the sequential recall state is cleared address 00 is recalled.

(6) Sequential recall grouping

The preset memory can be divided into a maximum of 10 groups. Any one of them can be specified for sequential recall.

The following describes the grouping method.

(a) When STO key ㉒ is pressed, ENTER key ⑮ starts flashing.

(b) Press the (.) key of DATA keys ⑯ then enter the 2-digit start address.

(c) Press (.) key of DATA keys ⑯ then enter the 2-digit end address.

(d) Press (.) key of DATA keys ⑯ then enter 1-digit group key number.

(e) When ENTER key ⑮ is pressed, the start and end addresses and the group number are set, the decimal point for the unit's digit on MEMORY ADDRESS readout ② goes on, and the start address is displayed.

─── NOTE ───

The addresses of two or more groups can be overlapped. (See the operation example in Fig. 4-2.)

(7) Specification of a sequential recall group

A sequential recall operation can be performed on any one of the groups formed in (6) above. The following shows the group specification method.

(a) When RCL key ㉑ is pressed, ENTER key ⑮ starts flashing.

(b) Press the (.) key of DATA keys ⑯ then enter the 1-digit group number.

(c) When ENTER key ⑮ is pressed, the corresponding group is specified, the start address of the group is shown, and the decimal point for the unit's digit on MEMORY ADDRESS readout ② goes on.

(d) To clear the group specification, press STO key ㉒, the (.) key of DATA keys ⑯ twice, and ENTER key ⑮ in this order. This causes the same effect as setting 00 to the start address and 99 to the end address. The grouping remains in memory.
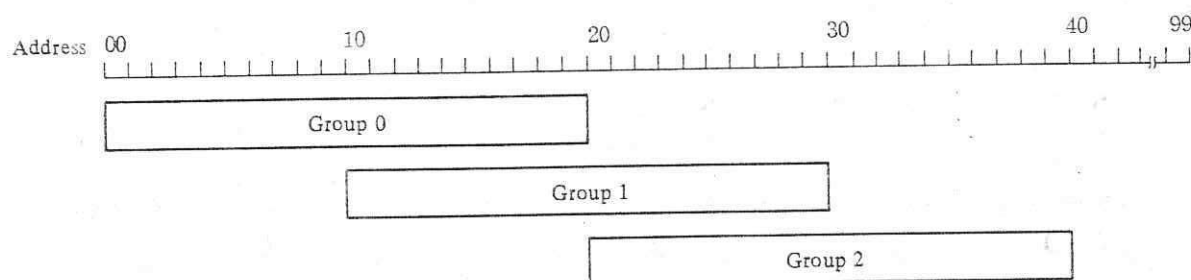
Key operation for the grouping above
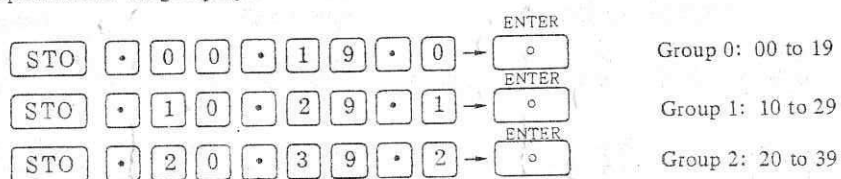
Fig. 4-2 Example of grouping operation

(8)   Program code for GP-IB

Header code	Data code	Description
RC	00 to 99	Recalling memory addresses 00 to 99.
ST	00 to 99	Storing into memory addresses 00 to 99.

Example for recalling memory address 20.

RC 20
— Data code
— Header code
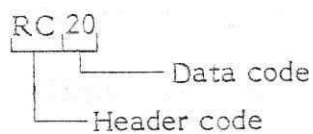
4-13 Independent Output Amplitude Preset Operation

(1)   General

The output amplitude of this Signal Generator can be set over the entire range with DATA key ⑯ and MODIFY knob ⑭. The independent output amplitude preset function, however, simplifies the setting procedure. It is especially helpful when some particular output amplitude are repeatedly used. Up to four such amplitudes may be stored.

(2)   Operatior procedure

The procedure is explained with an example.

(a)   Choose the preset amplitude

This example assigns amplitudes of 99, 80, 20, and 0 dB EMF to the AMPLITUDE PRESET keys ⑫ a, b, c, and d, respectively.

(b)   Set AMPLITUDE readout ⑩ to 99 dB using either the DATA keys (see paragraph 4-6, (2)) or the MODIFY knob (see paragraph 4-6, (3)).

(c)   Press the STO key ㉒.

(d)   Press the "a" key of AMPLITUDE PRESET keys ⑫.

(e)   Press the ENTER key ⑮. When the key light goes out, the operation is complete.

(f)   Repeat Steps (b) to (e) to assign amplitudes of 80, 20, and 0 dB to the AMPLITUDE PRESET keys "b", "c", and "d", respectively.

(g)   Recall operation

Pressing one of AMPLITUDE PRESE keys 'a" to "d" immediately recalls the output amplitude assigned to the key on the AMPLITUDE readout and a signal having the preset output amplitude is available at the RF OUTPUT connector ⑪.

Store operation

Step	Procedure
1	Choose the preset amplitudes. 99 dB : key "a" 80 dB : key "b" 20 dB : key "c" 0 dB : key "d"
2	Set the output amplitude to 99 dB EMF. · FUNCTION keys .... Press the AMPTD key. · DATA key .... Enter 99. · ENTER key .... Press.
3	STO key .... Press.
4	AMPLITUDE PRESET keys .... Press "a" key.
5	ENTER key .... Press the key and check that the key light goes out.
6	AMPLITUDE PRESET keys Assign amplitudes of 80, 20, and 0 dB to the keys "b", "c", and "d", respectively.

Recall operation

Step	Procedure
1	AMPLITUDE PRESET keys ...... Press "a" key. (Recalling is complete.)
2	AMPLITUDE (Output level) 99 dB EMF .... Displayed providing the output.

(3)   Program code for GP-IB

Header code	Data code	Description
RC	A to D	Recalling preset amplitude assigned to keys "a" to "d".
ST	A to D	Storing into memories to assign preset amplitude to keys "a" to "d".

Example for storing key "b" assignment.

S T B

SECTION V
OVERVIEW OF THE GP-IB

5-1 GENERAL

The GP-IB (General Purpose Interface Bus) has been known as a special bus structure defined by the IEEE Standard 488. The overall purpose of the interface system is to provide an effective communication link over which messages are carried in an unambiguous way among a group of interconnected devices.

5-2 DEVICES IN THE SYSTEM

The communication link requires three basic functional elements to organize and manage the flow of information to be exchanged among devices : (1) A device acting as a listener, (2) a device acting as a talker, and (3) a device acting as a controller.

A Talker sends data to Listeners on the bus, a Listener receives data from the Talker on the bus, and a Controller controls the activity of the bus. Many devices are both Talkers and Listeners, but there are devices that can be fixed to act as Talkers only or Listeners only with the "Only" mode of operation. There are also devices that act inherently as Listeners only (e.g., a printer).

The Controller is the only device capable of sending commands by which the activities on the bus are altered. The Controller can pick out a specific device and instruct it to be a Talker or Listener.

5-3 MESSAGE PATHS AND BUS STRUCTURE

The GP-IB contains a set of sixteen signal lines used to carry all information, interface messages, and device dependent messages among interconnected devices. Fig. 5-1 is a diagram of the interface connections and bus structure.
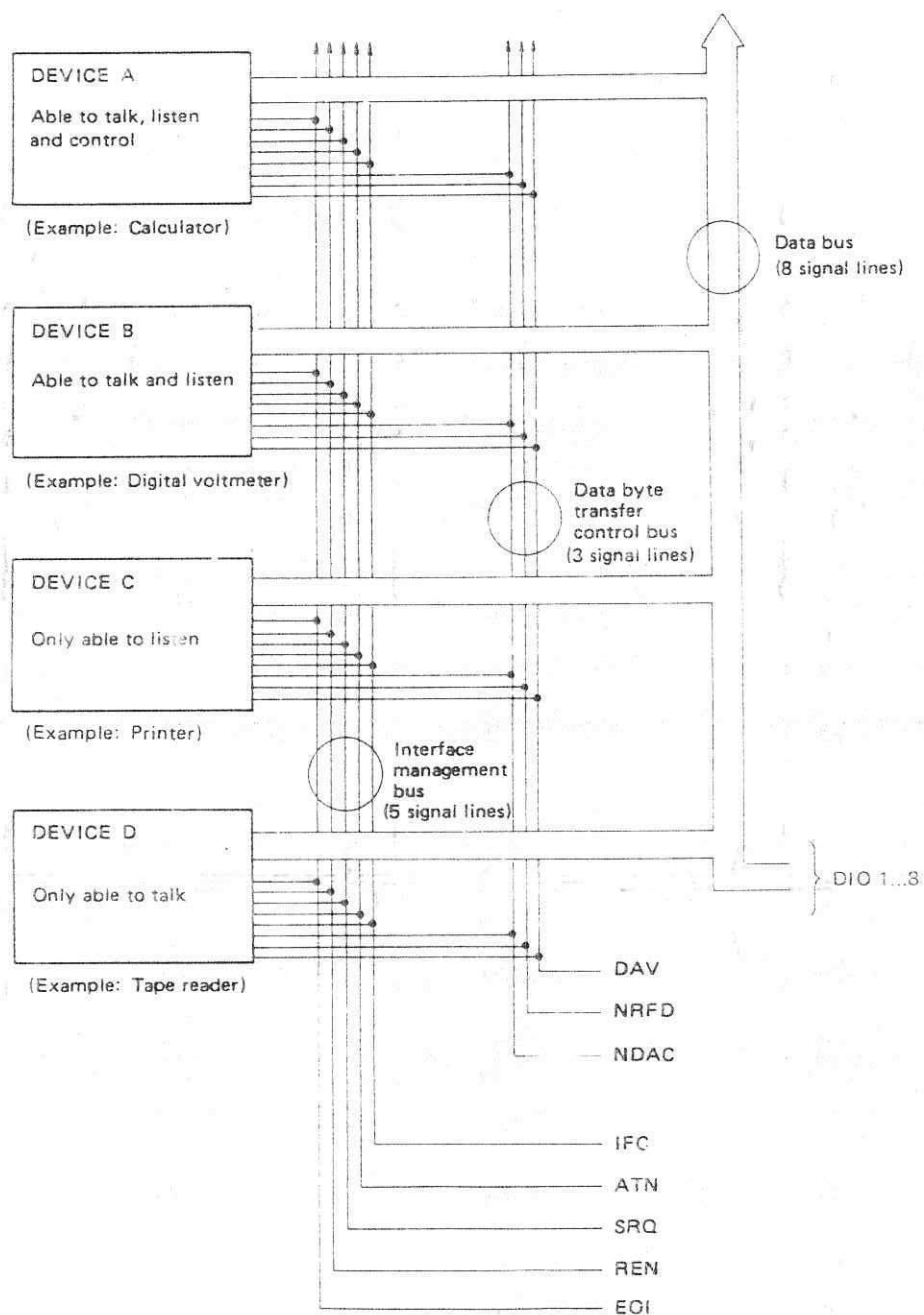
Fig. 5-1   Interface connection and bus structure

The bus structure is organized into three sets of signal lines :

(1)   Data bus, 8 signal lines (DIO 1 ... 8)

(2)   Handshake lines or data byte transfer control bus, 3 signal lines (DAV, NRFD and NDAC)

(3)   Control lines or interface management bus, 5 signal lines (ATN, IFC, SRQ, REN and EOI)

The bus consists of a 24-line passive cable of which sixteen lines are used for signal lines described above and the remaining eight are used for ground connection.

