MANUAL PART NUMBER
MEP8191A-1

ID NUMBERS

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

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

FM/AM SIGNAL GENERATOR

VP-8191A

Matsushita Communication
Industrial Co., Ltd.
4-3-1, Tsunashima-Higashi
Kohoku-ku, Yokohama, Japan
Tel: (045) 531-1231
Telex: 3822-671

Printed in Japan

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.

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 terminal 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.

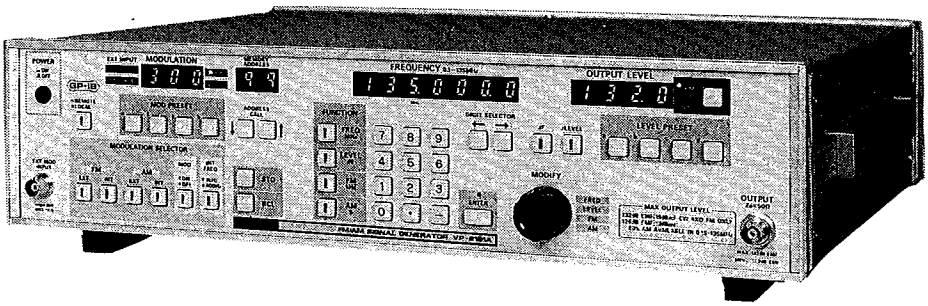
REMOVAL OF COVERS

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


FREQUENCY
OUTPUT LEVEL
MODULATION
MODULATION SELECTION
LEVEL SELECT
MODIFY
OUTPUT

VP-8191A

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 various instructions related to safety, electrical, and mechanical preparations.
Be sure to read this section before putting this Signal Generator into actual use.

(4) Section IV - Operation
Explains in detail the operation procedures for each function of this Signal Generator.

(5) Section V - Overview of GP-IB
Describes the GP-IB standard.

(6) Section VI - GP-IB Interface
Explains in detail the operation procedures related to the GP-IB interface.

(7) Section VII - Memory Control
Recall of assorted preset setups and modifications of the frequency and output levels can be controlled from a remote device. (This function is called the memory control hereafter.)
This section gives a detailed explanation of the functions available and the operation procedures for the memory control.

(8) Section VIII - Maintenance
A brief description of preventive maintenance.

1-2 ID NUMBER

This instrument is numbered with a ten-character ID number. The first seven digits and letter(s) are assigned uniquely for each product. The last three digits 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-8191A is a standard signal generator which generates CW, FM, AM, and mixed FM-AM signals over the 100 to 135,000 kHz range. It also features a GP-IB interface.

Frequencies between 30 and 135 MHz are directly generated fundamental waves while those in the 100 kHz to 29.9999 MHz range are generated using heterodyne down-conversion. The oscillation frequency is always synchronized with the reference crystal oscillator and can be set at any multiple of 100 Hz. The ΔF function directly reads increment and decrement (detuning frequencies) from the currently designated reference frequency.

The output level can be set in 0.1 dB increments between -130.9 and 19 dBm. The VP-8191A allows a choice of dBm (50 Ω) or dB EMF unit displays. The ΔLEVEL function directly reads the increment or decrement from the currently designated reference output level.

The VP-8191A provides modulation of FM up to 300 kHz deviation (RF above 3 MHz) or AM up to 80 % (RF above 0.15 MHz, output below 13 dBm). The mixed FM and AM is also available by combining internal and external modulations.

The VP-8191A stores up to 100 sets of parameters (carrier frequency, modulation functions, and output level) which can later be recalled. It also provides independent preset functions: four for output levels alone and four for the modulation functions. The settings are specified with the numeric input keys and the MODIFY control. Battery backup is provided so that the settings are retained even after the power has been turned off.

The GP-IB interface and memory control are provided as standard remote functions on the VP-8191A.

These features not only make the VP-8191A 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.

SECTION II
SPECIFICATIONS

2-1 RF FREQUENCY

Range: 100 kHz to 135 MHz

Display

Normal display : 0.0800 to 136.0000 MHz

ΔF display : 0 to ±0.9999 MHz

Resolution : 100 Hz

Accuracy : $\pm(5 \times 10^{-6} + 2$ counts) (RF < 0.3 MHz)

$\pm(5 \times 10^{-6} + 1$ count) (RF ≥ 0.3 MHz)

Stability

Aging rate: $\pm 1 \times 10^{-6}$/week (After 48 hours warm-up)

Temperature characteristics: Within $\pm 3 \times 10^{-6}$ (10°C to 35°C)

2-2 RF OUTPUT

Range

dBm: -130.9 dBm to 13 dBm with up to 80% AM; up to 19 dBm with no AM
(0 dBm : 1mW into 50Ω)

dB EMF: -17.9 dB to 126 dB with up to 80% AM ; up to 132 dB with no AM
(0 dB = 1 μV)

Normal display range

dBm: -130.9 to 19.0 dBm

dB EMF: -17.9 to 132.0 dB

ΔLEVEL display range: 0 to ±(value within whole usable range) dB

Resolution: 0.1 dB

Reference level: 13 dBm (126 dB EMF)

Accuracy: ±1 dB

Attenuator accuracy:

±1.0 dB (Output ≥ -113 dBm)

±1.5 dB (Output < -113 dBm)

Output impedance: 50Ω

VSWR: ≤ 1.2

Spurious output (Output ≤ 13 dBm)

Harmonics: ≤ -30 dBc

Non-harmonically related:

(1) 30 MHz ≤ RF ≤ 135 MHz

None

(2) 100 kHz ≤ RF < 30 MHz

-40 dBc

-50 dBc (measured in the frequency range below 30 MHz)

Residual modulation (S/N)

FM component: As S/N relative to 75 kHz deviation,with post-detection BW of 50 Hz to 15 kHz and with 50 μs de-emphasis

≥ 80 dB

AM component: As S/N relative to 30% AM, with post-detection BW of 50 Hz to 15 kHz

≥ 60 dB (exclude beat components close to RF 16, 20 and 26.7 MHz)

2-3 MODULATION

Internal modulation frequency: 400 Hz, 1 kHz within ±3%

External modulation input impedance: Approx. 10 kΩ

External modulation input level required: Approx. 3 V peak

FM

Frequency deviation: (1) 0 to 300 kHz (RF ≥ 3 MHz)

(2) 0 to 99.5 kHz (0.3 MHz ≤ RF < 3 MHz)

(3) 0 to 30.0 kHz (RF < 0.3 MHz)

Display: 0.0 to 300 kHz

Resolution: (1) 0.5 kHz (FM 0 to 100 kHz)

(2) 1 kHz (FM 100 to 240 kHz)

(3) 5 kHz (FM 240 to 300 kHz)

Accuracy: ±(8% of reading + 0.5 kHz)

Distortion: At 75 kHz deviation, with post-detection BW of 50 Hz to 15 kHz and with 50μs de-emphasis

(1) ≤ 0.1% (1 kHz rate)

(2) ≤ 0.05% (1 kHz rate, RF 10.7±1 MHz and 76 to 108 MHz)

Frequency response: 20 Hz to 120 kHz

(1) Within ±1 dB (with reference to 1 kHz)

(2) Within ±0.3 dB (with reference to 1 kHz, RF 10.7±1 MHz and 76 to 108 MHz)

Separation for MPX stereo signal:

≥ 60 dB (1 kHz rate, 75 kHz deviation, RF 76 to 108 MHz)

Incidental AM on FM:

≤ 0.5% (75 kHz deviation, 1 kHz rate, RF 10.7±1 MHz and 76 to 108 MHz)

AM (RF ≥ 0.15 MHz, Output ≤ 13 dBm)

Modulation depth: 0 to 80%

Display: 0.0 to 99.5%

Resolution: 0.5%

Accuracy: ±(5% of reading +2%)

Distortion: At 30% AM, with 1 kHz rate and with post-detection BW of 50 Hz to 15 kHz

(1) ≤ 0.5% (exclude beat components close to RF 16, 20 and 26.7 MHz)

(2) ≤ 0.3% (RF 0.4 to 1.7 MHz)

Frequency response: 20 Hz to 10 kHz*(RF 0.3 to 135 MHz)

Within ±1 dB (with reference to 1 kHz)

* The allowable max modulation rate depends on the carrier frequency and the depth of modulation as follows.

For 30% AM: Up to 2% of carrier frequency

Incidental FM on AM: ≤ 200 Hz (30% AM, 1 kHz rate, RF 10.7±1 MHz and 76 to 108 MHz)

FM-AM mixed modulation

(1) FM EXT + AM INT

(2) FM INT + AM EXT

2-4 PRESET

(1) F-L-M Assorted Preset

Carrier frequency (F), output level (L) and modulation setups (M) are assorted together and can be stored or recalled.

100 assorted data can be preset.

(2) Independent Output Level Preset

4 output levels can be stored and recalled independently of carrier frequency and modulation setups.

(3) Independent Modulation Setup Preset

4 modulation setups can be stored and recalled independently of carrier frequency and output level.

2-5 GP-IB CONTROL

As stated in Section VI

2-6 MEMORY CONTROL

(1) Recall operation of 100 assorted setups

(2) Frequency increment control

(3) Output level increment control

2-7 MISCELLANEOUS

Leakage: Will not interfere with measurement of 1 μV

Power requirements

Mains voltages

100V : 90V to 112V

120V : 106V to 132V

220V : 196V to 244V

240V : 214V to 250V

Mains frequency: 50/60 Hz

power consumption: 45VA or less

Ambient temperature and humidity (R.H.)

Limit range of guaranteed performance: 10°C to 35°C, up to 85%

Limit range of operation: 0°C to 40°C, up to 90%

Storage and transportation: -20°C to 70°C, up to 90%

Dimensions: 426 mm(W), 99 mm(H), 350mm(D) excluding legs, knobs, etc.

Mass: Approx. 10.5 kg

2-8 ACCESSORIES FURNISHED

1 Output cable, VQ-027C

1 Power Cable

1 Fuse 0.63A for mains voltage 100V or 120V, 0.315A for 220V or 240V

1 Instruction manual

SECTION III
INSTALLATION

3-1 POWER REQUIREMENTS

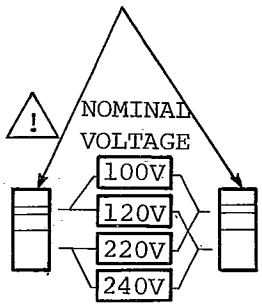
The Model VP-8191A can be operated from any power source supplying 100 V, 120 V, 220 V and 240 V (nominal values), 50 or 60 Hz. Power consumption is less than 45 VA.

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).

NOMINAL	RANGE
100 V	90 - 112 V
120 V	106 - 132 V
220 V	196 - 244 V
240 V	214 - 250 V

Voltage selection switches (shown set for 100 V)



3-2 MAINS VOLTAGE SELECTION

Refer to the figure above. Set the NOMINAL VOLTAGE switches to the setting (100 V, 120 V, 220 V or 240 V) 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.