Since the bus has a negative logic convention, a less positive voltage level is referred to as TRUE (binary 1) and a more positive voltage level is FALSE (binary 0).

5-4 DATA LINES (DATA BUS)

The data lines carry message bytes in a bit-parallel byte-serial form, asynchronously, and generally in a bidirectional manner. These lines carry either data or command information, depending upon the condition of the ATN management line. Normally, a seven-bit ASCII code represents each byte of messages, leaving the eighth bit available for parity checking. ·

Commands are categorized into two groups; Addressed Command Group effective only for Listeners and Universal Command Group effective for all devices. The following are typical commands with brief descriptions.

Addressed commands :

GTL   Go To Local. Returns the listening device(s) to local (front panel) control.

SDC   Selected Device Clear. Ruturns the listening device(s) to a predefined device-dependent state.

GET   Group Execute Trigger. Causes the listening device(s) to perform a device-dependent action.

UNL   Unlisten. Releases all listening devices from being Listeners.

Universal commands :

LLO   Local Lockout. Prevents the device operator from manually inhibiting remote program control.

DCL   Device Clear. Sets the device to its initial conditions.

SPE   Serial Poll * Enable. Places the device under serial poll mode.

SPD   Serial Poll Disable. Releases the device from serial poll mode.

* Polling is a means by which a Controller can identify a device that needs interaction with it. The Controller may poll devices for their operational condition one at a time, which is termed a serial poll, or as groups of devices simultaneously, which is termed a parallel poll.

The commands are sent from the Controller when the ATN line is Low (TRUE). MLA (My Listen Address) and MTA (My Talk Address) are used to designate the devices as a Listener or Talker respectively.

Each device has a 5-bit address switch usually on the rear panel to be used for assigning an address. Using this address the device can respond to addressed commands.

5-5 HANDSHAKE LINES (DATA BYTE TRANSFER CONTROL BUS)

A set of three interface signal lines (DAV, NRFD and NDAC) operates in what is called a three-wire interlocked handshake process to transfer each data byte across the interface :

(1) DAV line (Data Valid) is used to indicate the condition (availability and validity) of information on the DIO signal lines.

(2) NRFD line (Not Ready for Data) is used to indicate the condition of readiness of device(s) to accept data.

(3) NDAC line (Not Data Accepted) is used to indicate the condition of acceptance of data by device(s).

The timing chart for GP-IB interface handshaking is shown in Fig. 5-2, and its flowchart is shown in Fig. 5-3.

Each byte of data transferred by the interface uses the handshaking process between a source and acceptor. In a typical example, the source is a Talker and the acceptor is a Listener.

The Talker waits for NRFD (all Listeners become ready to receive) and, after receiving NRFD, it generates and sends a DAV. The Listener receives data after receiving this DAV, releases NDAC when all data have been received, and releases NRFD when the device is ready to receive the next byte of data. This sequence allows consecutive data transfer. A wired-OR configuration in the NRFD and NDAC lines permits data transfer at the rate of the slowest device. This enables the data transfer rate of these lines to match that of the device, assuring accurate data transfer.
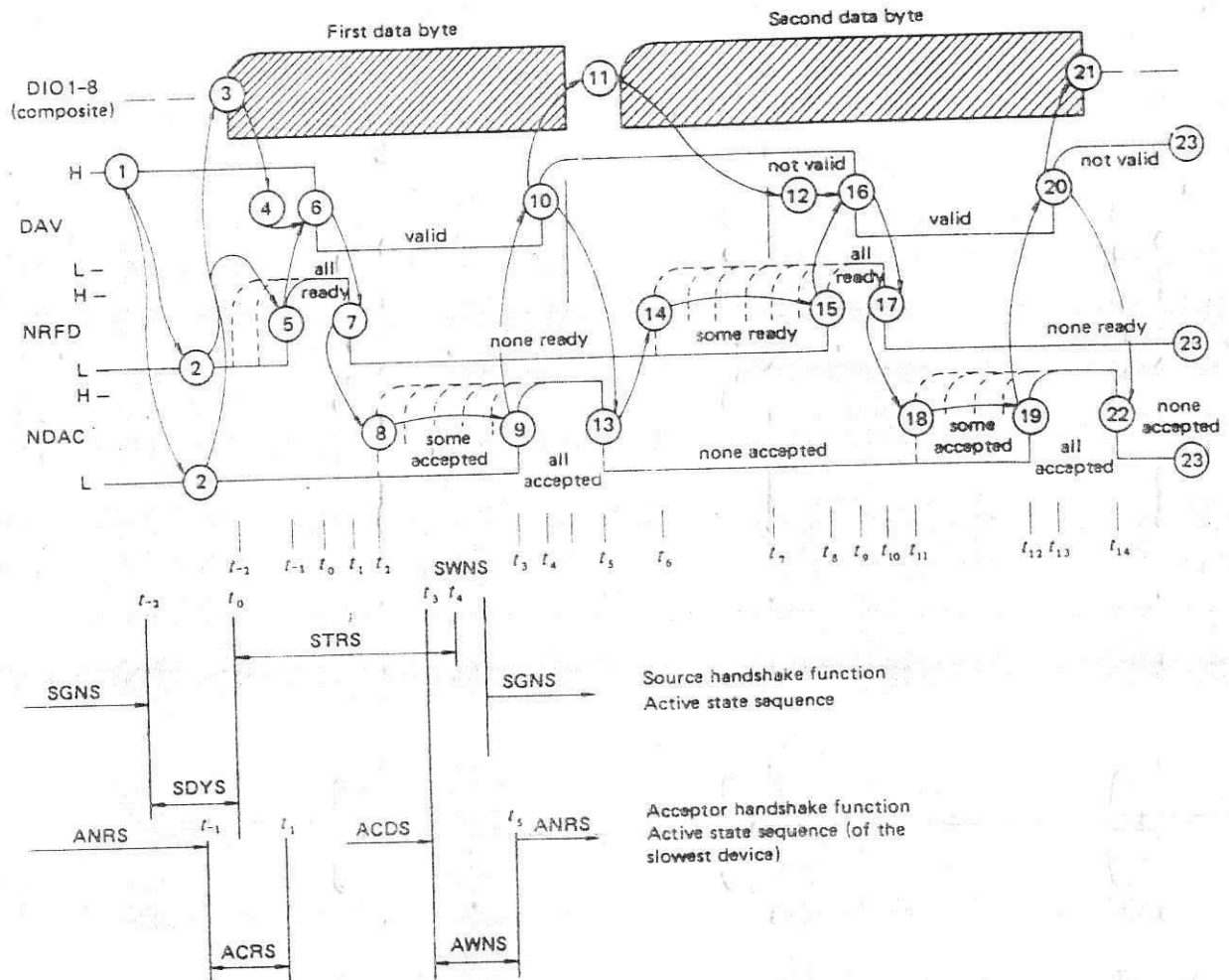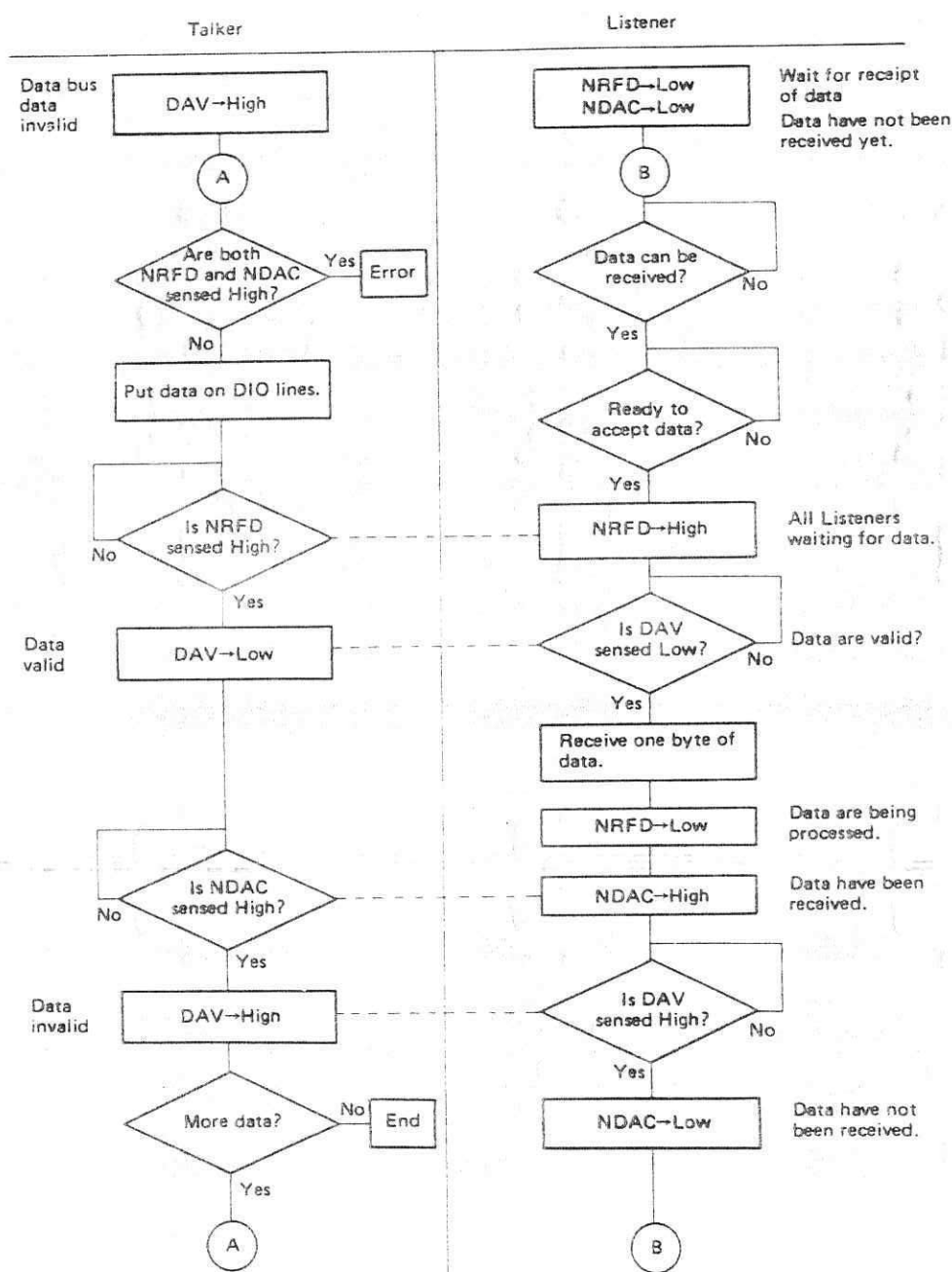
Fig. 5-2 Timing chart for handshaking

	Talker		Listener	

Data bus data invalid — DAV→High

(A)

Are both NRFD and NDAC sensed High? — Yes → Error

No

Put data on DIO lines.