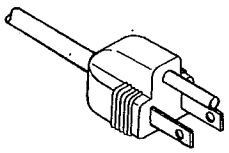
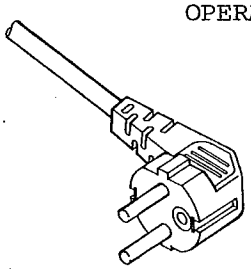
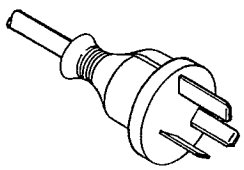
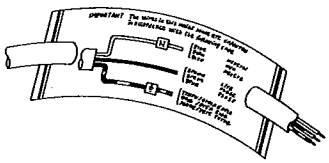
Nominal voltage	Fuse
100 V	250 V 0.63A (T)
120 V	
220 V	250 V 0.315A (T)
240 V	

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-8191A 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 National part numbers.

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

3-5 INTERCONNECTION WITH OTHER EQUIPMENT

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

The interconnections are made with BNC connectors and rear panel connectors. Although no hazardous voltage will appear on any pin of these connectors, the following notes should be considered to maintain normal operation of the instrument.

NOTES:

(1) The 14-pin connector should only be connected to the remote control unit prepared specifically for this instrument.

(2) It is recommended to remove all connections from the 14-pin connector when not in use for remote control.

3-6 SETTING OF GP-IB ADDRESS

NOTE

The device address should be set before turning on the instrument.
The address setting procedure is explained in 6-3.

3-7 MOUNTING ON THE BENCH

The instrument cabinet has plastic feet and fold-away tilt stand. The tilt stand raise 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.

3-8 PREPARATION

(1) Keep the instrument turned on for more than eight hours when the instrument is used first time after unpacking or after long term of storage period.
The memory back-up battery built in this instrument is a rechargeable nickel-cadmium cell and is always being recharged when the instrument is turned on. Normally charged battery will back-up the memory for several weeks, however, a long term of turning off may cause insufficient back-up due to the gradual discharge of the battery.

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

(3) Set the REMOTE/LOCAL key always to LOCAL state (the light is off) except when using GP-IB control.

SECTION IV
OPERATION

4-1 GENERAL

This section describes the operation procedures of the VP-8191A.

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 level of the RF output signal (output level 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-8191A allows assorted preset, independent output level preset, and independent modulation preset. The assorted preset can be remote-controlled with the memory control function.

This section contains first an outline of specific functions and definitions followed by a description of the front and rear panels. Then, the basic operations and 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 to modify preset parameter after recall or to store them in the first place, so they will be discussed first.

1. Basic operation for frequency control (Paragraph 4-5)
2. Basic operation for output level control (Paragraph 4-6)
3. Basic operation for modulation control (Paragraph 4-7)
4. Assorted preset operation (Paragraph 4-9)
5. Independent output level preset operation (Paragraph 4-10)
6. Independent modulation preset operation (Paragraph 4-10)

The GP-IB interface function is explained in Sections V and VI, and the memory control 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 level, and modulation functions--and recall them later with one simple operation. The VP-8191A holds up to 100 such sets. Since modifying a recalled set is generally easier than resetting everything, this is the function that is used for most purposes.

(2) Independent Output Level Preset

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

(3) Independent Modulation Preset

This auxiliary function simplifies modulation setting. Four frequently used sets of such data (modulated/unmodulated, modulation type, internal modulating signal, and modulation degree) may be stored and recalled as required independently of the assorted preset function.

(4) ⊿F Display

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

(5) ⊿LEVEL Display

This function displays the output level relative to the current reference level.

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-8191A appears at the end of this manual. In this figure, parts are numbered ① through ㉘ in the clockwise direction from the upper left hand corner. Their names and functions are briefly summarized below:

① POWER switch (Push-button)

Turns the mains power on and off.

② REMOTE/LOCAL key

Returns the VP-8191A from GP-IB remote to front panel (LOCAL) control. Always set to the LOCAL state (the light is off) for operation without the GP-IB interface.

③ EXT INPUT annunciators OVER/UNDER

Adjusting aid for setting the level of an external modulation source. The lights indicate that the input level is excessive or insufficient for calibrated display of % AM or FM deviation.

④ MODULATION readout

Indicates FM deviation or % AM.

⑤ kHz / % display lights

Indicate FM or AM modulation by illuminating the kHz or % light, respectively.

⑥ MOD PRESET keys [e] [f] [g] [h]

Used for independent modulation preset operation.

⑦ MEMORY ADDRESS readout

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

⑧ ADDRESS CALL keys

Call an assorted preset memory address to the memory address readout ⑦. They raise and lower the number on the display, respectively.

⑨ FREQUENCY readout

Displays the generated frequency in 7 numeric digits. Two decimal points are fixed at MHz and kHz positions.

⑩ DIGIT SELECTOR keys

Select the digit on the frequency or output level readout for modification.

⑪ ΔF key

Actuates the ΔF function which directly displays the detuning frequency, the frequency relative to the current reference frequency.

⑫ OUTPUT LEVEL readout

Displays the output level as a 4-digit value preceded by a minus sign (if necessary).

⑬ dB EMF / dBm / db (ΔLEVEL) unit indicator

Energizes one of three lights to indicate the current scale unit for output level. dB EMF is the unit for the open-end voltage (EMF) where 0 dB = 1 μV. dBm is the power unit for a 50 Ω load. dB (ΔLEVEL) is the unit for relative level ratio.

⑭ dB EMF / dBm unit changeover key

Selects the unit for the output level display between dB EMF and dBm.

⑮ OUTPUT connector

Supplies an output signal through the BNC receptacle.

⑯ LEVEL PRESET keys [a] [b] [c] [d]

Used for independent output level preset operation.

⑰ ΔLEVEL key

Actuates the ΔLEVEL function which directly displays the incremental output level, the difference between the actual output and the current reference levels.

⑱ MODIFY control

Increments or decrements the frequency, output level, FM frequency deviation (kHz) or AM modulation degree (%) by the specified step.

⑲ ENTRY key

Registers the frequency, output level, modulation degree, or memory address entered with the numeric keys or stores the independent modulation and output level preset data.

⑳ ENTRY light

Flashes to prompt registration with the ENTRY key if the input through the numeric keys has started.

㉑ Numeric input keys

Input the numeric values for the frequency, output level, modulation degree, and memory address. They include the digits 0 to 9, the decimal point (.), and minus sign (-).

㉒ FUNCTION keys

Select the parameters to be entered with the numeric input keys ㉑ or the MODIFY control ⑱ ; frequency (FREQ), output level (LEVEL), FM frequency deviation (FM), or AM modulation degree (AM).

㉓ STO key

Stores the assorted or independent preset data.

㉔ RCL key

Recalls the stored assorted preset data.

㉕ INT FREQ key

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

㉖ MOD ON/OFF key

Alternately turns modulation on and off.

㉗ MODULATION SELECTOR keys

Select which of the four modulation modes is to be used.

㉘ EXT MOD INPUT connector

Receives an external modulation signal through the BNC receptacle.

4-4 REAR PANEL FEATURES

The rear panel layout of the VP-8191A appears at the end of this manual. In this figure, parts are numbered ㉙ through ㉞ . Their names and functions are briefly summarized below:

㉙ GP-IB ADDRESS SWITCH

Specifies the device address for the GP-IB interface.

㉚ MEMORY CONTROL connector (14 pins)

Provides access to the stored assorted preset data for remote control operation.

㉛ NOMINAL VOLTAGE switch

Selects an appropriate mains voltage to suit local AC supply.

㉜ MAINS INPUT connector

Accepts the power cable.

㉝ FUSE holder

Holds the mains input fuse.

㉞ GP-IB connector (24 pins)

Connects the signal generator to the GP-IB for remote operation.

4-5 BASIC OPERATION FOR FREQUENCY CONTROL

Fig. 4-1 shows a part of the front panel related to frequency control operation. Basic operations include entering the required frequency directly through the numeric input keys, modification of the setting with the MODIFY control, and introducing the incremental frequency control with the ΔF function.

(1) Direct Reading Frequency Display

The FREQUENCY display covers the 0.0800 to 136.0000 MHz range and indicates the entered value as 7 numeric digits. There are two fixed decimal points indicating MHz and kHz, respectively. The display shown in Fig. 4-1 reads 135.0000 MHz. The minimum resolution of the frequency display is 100 Hz.

(a) Performance-guaranteed range

The VP-8191A performance is guaranteed within the range of 0.1000 to 135.0000 MHz.

(b) Display range

The display covers a wider range: 0.0800 to 136.0000 MHz.

NOTE

Settings outside the guaranteed range will not provide outputs with the stated accuracy.

(2) Direct Frequency Setting with the Numeric Input Keys

(a) Press the FREQ key, the first of the four FUNCTION keys ㉒ . The light in the key will be on to indicate frequency entry.

(b) Specify the required frequency with the numeric input keys ㉑ . The ENTRY light starts flashing to prompt registration of the displayed value. While the light flashes, the output frequency remains unchanged from the previous setting.

(c) Press the ENTRY key ⑲ . The ENTRY light goes out to indicate that the new data has been registered. The value on the FREQUENCY readout now represents the new output frequency.

NOTES

1. The readout accepts values outside the specified display range, but pressing the ENTRY key ⑲ returns the display to the previous value.
2. To correct an eror 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.