Is NRFD sensed High? — No loop

Yes

Data valid — DAV→Low

Is NDAC sensed High? — No loop

Yes

Data invalid — DAV→High

More data? — No → End

Yes → (A)

NRFD→Low NDAC→Low — Wait for receipt of data / Data have not been received yet.

(B)

Data can be received? — No loop

Yes

Ready to accept data? — No loop

Yes

NRFD→High — All Listeners waiting for data.

Is DAV sensed Low? — No loop / Data are valid?

Yes

Receive one byte of data.

NRFD→Low — Data are being processed.

NDAC→High — Data have been received.

Is DAV sensed High? — No loop

Yes

NDAC→Low — Data have not been received.

(B)

Fig. 5-3 Flowchart for handshaking according to the IEEE488 standard

5-6   CONTROL LINES (INTERFACE MANAGEMENT BUS)

Five interface signal lines are used to manage an orderly flow of information across the interface :

(1)   ATN   Attention. Identifies the information on the data bus.

Data can be sent when the ATN line is High, and the commands can be sent when it is Low.

(2)   IFC   Interface Clear. Initializes the bus to an idle state.

(3)   SRQ   Service Request.   Indicates the need for attention and to request an interruption of the current sequence of events.

(4)   REN   Remote Enable.   Places instruments under remote program control.   When the REN line is Low, devices are made to be ready for operation in remote mode.

(5)   EOI   End or Identify. Indicates the end of a multiple byte transfer sequence or, in conjuction with ATN, to execute a polling sequence.

5-7   MAJOR SPECIFICATIONS OF THE IEEE488 GP-IB

The maximum accumulative length of cable :	20 m
The maximum length between devices :	2 m
The maximum number of devices that can be connected, including controllers :	15
Transfer format :	3-wire handshaking
The maximum transfer rate :	1 M bytes/sec.
Data transfer :	8-bit parallel
Signal lines	
- Data lines (DIO 1 to DIO 8)	8 lines
- Control lines	8 lines
Handshaking lines (DAV, NRFD, NDAC)	
Interface management lines (ATN, REN, IFC, SRQ, EOI)	
-Signal/System ground	8 lines
Signal logic	Negative logic
- True : Level L	0.8 V or less
- False : Level H	2.0 V or more

Interface connector
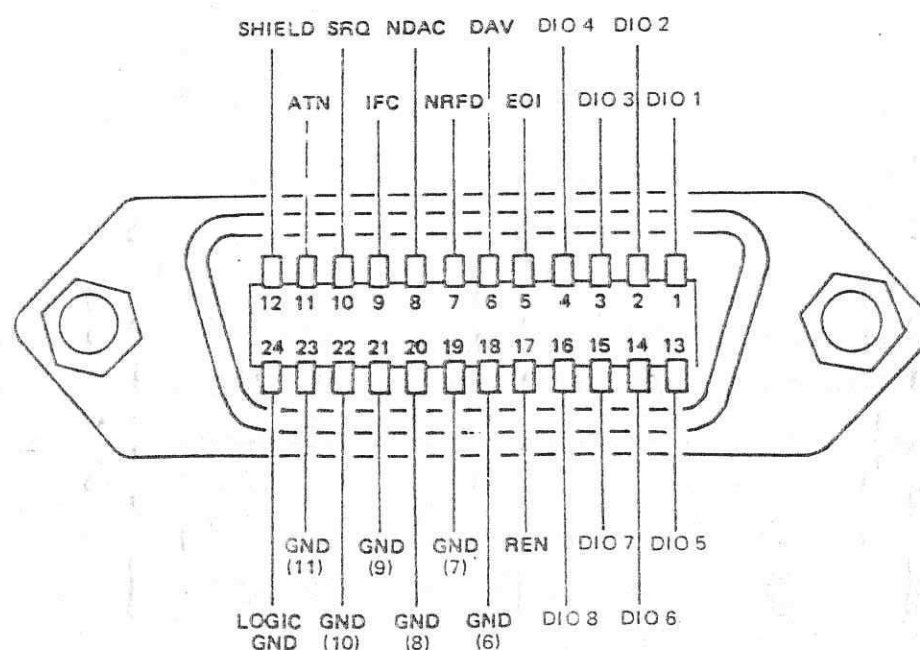
Table 5-1   Connector contact assignment

Contact	Signal line	Contact	Signal line
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI (24)	17	REN (24)
6	DAV	13	Gnd, (6)
7	NRFD	19	Gnd, (7)
8	NDAC	20	Gnd, (8)
9	IFC	21	Gnd, (9)
10	SRQ	22	Gnd, (10)
11	ATN	23	Gnd, (11)
12	Shield	24	Gnd, Logic

NOTE: Gnd, (n) referes to the signal ground return of the referenced contact. EOI and REN return on contact 24.

5-8 CODE ASSIGNMENT OF COMMAND INFORMATION

Command information is sent and received when the ATN line is Low.

Table 5-2　Code assignment of command information

b7 b6 b5 Bits →					0 0 0 MSG	0 0 1 MSG	0 1 0 MSG	0 1 1 MSG	1 0 0 MSG	1 1 0 MSG	1 0 1 MSG	1 1 1 MSG
b4	b3	b2	b1	Column Row →	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P		p
0	0	0	1	1	SOH GTL	DC1 LLO	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT SDC	DC4 DCL	$	4	D	T	d	t
0	1	0	1	5	ENQ PPC③	NAK PPU	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS GET	CAN SPE	(	8	H	X	h	x
1	0	0	1	9	HT TCT	EM SPD	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	? UNL	O	_ UNT	o	DEL

Vertical annotations: columns 3 and 4 — "MIA assigned to device"; columns 5 and 6 — "MTA assigned to device"; columns 6 and 7 — "Meaning defined by PCG code".

Column groupings:

- Addressed command group (ACG) — column 0
- Universal command group (UCG) — column 1
- Listen address group (LAG) — columns 2, 3
- Talk address group (TAG) — columns 4, 5

Primary command group (PCG) — columns 0–5

Secondary command group (SCG) — columns 6, 7

NOTES: ① MSG = INTERFACE MESSAGE

② b1 = DIO 1 ... b7 = DIO 7

③ REQUIRES SECONDARY COMMAND

SECTION VI
GP-IB INTERFACE

6-1   General
   The GP-IB interface allows the VP-8174A to operate under programmable control with the frequency, output amplitude, modulation, memory, and other function set by program codes sent from an external device. The interface also allows the generator to send the panel setting status and input data to the "External control interface" to an external device.

6-2   GP-IB Interface Capability
   Table 6-1 lists the interface capabilities of the VP-8174A's GP-IB implementation which provides the basic listener/talker, talk only/listen only, remote/local, and device clear functions.

Table 6-1   Interface functions

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

6-3   Setting the GP-IB Address

The GP-IB address is set through the front panel operation. Address setting range is from 0 to 30 and the set value will be indicated on the left most two digits of the six-digit FREQUENCY readout ⑧. I/O MODE light ⑨ turns on to show the generator is in the setting mode.

Follow the procedure below.

(a)   Press SHIFT key ㉙ making the light on and then press the[↔]/ I/O MODE key of MEMORY keys ㉘. This will turn I/O MODE light ⑨ to show the generator is now in the I/O mode setting condition.

(b)   Operate either[←]key or[→]key of DIGIT SELECTOR keys ⑬ to make the second digit from the left of FREQUENCY readout ⑧ flash.

(c)   Enter the required address within the range of 0 to 30 with DATA keys ⑯. To set address 12, for example, press "1" of DATA keys ⑯. FREQUENCY readout ⑧ reads as follows:

	1				
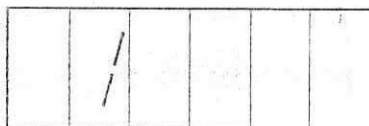
Then press 2 of DATA keys ⑯. FREQUENCY readout ⑧ reads as follows:

1	2				
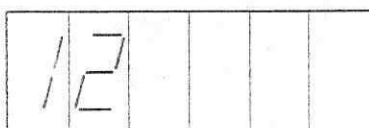
(d)   Press ENTER key ⑮ to fix address 12 and then turn POWER switch ① off.

(e)   Press POWER switch ① again to make the set value valid.

(f)   To release the I/O mode, press any one of FUNCTION keys ⑰ to ㉒. This will turn I/O light ⑨ off.

6-4   Interlocked Memory Control Function

The GP-IB interface allows two or more VP-8174A's preset memories to be recalled by interlocked control function. Let the VP-8174A be a master which generates recall signals and another VP-8174A a slave which receives signals "Master" and "slave" mentioned here correspond to "talk only" and "listen only" of the GP-IB.

(1)   Setting mode

The modes are defined as follows:

Releases master and slave: 0

Slave: 1

Master: 2

One out of the above three values is shown in the third digit from the left on FREQUENCY readout ⑧. Follow the procedure below.

(a)   Press SHIFT key ㉙ making the light on and then press the⌷↑⌷/ I/O MODE key. This will turn I/O MODE light ⑨ on indicating the generator accepts the I/O mode setting.