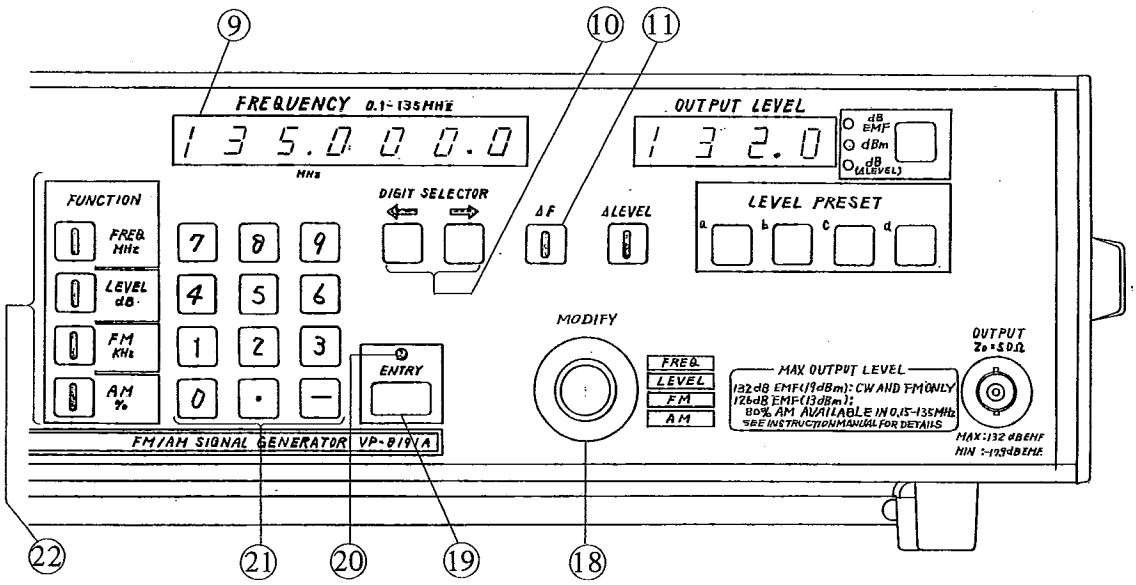


Fig. 4-1 Frequency controls

Example: Setting a frequency of 123.4567 MHz

Step	Keystroke	FREQUENCY readout	ENTRY key
①	FUNCTION FREQ MHz (On)	Current value	○← Off ENTRY
②	1 key	1.	
③	2 key	12.	
④	3 key	123.	
⑤	• key	123.	↙Flashing ○ ENTRY
⑥	4 key	123.4	
⑦	5 key	123.45	
⑧	6 key	123.456	
⑨	7 key	123.4567	
⑩	ENTRY key	123.4567	○←Off ENTRY

(3) Setting with the MODIFY Control

The setting can also be altered with the MODIFY control ⑱ :

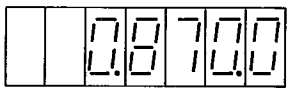
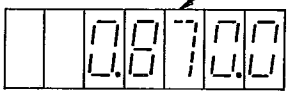
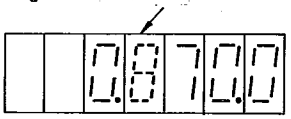
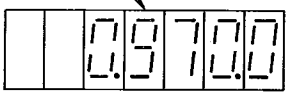
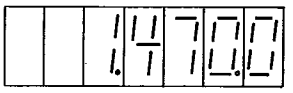
(a) Press the FREQ key, the first of the FUNCTION keys ㉒ making the light in the key on. The FREQUENCY readout ⑨ remains to read the previous frequency setting (0.8700 MHz for the following example).

(b) Press either of the DIGIT SELECTOR keys ⑩ . One of the digits on the FREQUENCY readout ⑨ will start to flash. This digit may then be altered with the MODIFY control ⑱ .

(c) The flashing may be shifted to an adjoining digit with the DIGIT SELECTOR keys ⑩ ◀or▶.

(d) Rotate the MODIFY control ⑱ to raise or lower the current digit reading. The digit will stop flashing.

Example: Altering the output frequency from 0.8700 to 1.4700 MHz

Step	Operation	FREQUENCY readout
①	FUNCTION [0] FREQ MHz Press the FREQ key making the light in the key on.	Current value 
②	Press either the ◀ or ▶ key.	Starts to flash. (Assumption: This digit was assigned last time.) 
③	Press the ◀ key.	The digit to the left will start to flash. 
④	Rotate the INCREMENT control clockwise (CW) one step.	The digit will change from "8" to "9" and stop flashing. 
⑤	Rotate the INCREMENT control clockwise (CW) another five steps.	

(4) ⊿F Function (⊿F Direct Reading)

(a) Specify the desired reference frequency using the procedure just described. The light in the ⊿F key ⑪ must be off for this step.

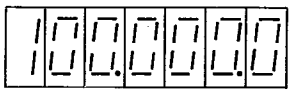
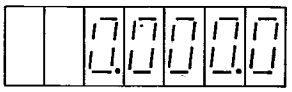
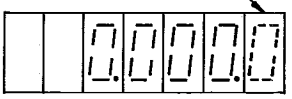
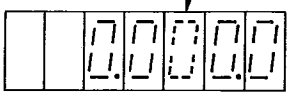
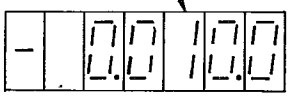
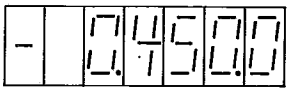
(b) Press the ⊿F key ⑪ making the light in the key on. The FREQUENCY readout 9 will display 0.000.0.

(c) Repeat Steps (b) and (c) in paragraph (3) above to select the digit to be modified.

(d) Repeat Step (d) in paragraph (3). The readout will display the detuning frequency, the difference between the actual frequency and the current reference frequency.

(e) Press the ⊿F key ⑪ to release the ⊿F function making the light off.
Pressing one of the FUNCTION keys ㉒ automatically releases this mode as well.

Example: Lowering the output frequency by 0.4500 MHz

Step	Operation	FREQUENCY readout
①	Specify the reference frequency.	Displays the reference frequency. 
②	Press the ⊿F key making the light on.	The reading changes. 
③	Press either the ← or → key.	Starts to flash. (Assumption: This digit was assigned last time.) 
④	Press the ← key twice.	The second digit to the left will start to flash. 
⑤	Rotate the INCREMENT control counterclockwise (CCW) one step.	The digit will change from "0" to "1" and stop flashing. 
⑥	Rotate the INCREMENT control counterclockwise (CCW) another forty-four steps.	

NOTES

1. The ⊿F function covers the detuning range -0.9999 to +0.9999 MHz for output frequencies in the range 0.0800 to 136.0000 MHz. 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 the light in the ⊿F key ⑪ is on. To view the actual frequency, press the ⊿F key making the light in the key off.

4-6 BASIC OPERATION FOR OUTPUT LEVEL CONTROL

Fig. 4-2 shows a part of the front panel related to output level control operation. Basic operations include entering the required output level directly through the numeric input keys, modification of the setting with the MODIFY control, and introducing the incremental level control with the ⊿LEVEL function.

(1) Direct Reading Output Level Display

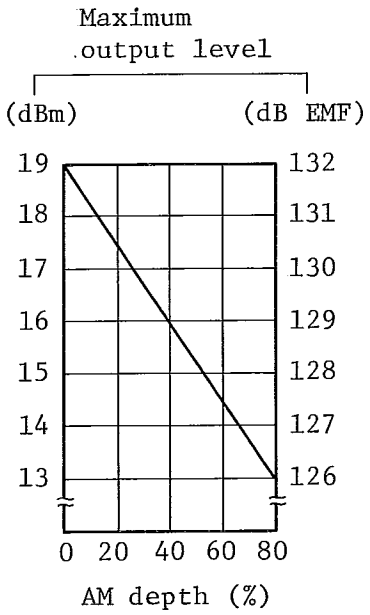
The OUTPUT LEVEL display covers the -130.9 to 19.0 dBm (-17.9 to 132.0 dB EMF) range. It allows a choice of dB EMF or dBm unit. A light labeled dB EMF or dBm comes on to indicate the unit in effect. The display shown in Fig. 4-2 reads 132.0 dB EMF.

(2) Maximum Output Level

The maximum available output level of this instrument depends on the AM depth as shown on the right.

With zero percent AM (i.e. CW or FM), the maximum level of 19 dBm (132 dB EMF = 4 V) is obtained.

With 80% AM, the maximum obtainable level will decrease to 13 dBm (126 dB EMF = 2 V).



NOTE

In AM application, always be careful not to increase the output level over the limit shown on the graph above, since the output level readout itself can be set up to 19 dBm (132 dB EMF) regardless of any AM settings.

(3) Direct Setting with the Numeric Input Keys

(a) Select the output level unit with the dB EMF/dBm unit changeover key ⑭ making the corresponding light of the unit indicator ⑬ on.

(b) · Press the LEVEL key, the second of the four FUNCTION keys ㉒ . The light in the key will be on to indicate output level entry.

(c) Specify the required output level with the numeric input keys ㉑ . The ENTRY light starts flashing to prompt registration of the displayed value. The actual output remains at the previously designated level until the new data has been entered.

(d) Press the ENTRY key ⑲ to register the output level indicated on the display. The ENTRY light goes out to indicate that the new data has been registered.

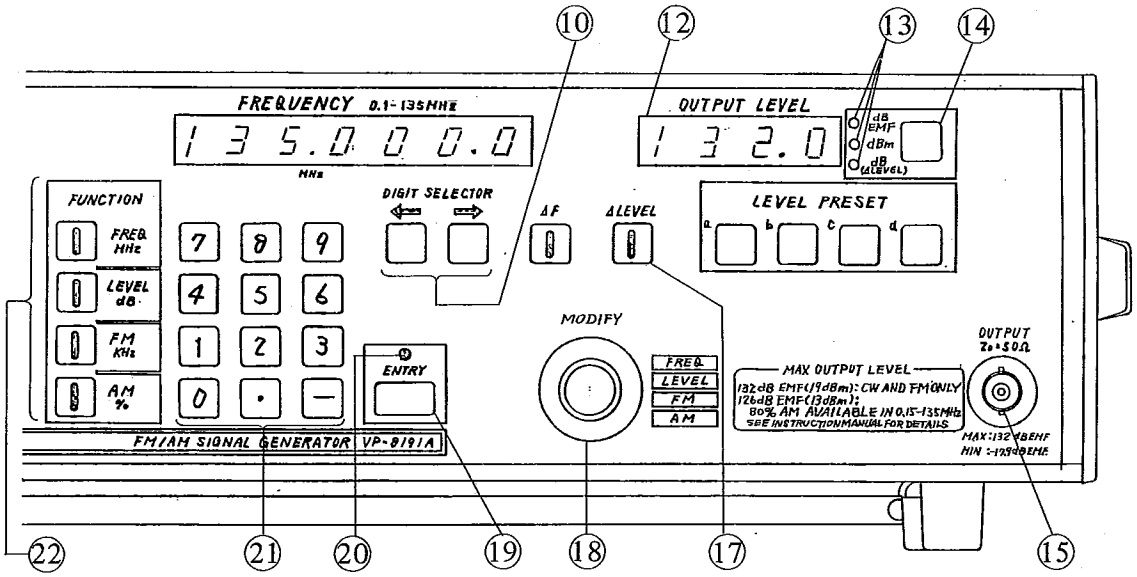


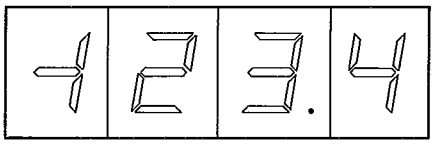
Fig. 4-2 Output level controls

Example: Setting an output level of -123.4 dBm

Step	Keystroke	OUTPUT LEVEL readout	ENTRY key
①	FUNCTION [0] LEVEL dB key	Current value	Off ○ ENTRY
②	dB EMF/dBm unit changeover key ⑭	dBm	
③	[—] key	— .	
④	[1] key	— 1.	
⑤	[2] key	— 12.	Flashing ○ ENTRY
⑥	[3] key	-123.	
⑦	[•] key	-123.	
⑧	[4] key	-123.4	
⑨	ENTRY key	-123.4	○←Off ENTRY

NOTES

1. The minus sign for a 4-digit numeral (e.g. -123.4) will appear as illustrated on the right.



2. The readout accepts values outside the specified display range, but pressing the ENTRY key ⑲ returns the display to the previous value.
3. To correct an error made during the numeric key input, press the LEVEL key a second time and restart.

(4) Setting with the MODIFY Control

The setting can also be altered with the MODIFY control ⑱ :

(a) Press the LEVEL key, the second of the four FUNCTION keys ㉒ , making the light in the key on. The OUTPUT LEVEL readout ⑫ remains to read the previous output level setting.