(b)   Operate the⌷←⌷or⌷→⌷key of DIGIT SELECTOR key ⑬ to make the third digit from the left flash.

(c)   Enter the required value, 0, 1, or 2 with DATA keys ⑯ . To set master⌷ 2 ⌷, for example, press "2" of DATA keys ⑯ . FREQUENCY readout ⑧ reads as follows:

```
 ___ ___ ___ ___ ___
|   |   |   |   |   |
|   | 2 |   |   |   |
|___|___|___|___|___|
```
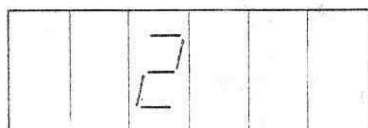
(d)   Press ENTER key ⑮ to fix master⌷ 2 ⌷and then press POWER switch ① to turn the power off.

(e)   Press POWER switch ① to turn the power on again to make the set value valid.

(f)   To release the I/O mode, press any one of FUNCTION keys ⑰ to ㉒ . This turns I/O MODE light ⑨ off.

```
┌─────────────────────── NOTES ───────────────────────┐
│  1.   The mode on this instrument is determined by the value set at power on.  It is │
│       always necessary to turn the power off and then on again to change modes.      │
│  2.   Use shielded GP-IB cable and connector that comply with FCC, CISPR, VDE and    │
│       other standards for interference suppression.                                  │
└──────────────────────────────────────────────────────┘
```

(2)   Connection

Fig. 6-1 shows the connection of the system.
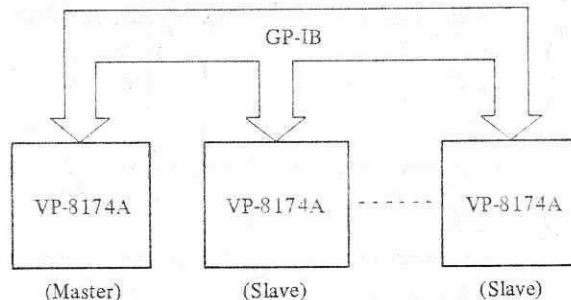
Fig. 6-1 Interlocked memory control system

The system consists of a master VP-8174A on the left and one or more slave VP-8174A's. GP-IB connector of each VP-8174A is connected to the common GP-IB bus.

(3)   Interlocked memory recall

(a)   Connect VP-8174A as shown in Fig. 6-1.

(b)   Follow the procedure given in paragraph 6-4 (1)
Mode setting to set conditions on the master instrument and slave instruments.

(c)   The desired address preset memory can be recalled for slave generators at the same time with the master generator.

(d)   Other functions available are those discussed in SECTION IV paragraph 4-8 (5) sequential recall operation, (6) sequential recall grouping, and (7) sequential recall group assignment.

```
┌─────────────────────── NOTE ───────────────────────┐
│   If addressed control through the GP-IB (normal GP-IB control operation) is        │
│ required, the MASTER/SLAVE for interlocked memory recalling must be released.       │
└──────────────────────────────────────────────────────┘
```

6-5   Device Clear Function

VP-8174A returns to its initial state upon receiving DCL or SDC. See Table 6-2 below.

Table 6-2 Initial state of VP-8174A

Frequency	: 110 MHz
Output amplitude	: -19dB EMF
Modulation setting	
AM depth	: 0%
Monophonic FM deviation	: 0 kHz
FM stereo modulation factor	: 0%
Pilot level	: 15%
Modulation mode	
Modulation	: AM
SIGNAL ON/OFF	: OFF
PILOT ON/OFF	: OFF
INT/EXT	: INT
400 Hz/1 kHz	: 400 Hz
Memory address	: 00
FUNCTION	: FREQ
Valid digit for MODIFY	: LSD
External control output signal	
P1	: 0
P2	: 0
Transition frequency for relay drive output	: 30 MHz

6-6   Functions Allowing Remote Control

Table 6-3 lists the functions remotely controllable through the GP-IB interface, while Table 6-4 lists the functions uncontrollable.

Table 6-3 Functions allowing remote control through GP-IB

Setting frequency	: 0.1000 to 110.000 MHz
Setting output amplitude	: -19 to 99 dB EMF
Setting AM depth	: 0 to 60%
Setting monophonic FM deviation	: 0 to 99.5 kHz
Setting FM stereo modulation factor	: 0 to 133%
Setting pilot level	: 0 to 15%
Selecting modulation mode	: AM/FM
Selecting internal/external modulation	: INT/EXT
Selecting internal modulation frequency	: 400 Hz/1 kHz
Turning modulation signal on and off	: ON/OFF
Turning pilot signal on and off	: ON/OFF
Selecting FM mode	: MONO, L=R, L, R, L=-R
Store and recall of preset memory	: 00 to 99, A to D
Setting the external control output signal	: B00000000 to B11111111
	H00 to HFF
	D0 to D255
	S0 to S7
	R0 to R7
Setting transition frequency for relay drive output	: 1 to 110 MHz
	-1 to -110 MHz
Selecting talker mode	: 0/1

Table 6-4 Function not allowing remote control through the GP-IB

MODIFY function
Memory sequential recall
Memory grouping
ΔF function
Setting the I/O mode

6-7   Remote/Local Function

The remote/local function is controlled by the system controller and LOCAL key ㊳ on the front panel. The VP-8174A is always in one of the following three states:

(1)   Local Mode

The VP-8174A enters the local mode when:

 i)   The power is turned on.

 ii)   The LOCAL key ㊳ is pressed, making REMOTE indicator ㊴ off.

 iii)   It receives a GTL signal.

 iv)   The REN line becomes false in the remote mode.

------------------------------- NOTE -------------------------------

The transition from the remote to local mode does not change any of the panel settings.

----

(2)   Remote Mode

The VP-8174A enters the remote mode if it receives an MLA signal when the REN line is true.

------------------------------- NOTES -------------------------------

1.   In the remote mode, the only operable front panel keys are the POWER switch ① and the LOCAL key ㊳ .

2.   The transition from the local to remote mode does not change any of the panel settings.

----

(3)   Remote Mode with Lockout

In this state, pressing LOCAL key ㊳ does not return the mode to local.

The VP-8174A stays in the remote mode, until it receives a GTL addressed command, the REN line turns false, or the power is turned off and reapplied.

6-8   Response to Commands

   Table 6-5 lists commands and the generator's response to them.

Table 6-5 VP-8174A responses to Commands

Type	Command	Description	Response
Universal commands	DCL	Device clear - Clears all device.	Yes
	SPE	Serial poll enable	No
	SPD	Serial poll disable	No
	PPU	Parallel pool unconfigure	No
	LLO	Local lockout - Disables Remote/Local switch on responding devices.	Yes
Addressed commands	UNL	Unlisten - Clears Bus of all listeners.	Yes
	UNT	Untalk - Unaddresses the current talker so that no talker remains on the bus.	Yes
	SDC	Selective device clear - Clears addressed devices.	Yes
	GTL	Go to local - Returns responding devices to local control.	Yes
	PPC	Parallel poll configure	No
	GET	Group execute trigger	No
	TCT	Take control	No

6-9   Program Code Input Format

(1)   Input Program Message Format

(a)   To set ON/OFF of each key and measurement conditions by use of the GP-IB interface, the controller must send program messages to the VP-8174A through the GP-IB interface. The VP-8174A is able to receive up to 255 ASCII bytes long (including the terminating carriage return line feed pair or EOI) for one program message.

The message format is:
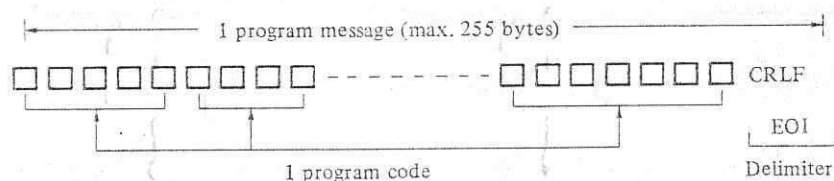
(b)   Delimiter for a program message must be one of the following:
    1) CR + LF (equivalent to 0D + 0A in hexadecimal notation)
    2) LF   (equivalent to 0A in hexadecimal notation)
    3) EOI   (uniline message of the GP-IB)

(c)   The individual program words may be written continuously or delimited with commas (,) or spaces (⊔).

(d)   Example: The following three sequences all set the frequency to 100.000 MHz, the output amplitude to 20 dB, and the AM depth to 30%.

1. With nothing between program words:

FR100.000 AP20 AM30 CRLF

Frequency   Output   AM depth Delimiter
             amplitude

2. With commas (,) between program words:

FR100.000 , AP20 , AM30 CRLF

Frequency   Output   AM depth Delimiter
             amplitude

3. With spaces (⊔) between program words:

FR100.000 ⊔ AP20 ⊔ AM30 CRLF

Frequency   Output   AM depth Delimiter
             amplitude

Any of formats 1, 2, and 3 is allowed.

(2)   Input Format

A GP-IB interface command consists of a header in two uppercase letters (excluding headers for external control signal setting), and a data code (usually a number).

Example: The following sequence sets the frequency to 110.000 MHz.

F R 1 1 0 . 0 0 0

Header   Data code

(a)   Frequency setting

The frequency can be set in MHz, anywhere between 0.1000 MHz and 110.000 MHz with the header FR and the frequency expressed as a fixed-point decimal number.

Example: The following sequence sets the frequency to 102.345 MHz.

F R 1 0 2 . 3 4 5

--- NOTES ---

1.   If frequency is set outside the predefined range, it is ignored.
2.   Missing decimal places are automatically filled with zeroes.

(b)   Output amplitude setting

The output amplitude can be set anywhere between -19 dB EMF and 99 dB EMF with the header AP or LE, and data specification consisting of an optional negative sign (-) and numerals (0 to 9).

Examples: The following sequence sets the open-end output (dB EMF) to 80 dB.

A P 8 0

--- NOTE ---

If the amplitude is set outside the predefined range, it is ignored.

(c)   Selecting modulation mode

Table 6-6 shows the selection of modulation modes.

Table 6-6 Modulation mode selection

Modulation mode		Header code	Data code
Modulation	AM FM	AM FM	
	OFF ON	MO	0 1
Modulation signal	EXT INT 1 kHz INT 400 Hz	TO	0 1 4
Pilot signal	OFF ON	PL	OF ON

── NOTES ──

1. Sending program code "AM" or "FM" in Table 6-6 causes the same effect as pressing FM key ⑲ or AM key ⑳. The codes are effective for just switching the modulation from AM to FM or vice versa. They are also effective for selecting the FM modulation only for FM mode selection.