(b) Press either of the DIGIT SELECTOR keys ⑩ . One of the digits on the OUTPUT LEVEL readout ⑫ will start to flash. This digit may then be altered with the MODIFY control ⑱ .

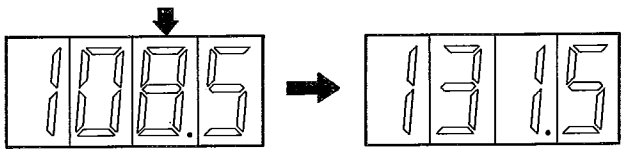
(c) The flashing may be shifted to an adjoining digit with the DIGIT SELECTOR keys ⑩ ← or→.

(d) Rotate the MODIFY control ⑱ to raise or lower the current digit reading. The digit will stop flashing.

(e) Output level setting range

The output level ranges from -17.9 to 132.0 dB for the dB EMF display and from -130.9 to 19.0 dBm for the dBm display. No matter how much the MODIFY control ⑱ is rotated, the display will not read outside these limits. For example, if the digit "8" in Fig. 4-3 is to be altered, rotating the MODIFY control ⑱ clockwise raises the reading to 131.5 dB but no further. Similarly, if the digit "0" in Fig. 4-3 is to be altered, rotating the MODIFY control ⑱ counterclockwise drops the reading only to -11.5 dB. (Note. The indication in the step next to 8.5 is -1.5 in lieu of -8.5, since the decrement is 10 dB in this case.)

Upper limit when the digit "8" is altered



Lower limit when the digit "0" is altered

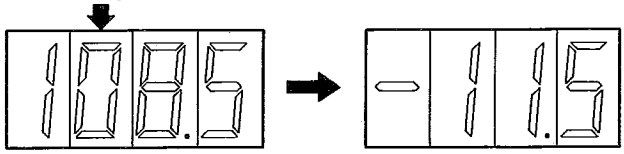


Fig. 4-3 Output level limits

(5) ⊿LEVEL function (⊿LEVEL Direct Reading)

(a) Specify the desired reference output level using the procedure described in paragraph (3) above.

(b) Press the ⊿LEVEL key ⑰ making the light in the key on. The dB (⊿LEVEL) light of the unit indicator ⑬ will come on and the OUTPUT LEVEL readout ⑫ will display 00.0.

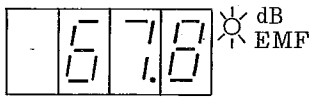
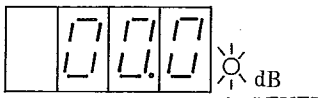
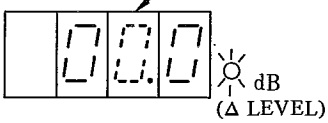
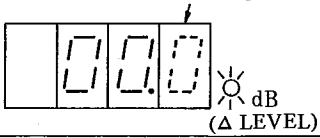
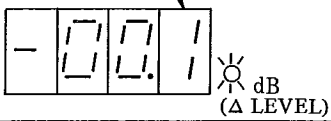
(c) Repeat Steps (b) and (c) in paragraph (4) above to select the digit to be altered.

(d) Repeat Step (d) in paragraph (4). The readout will display the difference between the actual output level and the current reference output level set in step (a) above.

(e) Press the ⊿LEVEL key ⑰ to release the ⊿LEVEL function making the light in the key off. The dB (⊿LEVEL) light will go out and the previous unit indication will resume.

Pressing one of the FUNCTION keys ㉒ automatically releases the ⊿LEVEL function as well.

Example: Lowering the output level by 2.6 dB

Step	Operation	OUTPUT LEVEL readout
①		Current value 
②	⊿LEVEL Press [⊿] key making the light on.	
③	Press either the [←] or [→] key.	Flashing 
④	Press the [→] key.	Flashing 
⑤	Rotate the INCREMENT control counterclockwise (CCW) one step.	The digit should change from "0" to "1" and stop flashing. 
⑥	Rotate the INCREMENT control counterclockwise (CCW) another twenty-five steps.	

4-7 BASIC OPERATION FOR MODULATION CONTROL

Fig. 4-4 shows a part of the front panel related to modulation control operation. Table 4-1 shows the modulation modes available on the VP-8191A and the coresponding output signals:

Table 4-1 Output signals

CW (Unmodulated continuous wave)	Frequency modulation		Amplitude modulation		Mixed FM-AM
Within 100kHz to 135MHz range	FM EXT	FM INT	AM EXT	AM INT	FM EXT + AM INT FM INT + AM EXT
	FM wave generated by modulation of an external signal with a frequency between 20Hz and 120kHz	FM wave generated by modulation of a sine wave with a frequency of 400Hz or 1kHz from the built-in oscillator	AM wave generated by modulation of an external signal with a frequency between 20Hz and 10kHz	AM wave generated by modulation of a sine wave with a frequency of 400Hz or 1kHz from the built-in oscillator	

(1) CW (Unmodulated continuous wave)

Press the MOD ON/OFF key. ㉖ making the light off. The output will be a continuous wave regardless of other current key settings, the presence of external modulation signals, and the displayed modulation degree.

(2) FM and AM

Follow the procedure given in Table 4-2 on page 4-17.

The MODIFY control ⑱ can be used to increment or decrement the set value of the modulation readout ④. The modification can be made over entire range in increments shown below.