2. Data codes other than those shown in Table 6-6 will be ignored.

(d) Selecting FM mode

Table 6-7 shows the codes for setting the FM mode.

Table 6-7 FM mode setting

FM mode		Header code	Data code
Monophonic FM		MS	1
FM stereo	L=R	MS	2
	L		3
	R		4
	L=-R		5

── NOTES ──

1. To set the FM mode, "FM" must be selected for the modulation mode discussed in the preceding paragraph (c). Otherwise, the setting according to Table 6-7 will be invalid.

2. Data codes other than 1 to 5 will be ignored.

(e) Setting modulation

Table 6-8 shows the codes for setting modulation.

Table 6-8 Modulation setting code

Modulation	Setting range	Header code	Data code
AM depth	0 to 60%	AM	0 to 60
Monophonic FM deviation	0 to 99.5 kHz	FM	0 to 99.5
FM stereo modulation factor	0 to 133%	FM	0 to 133
Pilot level	0 to 15%	PL	0 to 15

── NOTES ──

1. To set the monophonic FM deviation, "FM" must be selected for the modulation mode discussed in the preceding paragraph (c) and "Monophonic FM" must be selected for the FM mode in paragraph (d).

2. To set the FM stereo modulation and pilot level, select "FM" for the modulation mode and then select "FM stereo" for the FM mode.

3. Setting beyond the allowable range is ignored.

4. Missing decimal places are automatically filled with zeroes.

5. Setting the AM depth, FM deviation and FM stereo modulation factor turn the MOD SIGNAL on. Setting the PILOT level also turns the PILOT on.

Example 1: Setting the AM depth of 30%.

AM 30

Example 2: Setting the monophonic FM deviation of 75.0 kHz.

FM MS1 FM75

Example 3: Setting the PILOT signal level of 10%.

FM MS2 PL10

(f)   Preset memory store operation

Store operation can be made for 100 (00 to 99) assorted preset memories and 4 (a to d) independent output amplitude preset memories.

The header is ST. The data codes are 2-digit numerals 00 to 99 of memory addresses for the assorted preset and uppercase letters A to D for the independent output amplitude preset.

Example 1:   Storing current front panel setting of frequency, output amplitude and modulation functions into memory address 15.

(Storing into the assorted preset memory.)

ST 15

Example 2:   Storing current front panel setting of output amplitude into the independent output amplitude preset memory "a".

STA

(g)   Preset memory recall operation

Recall operation can be made for 100 (00 to 99) assorted preset memories and 4 (a to d) independent output amplitude preset memories.

The header is RC. Data codes are the same as those in the store operation above.

Example: Recalling from the memory address 15.

(Recalling from the assorted preset memory.)

RC 15

```
─────────────────────────── NOTE ───────────────────────────
   Data codes other than 00 to 99 and A to D will be ignored.
```

(h)   Setting External Control Output Signal

The external control output signal can be set in five kinds of data format. (See paragraph 7-8 for detailed use.) A header code requires "P1" for assigning port 1 or "P2" for assigning port 2. It also requires a code before the data code that determines the data format as follows.

B .... binary data
H .... hexadecimal data
D .... decimal data
S ..... Sets (to 1) the specified bit
R .... Resets (to 0) the specified bit

Table 6-9 Program code for external control output signal

Header code		Data code	Description
P1 or P2	B	00000000 to 11111111	Sets 8 bits of port 1 or port 2 in binary data
	H	00 to FF	Sets 8 bits of port 1 or port 2 in hexadecimal data
	D	0 to 255	Sets 8 bits of port 1 or port 2 in decimal data
	S	0 to 7	Sets (to 1) specified bit of port 1 or port 2
	R	0 to 7	Resets (to 0) specified bit of port 1 or port 2

Example: Set port 1 as follows:

$$0 \quad 1 \quad 0 \quad 1 \quad 0 \quad 1 \quad 0 \quad 1$$

$$P1_7 \quad P1_6 \quad P1_5 \quad P1_4 \quad P1_3 \quad P1_2 \quad P1_1 \quad P1_0$$

Ex. 1 P1B01010101

Ex. 2 P1H55

Ex. 3 P1D85

Ex. 4 P1S0246 P1R1357

(i)   Setting transition frequency for relay drive output

The VP-8174A has DRIVE OUTPUT connector ㉛ on the rear panel from which a relay drive output of +5V, 50 mA can be obtained. Setting a transition frequency reverses the output polarity between HIGH and LOW. The relationship between the set transition frequency and the drive output signal obtained is shown below. (See paragraph 7-12 for detailed use.)

Transition frequency F_R		Condition of RF output frequency F	Relay drive output
Settable range	Setting resolution		
1 to 110 MHz	1 MHz	$F \geqq F_R$	HIGH
		$F < F_R$	LOW
Setting with a minus (-) sign: (-1 to -110 MHz)		$F \geqq F_R$	LOW
		$F < F_R$	HIGH

The transition frequency is set with the following program code.

Header code: DR

Data code: 1 to 110

-1 to -110

Example: Setting a transition frequency of 75 MHz (F < F_R: LOW).

D R 75

(j)   Selecting a talker mode

Two types of talker modes are available on the VP-8174A. With the header code "TM", the data code "0" or "1" selects as follows.

TM0 ..... Sends out set conditions when VP-8174A is assigned as a talker.

TM1 ..... Sends out in decimal notation the signal applied to port 2 of the external control interface. (See paragraph 7-8 for detailed use.)

Refer to the output format for program codes shown in the next paragraph 6-10 for the detailed description of the talker's data output format.

--- NOTE ---

The VP-8174A is in the TM0 mode at power on.

6-10 Output Format for Program Codes

The VP-8174A has a basic talker function. If assigned as a talker, the generator sends out, with the header code "TM", the set conditions or the data aplied to port 2 of the external control interface. The data is output in a 7-bit ASCII code with delimiters EOI and LF simultaneously. The output format for the two talker modes are explained as follows.

(1) Talker mode 0 (TM0)

The generator in this mode sends out its conditions set when assigned as a talker.

(a) An example output format:

(Ex.) Frequency: 110 MHz

Output amplitude: 99 dB

Modulation factor: FM stereo 100%

Pilot level 10%

Modulation mode: MOD SIGNAL on

PILOT on

MOD SIGNAL INT 1 kHz

FM mode L=R

External control signal: Value set for port 1
(11111111)

Value set for port 2
(11111111)

Transition frequency for relay
drive output: 75 MHz

FR110.000␣AP99␣AM30␣FM␣MS2␣PL10␣PLON␣MS2␣
             *   *   *

FM100␣FM␣MO1␣TO1␣P1D255␣P2D255␣DR75CRLF

The example output format above contains asterisked program codes which have no relation with the current set condition. They are explained in paragraph (c) below.

(b) The output format for the VP-8174A

The following is the general format of the generator's output.

FRdddddddd␣APddd␣AMdd␣FM␣MS2␣PLdd␣PLdd␣MSd␣
   (1)   (2)   (3) (4) (5) (6)   (7) (8)

FMddddd␣hh␣MOd␣TOd␣P1Dddd␣P2Dddd␣DRdddd CRLF
   (9)   (10) (11) (12)   (13)   (14)   (15)   (16)

hh: header code

ddd: data code for each program code

␣: space

(c)   Description of program codes

Program code	Description	Data code
(1) FRddddddd	Set value for RF frequency	0.1000 to 29.9999/30.000 to 110.000
(2) APddd	Set value for output amplitude	-19 to 99
(3) AMdd	Set value for AM depth	0 to 60
*(4) FM	Switches modulation to FM	
*(5) MS2	Selects L=R for FM mode	
(6) PLdd	Set value for PILOT level	0 to 15
(7) PLdd	PILOT ON or OFF	ON/OFF
(3) MSd	Set condition for FM mode	1 (MONO)/2 (L=R)/3 (L)/4 (R)/ 5 (L=-R)
(9) FMdddd	Set value for FM deviation or FM stereo modulation factor	0.0 to 99.5/0 to 133
(10) hh	Modulation AM or FM	AM/FM
(11) MOd	MOD SIGNAL ON/OFF	0 (OFF)/1 (ON)
(12) TOd	Selection of modulation signal	0 (EXT)/1 (INT 1 kHz)/4 (INT 400 Hz)
(13) P1Dddd	Set value for port 1 external control output signal	0 to 255
(14) P2Dddd	Set value for port 2 external control output signal	0 to 255
(15) DRdddd	Set value for transition frequency for relay drive output	1 to 110/-1 to -110
(16) CRLF	Delimiter (EOI message comes simultaneously with LF)	

The asterisked program codes in (a) and in this paragraph have no relation with the current set condition of the signal generator. They are inserted for convenience to use the output format commonly as the input format for setting this signal generator. The insertion of these program codes and the systematic sequence of sixteen codes shown in (b) enable the output format to be used as the setting program of the VP-8174A. For detailed information on program codes, see paragraph 6-9.

--- NOTE ---

External control output signal can be set in one of five types of data fomat. The output format with talker mode 0, however, allows the set value for external control ssed in decimal notation only.

(2)   Talker mode 1 (TM1)

Sends out in decimal notation an 8-bit data applied to port 2 of the external control interface. Given below is an example output format:

Example: When data applied to port is (11111111):

255 CRLF

Delimiter (EOI message appears
simultaneously with LF)

NOTES

1.   If port 2 is not in the input mode, it will be an error and (MODE MISMATCH) will be sent out.

2.   As for switching between input and output modes of port 2, see paragraph 7-3.

Table 6-10 List of GP-IB program codes

Item	Header code	Data code	Description
RF output frequency	FR	0.1000 to 29.9999 30.000 to 110.000	Sets between 0.1 and 110 MHz
Output amplitude	AP or LE	-19 to 99	Sets between -19 and 99 dB EMF
Modulation degree			
AM	AM	0 to 60	Sets AM depth between 0 and 60%
Monophonic FM	FM	0.0 to 99.5	Sets FM deviation between 0 and 99.5 kHz
FM stereo	FM	0 to 133	Sets FM stereo modulatio factor between 0 to 133%
Pilot level	PL	0 to 15	Sets Pilot level between 0 and 15%
Modulation mode			
AM/FM	AM		Selects AM
	FM		Selects FM
MOD signal ON/OFF	MO	0 1	Turns MOD signal off Turns MOD signal on
Pilot signal ON/OFF	PL	OF ON	Turns PILOT signal off Turns PILOT signal on
Type of MOD signal	TO	0 1 4	Selects external signal (EXT) Selects internal 1 kHz (INT 1 kHz) Selects internal 400 Hz (INT 400 Hz)
FM mode	MS	1 2 3 4 4	Selects MONO (monophonic) Selects L=R (stereo) Selects L (stereo) Selects R (stereo) Selects L=-R (stereo)

Table 6-10 List of GP-IB program codes (Cont'd)

Item	Header code	Data code	Description
Memory Store	ST	00 to 99	Stores into assorted preset memories
		A to D	Stores into independent output amplitude preset memories
Recall	RC	00 to 99	Recalls from assorted preset memories
		A to D	Recalls from independent output amplitude preset memories
External control output signal	P1 or P2	B00000000 to B11111111	Sets in binary data the control output of port 1 or port 2
		H00 to HFF	Sets in hexadecimal data the control output of port 1 or port 2
		D0 to D255	Sets in decimal data the control output of port 1 or port 2
		S0 to S7	Sets (to 1) the specified bit of port 1 or port 2
		R0 to R7	Resets (to 0) the specified bit of port 1 or port 2
Transition frequency for relay drive output	DR	1 to 110	RF output frequency $\geq$ transition frequency: Dreive output is HIGH
			RF output frequency $<$ transition frequency: Drive output is LOW
		–1 to –110	Ignoring minus (–) sign, RF output frequency $\geq$ transition frequency: Drive output is LOW
			RF output frequency $<$ transition frequency: Drive output is HIGH
Taker mode	TM	0	Sends out set conditions of VP-8174A
		1	Sends out data applied to port 2

SECTION VII
EXTERNAL CONTROL INTERFACE

7-1   General

The VP-8174A has an external control interface and relay drive output. They are to be connected to the connectors on the instrument's rear panel. The following describes their basic functions.

(1)   General description of the external control interface function

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

(a)   Remote sequential recall

Externally controls sequential recalling.

(b)   Remote modify control

Externally controls modifying of RF frequency or output amplitude with a rotary encoder.

(c)   Remote direct recall

Externally controls direct memory recalling.

(d)   Control signal output

The 8-bit, 2-port TTL level signals are available.

(e)   Printout of memory content (List output)

Outputs all or part of memory content.

(f)   Transfer of memory content (between the same type of generator.)

Transfers all or part of memory content to another VP-8174A.

(g)   Data read

Reads an external 8-bit TTL-level signal in decimal data. The function is available only through the GP-IB interface.

(2)   General description of the relay drive output

A +5V, 50 mA signal for relay operation is available from DRIVE OUTPUT connector ㉛ . The output reverses its polarity at a predetermined transition frequency. This function is used for controlling signal switches, output impedence switches or dummy antenna switches.

The detailed information on how to use the external control interface and drive output is given in paragraphs 7-2 to 7-11, and in paragraph 7-12.

7-2 Connector Pin Connection and Pin Functions

(1) Pin assignment

For the external control connection, EXT CONTROL I/O connector ㉞ is used. Fig. 7-1 shows pin assignment.
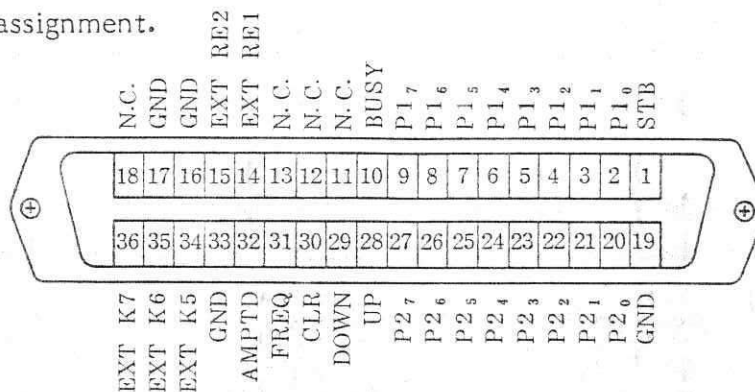

Fig. 7-1 Pin Assignment of External Control I/O Interface

For the 36-pin connector plug and cable, use shielded ones.

──────── NOTE ────────

When using list output or memory copy function, use the optional cable VQ-023H10.

(2) Pin functions

The following is a brief description of the functions of the external control connector pins shown in Fig. 7-1.

No.	Name	Function
1	STB	Timing pulse input terminal for loading data in the direct recall or receive mode for transferring memory content. Or a terminal for applying an acknowledge signal from the printer during list output.
2 to 9	$P1_0$ to $P1_7$	8-bit data I/O terminals (port 1) for control output, direct recall, memory transfer and list output.
10	BUSY	Output terminal for signal informing that the instrument is unable to receive data during direct recall operation. Or an output terminal for strobe signal from the instrument to the printer during list output, and from the sending unit to the receiving unit during memory transfer sending mode.
11 to 13	N.C.	Not connected to the internal circuit of the instrument.

14	EXT RE1	Rotary encoder input terminal 1 for modification.
15	EXT RE2	Rotary encoder input terminal 2 for modification.
16 to 17	GND	Frame ground
18	N.C.	Not connected to the internal circuit of the instrument.
19	GND	Frame ground
20 to 27	$P2_0$ to $P2_7$	8-bit data I/O terminal (port 2) for control output and data read.
28	UP	UP key input terminal for sequential recalling.
29	DOWN	DOWN key input terminal for sequential recalling.
30	CLR	CLEAR key input terminal for sequential recalling.
31	FREQ	FUNCTION FREQ key input terminal.
32	AMPTD	FUNCTION AMPTD key input terminal.
33	GND	Frame ground
34 to 36	EXT K5 to 7	Spare terminals. Do not connect any external devices.

7-3   Mode Selection

Five modes are selectable through panel key operation. Fig. 7-2 shows an example operation and the following is the procedure.

(1)   Press SHIFT key ㉙ and the [↑] /I/O MODE key of MEMORY keys ㉘ making I/O MODE light ⑨ on. FREQUENCY readout ⑧ then displays external control interface modes according to the rule given below.

FREQUENCY

A2	A1	TL	P1	P2	0

·I/O MODE

Each digit displays as follows:

A1, A2: Displays the GP-IB device address in decimal number of 0 to 30.

TL: Specifies master and slave in the interlocked memory control function.

     (See paragraph 6-4 for detail.)

P1: Displays the mode for P1.

P2: Displays the mode for P2.

P1 and P2 indicate the following modes:

P1	Mode	P2	Mode
0	Control output mode	0	Control output mode
1	Memory direct recall mode	1	Data read mode
2	Memory list output mode		
3	Memory copy receive mode		
4	Memory copy send mode		

(2)   Press DIGIT SELECTOR keys ⑬ several times to flash P1 or P2.

(3)   Press a desired key out of Data keys ⑯ 0 to 4. Then press ENTER key ⑮ to change the display.

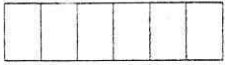(4)   Turning the instrument power off and then on again changes the interface mode to the one just set.
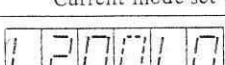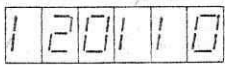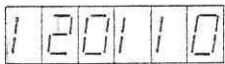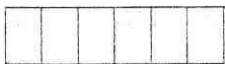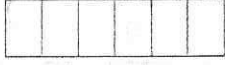
Step	Keystroke	FREQUENCY readout	ENTER key
1	SHIFT ⃝	☐☐☐☐☐ ○ I/O MODE ↖ Off Current frequency set value.	ENTER ⃝ Off
2	I/O MODE ⬆	1 2 0 0 1 0 ● I/O MODE ↖ On Current mode set value.	
3	⇨ ... or ⇦ ...	1 2 0 0 1 0 ● I/O MODE ↖ On Causes to flash the digit indicating the P1 mode.	
4	1	1 2 0 1 1 0 ● I/O MODE ↖ On	ENTER ● Flashes
5	ENTER ⃝	1 2 0 1 1 0 ● I/O MODE ↖ On	ENTER ⃝ Off
6	(Approx. 5 min.)	☐☐☐☐☐ ○ I/D MODE ↖ Off Current frequency set value.	
7	POWER ☐ Off	───────────────	
8	POWER ☐ On	☐☐☐☐☐ ○ I/O MODE ↖ Off Current frequency set value.	ENTER ⃝ Off

Fig. 7-2 Setting P1 of the external control interface to the memory direct recall mode

────── NOTE ──────

The mode on this instrument is determined by the value set at power on to avoid faulty assertion. Therefore it is always necessary to turn the power off and then on again to change the mode.

7-4   Common for The External Control Interface Operation

The external control interface is a control I/O for TTL logic. Given below are the description common to all the interface modes.

(1)   Input signal

A TTL-level logic signal. Since every input terminal is pulled up to +5V inside, HIGH/LOW of the input signal is determined by selecting either open or short-circuit for the input and GND terminals.

(2)   Output signal

A TTL-level logic signal. The fan-out of each output is 1 for LS-TTL.

(3)   Connecting cable

Use the dedicated cable to connect devices for memory data list output and memory data transfer. For other operations, use shielded cable and plug. Otherwise it may result in malfunction due to electrostatic or other interferences.

The paragraphs 7-5 to 7-11 describe the operation procedure for each mode.

7-5   Remote Sequential Recall

(1)   Function

Remote operation of up ($\uparrow$), down ($\downarrow$), and clear (CLR) for the sequential recall of memory addresses.

(2)   Pins used

No.	Name	Function
28	UP	UP ($\uparrow$) signal input terminal
29	DOWN	DOWN ($\downarrow$) signal input terminal
30	CLR	Clear (CLR) signal input terminal
33	GND	Frame ground

(3)   Electrical operating conditions

UP, DOWN, and CLR operation is activated at the rising edge where UP/DOWN/CLR signal turns from LOW to HIGH. The timing condition is shown below
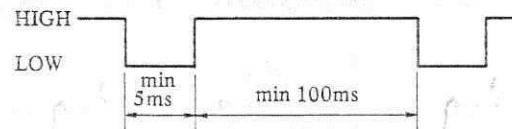
7-6   Remote Modify

(1)   Function

Remote operation for controlling modification with a rotary encoder.   Either frequency (FREQ) or output amplitude (AMPTD) is selectable for modification.

(2)   Pins used

No.	Name	Function
14	EXT RE1	Rotary encoder input terminal
15	EXT RE2	Rotary encoder input terminal
16	GND	Frame ground
31	FREQ	FREQ key input terminal
32	AMPTD	AMPTD key input terminal
33	GND	Frame ground

(3)   Electrical operating conditions

FREQ or AMPTD is selected at the rising edge where the input signal from the FREQ and AMPTD terminals turns from LOW to HIGH. The timing conditions are as same as those given in paragraph 7-5(3).

To connect to EXT RE1 and EXT RE2, use a rotary encoder of contact type, dual-phase pulse output.

The timing conditions for setting modification signals are shown below.
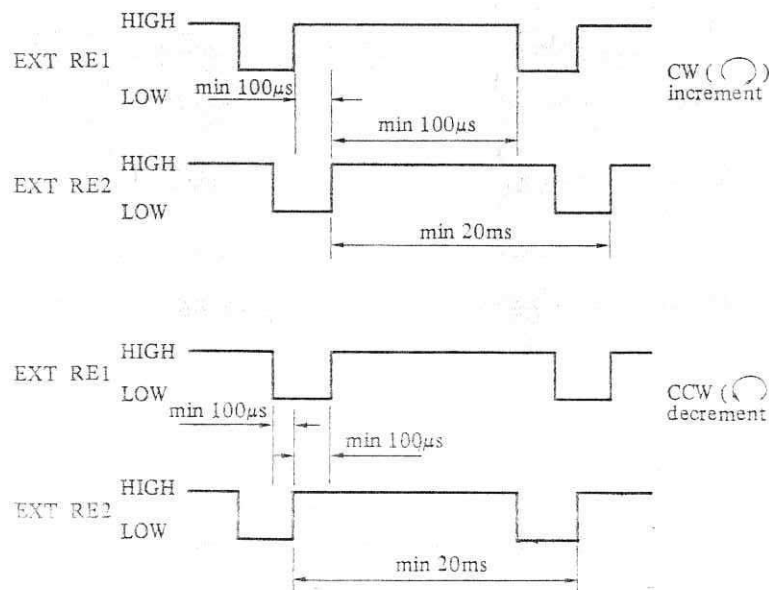
7-7   Remote Direct Recall

(1)   Function
Remote operation of memory direct recall.

(2)   Pins used

No.	Name	Function
1	STB	Timing pulse input terminal for loading data.
2 to 9	$P1_0$ to $P1_7$	Address data input terminals
10	BUSY	Output terminal for signal informing that the instrument can not receive data.
19	GND	Frame ground

(3)   Electrical operating conditions
Set address data 00 to 99 for $P1_0$ to $P1_7$ with BCD. Given below is the relationship between the input signal of each terminal and address data.

$P1_7$	$P1_6$	$P1_5$	$P1_4$	$P1_3$	$P1_2$	$P1_1$	$P1_0$	Address data
0	0	0	0	0	0	0	0	00
0	0	0	0	0	0	0	1	01
			thru					thru
0	0	0	0	1	0	0	1	09
0	0	0	1	0	0	0	0	10
			thru					thru
1	0	0	1	1	0	0	1	99

0:LOW 1:HIGH

Applying a timing pulse to the STB terminal after setting the above address data recalls the memory of the set address. The timing conditions for each terminal are shown below.
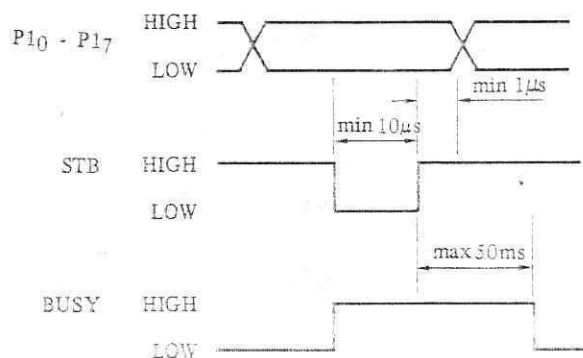
7-8   Control Signal Output

(1)   Function

Provides TTL-level signals for controlling external devices. The maximum allowable number of signals is 8-bit x 2-port.

(2)   Pins used

No.	Name	Function
2 to 9	$P1_0$ to $P1_7$	8-bit data output terminals (port 1)
20 to 27	$P2_0$ to $P2_7$	8-bit data output terminals (port 2)
19	GND	Frame ground

(3)   Setting for an output signal

Set the output signal for each terminal by panel operation. The data must be in decimal number with $P1_0/P2_0$ as LSB and $P1_7/P2_7$ as MSB. Fig. 7-3 shows an example setting.

The procedure is given below.

(a)   Press SHIFT key ㉙ , and the 1/PORT 1 key (setting port 1) or 2/PORT 2 key (setting port 2) of DATA keys ⑯ .

(b)   I/O MODE light ⑨ turns on and FREQUENCY readout ⑧ shows the current set value. 1 or 2 at the left indicates either port 1 or port 2 is used.

(c)   Enter a numeric value from 0 to 255 with DATA keys ⑯ and press ENTER key ⑮ . This will renew the external control output signal.

Given below is the relationship between the decimal set values displayed on the panel and the output signals.

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

0:LOW   1:HIGH
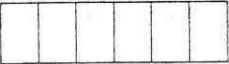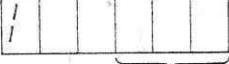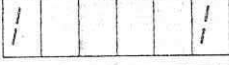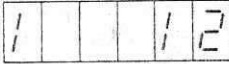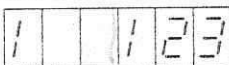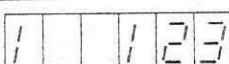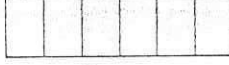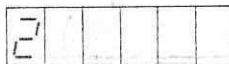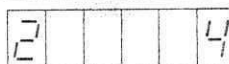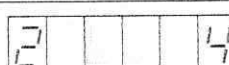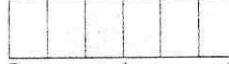
Step	Keystroke	FREQUENCY readout	ENTER key
1	SHIFT ⊙ On	[blank display] ○ I/O MODE Off — Current frequency set value	ENTER ○ Off
2	PORT1 1	1 [ ] [ ] [ ] [ ] • I/O MODE On — Current control output set value	
3	1	1 [ ] [ ] [ ] 1 • I/O MODE On	ENTER ● Flashing
4	2	1 [ ] [ ] 1 2 • I/O MODE On	
5	3	1 [ ] 1 2 3 • I/O MODE On	
6	ENTER ○	1 [ ] 1 2 3 • I/O MODE On	ENTER ○ Off
7	SHIFT ⊙ On	[blank display] ○ I/O MODE Off — Current frequency set value	
8	PORT2 2	2 [ ] [ ] [ ] [ ] • I/O MODE On — Current control output set value	
9	4	2 [ ] [ ] [ ] 4 • I/O MODE On	ENTER ○ Flashing
10	ENTER ○	2 [ ] [ ] [ ] 4 • I/O MODE On	ENTER ○ Off
11	(About 5 min. after)	[blank display] ○ I/O MODE Off — Returns to the current frequency set value	

Fig. 7-3 Example setting of port 1/port 2 control output.

(4)   Program code for GP-IB

Header code		Data code	Description
P1 or P2	B	00000000 thru 11111111	Sets 8 bits of port 1 or port 2 in a binary data.
	H	00 thru FF	Sets 8 bits of port 1 or port 2 in a hexadecimal data.
	D	0 thru 255	Sets 8 bits of port 1 or port 2 in a decimal data.
	S	0 thru 7	Sets (to 1) specified bit of port 1 or port 2.
	R	0 thru 7	Resets (to 0) specified bit of port 1 or port 2.

Example for setting control output signal of port 1

0	1	0	1	0	1	0	1
$P1_7$	$P1_6$	$P1_5$	$P1_4$	$P1_3$	$P1_2$	$P1_1$	$P1_0$

Example 1. P1B01010101
Example 2. P1H55
Example 3. P1D85
Example 4. P1 S0246 P1R1357

└─ Data code
└─ Header code

7-9   Printout (list output) of Memory Content

(1)   Function

Outputs all or part of 100 preset data in memory to a Centronics compatible printer.

(2)   Pins used

No.	Name	Function
1	STB	Terminal for acknowledge signal input from the printer.
2 to 9	$P1_0$ to $P1_7$	Terminal for data output to the printer.
10	BUSY	Terminal for strobe signal to the printer.
19	GND	Frame ground

	Pin connection										
Printer	1	2	3	4	5	6	7	8	9	10	19
VP-8174A	10	2	3	4	5	6	7	8	9	1	19

Other pins are not connected.

Use the dedicated cable VQ-023H10 for connecting the instrument and printer.

(3)   Operation procedure

Follow the procedure below.

(a)   Select the list output for P1 I/O mode.

SHIFT   I/O MODE   [⇒] .... [⇒]   ENTER
[o]   [⇧]   [2]   [o]
                     or
                     [⇐] .... [⇐]
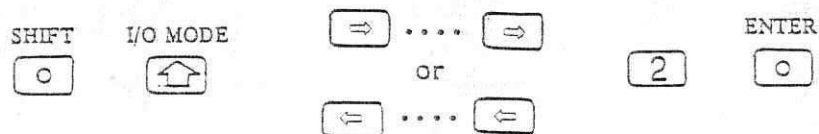
Press to flash the digit indicating the P1 mode.

(b)   Turn the power once off then on again.

POWER   POWER
[   ]   [   ]
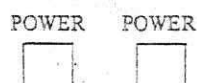
(c)   Set the start address (ex. 12) and end address (ex. 34) for the data portion to be listed.

                                    ENTER
[STO] [•] [1] [2] [•] [3] [4] [o]

(d)   For printing out the entire data, release the start/end addresses.

ENTER

[STO]   [•]   [•]   [O]

(e)   Connect the printer to EXT CONTROL I/O connector ㉞ .

(f)   Start listing. During the operation, the light in SHIFT key ㉙ turns on and the key operation is disabled.

SHIFT   LIST

[O]   [CLR]
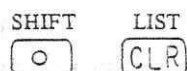
(4)   List output example of memory content

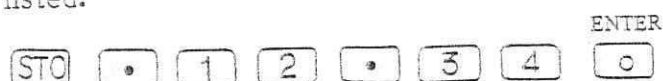| No.	FREQ MHz	AMPTD dBuVemf	FM-mono kHz	FM-st %	AM %	PILOT %		MODU	TONE
12	.1000	99	75.0	100	30	00	OFF	AM	400
13	.2000	99	75.0	100	30	00	OFF	AM	400
14	.5000	99	75.0	100	30	00	OFF	AM	400
15	1.0000	99	75.0	100	30	00	OFF	AM	400
16	2.0000	99	75.0	100	30	00	OFF	AM	400
17	5.0000	99	75.0	100	30	00	OFF	AM	400
18	10.0000	99	75.0	100	30	00	OFF	AM	400
19	20.0000	99	75.0	100	30	00	OFF	AM	400
20	20.0000	70	75.0	100	30	00	OFF	AM	400
21	20.0000	50	75.0	100	30	00	OFF	AM	400
22	20.0000	30	75.0	100	30	00	OFF	AM	400
23	20.0000	10	75.0	100	30	00	OFF	AM	400
24	20.0000	00	75.0	100	30	00	OFF	AM	400
25	20.0000	-10	75.0	100	30	00	OFF	AM	400
26	50.0000	99	75.0	100	30	00	OFF	FM	1k
27	80.0000	99	75.0	100	30	00	OFF	FM	1k
28	110.0000	99	75.0	100	30	00	OFF	FM	1k
29	80.0000	99	75.0	100	30	00	OFF	FM	EXT
30	80.0000	99	75.0	100	30	10	ON	L= R	1k
31	80.0000	99	75.0	100	30	10	ON	L	1k
32	80.0000	99	75.0	100	30	10	ON	R	1k
33	80.0000	99	75.0	100	30	10	ON	L=-R	1k
34	80.0000	99	22.5	30	30	10	ON	OFF	1k

7-10 Transfer of Memory Content (Memory Copy)

(1) Function

Transfers from a generator to another the entire 100 preset memory data and amplitude preset memory data, or the part of the 100 preset memory data. The function is available only between the VP-8174A generators.

(2) Pins used

No.	Name	Function
1	STB	Timing pulse input terminal for loading data in the receive mode.
2 to 9	$P1_0$ to $P1_7$	Terminals for sending and receiving memory data.
10	BUSY	Timing pulse output terminal in the send mode.
19	GND	Frame ground

	Pin connection										
Receiving generator	1	2	3	4	5	6	7	8	9	10	19
Sending generator	10	2	3	4	5	6	7	8	9	1	19

Other pins are not connected.

Use the dedicated cable VQ-023H10 for connecting the VP-8174A to another VP-8174A.

(3) Operational procedure

(a) Select the memory transfer receive mode for P1 I/O mode of the receiving generator.

SHIFT   I/O MODE   ⇒ .... ⇒   or   ⇐ .... ⇐   3   ENTER
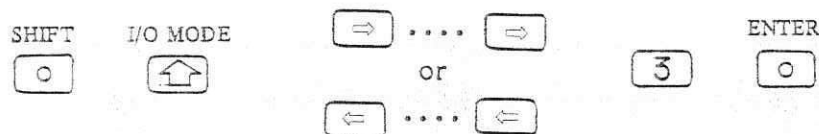
Press to the digit indicating the P1 mode.

(b) Select the memory transfer send mode for P1 I/O mode of the sending generator.

SHIFT   I/O MODE   ⇒ .... ⇒   or   ⇐ .... ⇐   4   ENTER
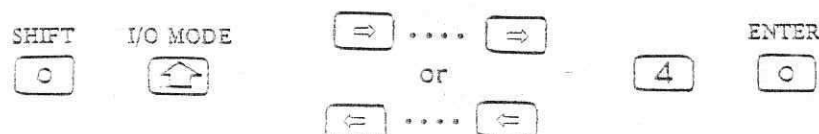
Press to the digit indicating the P1 mode.

(c)   Turn the power of both the generators on and off again.

POWER   POWER

☐   ☐

(d)   Set on the sending generator start address (ex. 12) and end address (ex. 34) of the data portion to be transferred.

ENTER

STO [·] [1] [2] [·] [3] [4] [○]

(e)   To transfer the entire data, clear the start/end addresses on the sending generator.

ENTER

STO [·] [·] [○]

(f)   Connect EXT CONTROL I/O connector ㉞ of the sending and receiving generators.

(g)   Start the copy operation on the sending generator.

SHIFT   COPY

[○]   [⇩]

(h)   During transfer, the light in SHIFT key ㉙ turns on and both the generators and the panel key operation is disabled. It takes approximately twenty seconds to transfer the entire data in the memories.

7-11 Data Read

(1) Function

By GP-IB control, the VP-8174A can read 8-bit TTL-level data applied to EXT CONTROL I/O connector ㉞ .
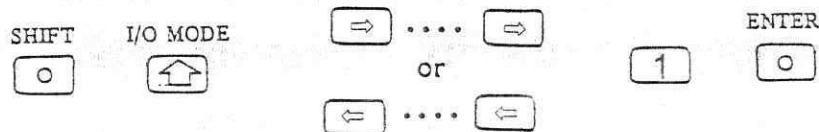
(2) Terminals used

No.	Name	Function
19	GND	Frame ground
20 to 27	$P2_0$ to $P2_7$	8-bit data input terminals (port 2)

(3) Operation procedure

Input signal for each terminal is sent out to the GP-IB. The data must be in decimal number with $P2_0$ as LSB and $P2_7$ as MSB.
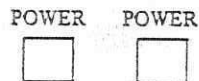
The procedure is given below.

(a) Set the data read mode for P2 I/O mode.

SHIFT I/O MODE ⇒ .... ⇒ or ⇐ .... ⇐ 1 ENTER

Press to flash the digit indicating the P2 mode.

(b) Turn the power of both the generators off and on again.

POWER POWER

(c) Connect the signal to be read to EXT I/O connector ㉞ .

(d) Connect the VP-8174A and the controller (computer).

(e) Set "1" for the talker mode of the VP-8174A by the controller. Then, send out command "TM1" from the controller.

(f) When the controller designates the VP-8174A to act as a talker, the generator will send out data applied to its $P2_0$ to $P2_7$ terminals to the controller.

The following is the relationship between the data applied to $P2_0$ to $P2_7$ and data to be sent out.

$P2_7$	$P2_6$	$P2_5$	$P2_4$	$P2_3$	$P2_2$	$P2_1$	$P2_0$	Data to be sent out
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
			thru					thru
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

0: LOW 1: HIGH

-NOTE-

If port 2 is not in the data read mode, an error message "MODE MISMATCH" will be sent out on designating the VP-8174A to act as a talker.

7-12 Relay Drive Output

(1) Function

Provides TTL relay drive output that reverses its polarity (HIGH/LOW) at a predetermined transition frequency (F_R). Transition occurs at the point where the generator's RF output frequency (F) matches F_R. F_R can be set within the range from 1 MHz to 110 MHz.

The output is used for switching small reed relays. (HIGH: +5 V, Current capacity: 50 mA). The application includes the control of switching devices for signals, output impedance, and dummy antennas. Given below are the relationship between the transition frequency and the relay drive output.

Transition frequency F_R		Condition of RF output frequency F	Relay drive output
Settable range	Setting resolution		
1 to 110 MHz	1 MHz	$F \geqq F_R$	HIGH
		$F < F_R$	LOW
Setting with a minus (-) sign:			
(-1 to -110 MHz)		$F \geqq F_R$	LOW
		$F < F_R$	HIGH

(2) Output terminal

DRIVE OUTPUT connector ㉛ on the instrument's rear panel is an RCA-type pin jack. As shown in Fig. 7-4, the inner conductor supplies output and the outer conductor is connected to the frame ground. For connecting DRIVE OUTPUT connector ㉛ and relay, connect the inner conductor and the ⊕ terminal of the coil, and the outer conductor and the ⊖ terminal of the coil. If the coil of the relay has no polarity, either connection is allowed.

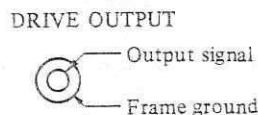DRIVE OUTPUT
— Output signal
— Frame ground

Fig. 7-4 Relay Drive Output Connector

(3)   Setting transition frequency

Transition frequency setting is made through panel key operation. Fig. 7-5 shows an example setting. The procedure is as follows:

(a)   Press SHIFT key ㉙ and the 3/DRIVE key of DATA keys ⑯ .

(b)   I/O MODE light ⑨ turns on and FREQUENCY readout ⑧ indicates the current set value.

(c)   Enter a value within the range from 1 to 110 or -1 to -110 with DATA keys and press ENTER key ⑮ . This will renew the transition frequency value.

Step	Keystroke	FREQUENCY readout		ENTER key
1	SHIFT ☐ On	[ ] Current RF output frequency set value	I/O MODE ○ Off	ENTER ☐ Off
2	DRIVE ☐ 3	[ ] Current transition frequency set value	I/O MODE ● On	
3	☐ —	[—]	I/O MODE ● On	ENTER ● Flashing
4	☐ 3	[— 3]	I/O MODE ● On	
5	☐ 0	[— 30]	I/O MODE ● On	
6	ENTER ☐	[— 30]	I/O MODE ● On	ENTER ☐ Off
7	About 5 min. after	[ ] Returns to current RF output frequency set value	I/O MODE ○ Off	

Fig. 5-5 Example setting of transition frequency value for the relay drive output

─────────────NOTE─────────────

Transient frequency of drive output cannot be stored in the preset memory.

(4) Program code for GP-IB

Header code	Data code	Description
DR	1 to 110	When $F \geqq F_R$ drive output will be HIGH. When $F < F_R$ drive output will be LOW.
	-1 to -110	When $F \geqq F_R$ with the minus sign ignored, drive output will be LOW. When $F < F_R$ with the minus sign ignored, drive output will be HIGH.

SECTION VIII
MAINTENANCE

8-1 Cleaning

Clean panels and covers with a dry soft cloth. Do not use an organic solvent such as lacquer thinner or benzene. For stubborn dirt, use a cloth moistened with a small amount of a neutral detergent and then wipe with a dry cloth.

8-2 Judgment for Memory Backup

If the operation panel fails to have the same settings as when the power was last turned off, the memory backup function may be defective. For remedy, contact your nearest service representative.

8-3 Calibration or Service

If inspection or calibration to maintain the specified performance is desired, contact your nearest service representative. Any problems with operation breakdowns should also be immediately reported to the representative.

8-4 Daily Maintenance

This Signal Generator has no moving parts that require lubrication or inspection, so no daily maintenance is necessary.

8-5 Transportation and Storage

When transporting the Signal Generator, protect it with a package comparable to the one in which it was delivered. If it is not going to be used for a long time, wrap it in a plastic sheet to prevent dust intrusion and store it away from heat and humidity.

Front panel

Rear panel