	Range	Increment/step	Readout
FM deviation	0 - 100 kHz	0.5 kHz	0.0, 0.5, ... , 99.5, 100
	100 - 120 kHz	See Note below	100, 100., 101, ... , 119, 119., 120
	120 - 240 kHz	1 kHz	120, 121, ... , 239, 240
	240 - 300 kHz	5 kHz	240, 245, ... , 295, 300
% AM	0 - 80 %	0.5 %	0.0, 0.5, ... , 79.5, 80.0

Note: In this FM deviation range, the minimum settable increment is 0.5 kHz although the readout resolution is 1 kHz. The increment/step is thus 0.5 kHz, i.e. two steps are required for 1 kHz increment on the readout. The decimal point display shows an additional 0.5 kHz deviation (e.g. 112 = 112.0 kHz, 112. = 112.5 kHz).

(3) Mixed FM-AM

Simultaneously pressing and turning on a pair of the MODULATION SELECTOR keys ㉗--the FM EXT and AM INT or the FM INT and AM EXT--actuates the corresponding mixed FM-AM modes. The FM deviation and % AM may be altered separately using the procedure just described in Step (2).

Pressing any one of the four MODULATION SELECTOR keys alone releases the mixed FM-AM mode and sets the corresponding single modulation mode.

NOTES

The modulation readout of this Signal Generator is calibrated in the following conditions.

(1) Always for internal modulations.

(2) For external modulations, only when both the OVER and UNDER lights of EXT INPUT annunciators are off.

Note that the readout does not necessarily indicate the FM deviation or % AM actually obtained. It merely indicates the expectable FM deviation or % AM on the assumption that the MOD ON/OFF key is on, and the modulation signal of predetermined reference level has been applied to the modulation circuitry within the instrument. The reference level for calibrated readout is maintained always for internal modulation and by OVER and UNDER annunciators for external modulation.

Accordingly the modulation readout display should be ignored when the MOD ON/OFF key is off, or either OVER or UNDER light is on.

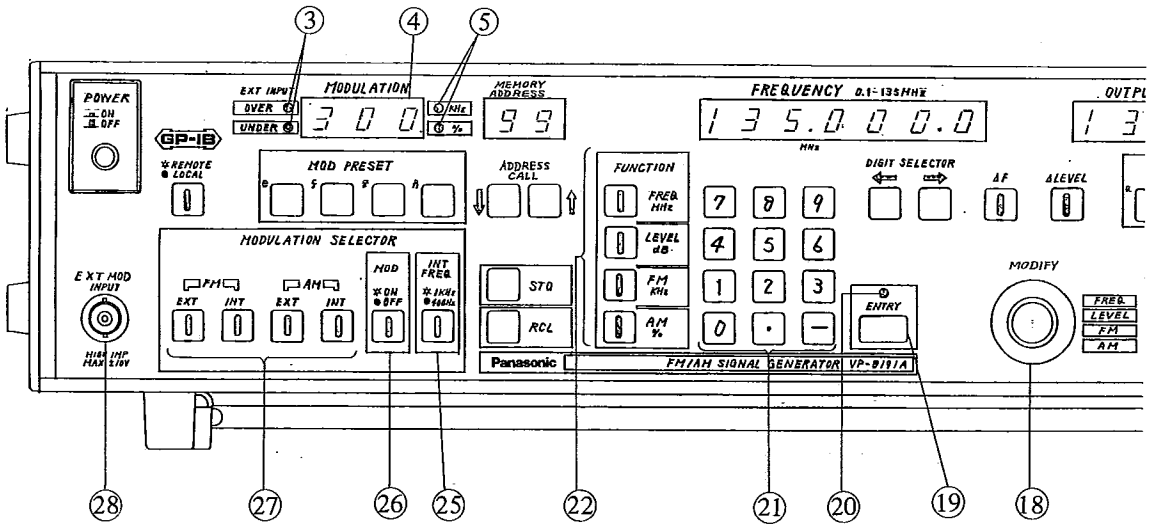


Fig. 4-4 Modulation controls

Table 4-2 Setting up for FM and AM modulation

Frequency modulation		Amplitude modulation	
F M EXT	F M INT	A M EXT	A M INT
Press the FUNCTION FM kHz key making the light on.		Press the FUNCTION AM % key making the light on.	
FM EXT [0] Press the key making the light on.	FM INT [0] Press the key making the light on.	AM EXT [0] Press the key making the light on.	AM INT [0] Press the key making the light on.
EXT INPUT OVER UNDER Adjust the external tone signal level applied to the EXT AF INPUT terminals until both the OVER and UNDER lights go out.	———	EXT INPUT OVER UNDER Adjust the external tone signal level applied to the EXT AF INPUT terminals until both the OVER and UNDER lights go out.	———
7 8 9 / 4 5 6 / 1 2 3 / 0 · − Enter the required modulation degree (FM deviation or % AM) through the numeric input keys. → ENTRY Press the ENTRY key. The flashing light will go out.			
MODULATION 99.5 0kHz The entered FM deviation is displayed		MODULATION 80.0 0% The entered % AM is displayed.	
———	INT FREQ *1kHz •400Hz [0] Select 1 kHz or 400 Hz.	———	INT FREQ *1kHz •400Hz [0] Select 1 kHz or 400 Hz.
MOD *ON •OFF [0] Press the MOD ON/OFF key making the light on to activate the modulation function.			

NOTES

1. The % AM display covers the range between 0.0 and 99.5%, but performance is only guaranteed between 0.0 and 80.0%. Any setting above this range will not provide quantitative modulation with the stated performances.
2. AM setting can be made for any level of RF output. However, any setting for output level above 13 dBm (126 dB EMF) will not provide AM with the stated performances.
3. Low carrier frequencies impose a restriction on the maximum modulation frequency: At 30% modulation, the maximum modulation frequency is 2% of the carrier frequency. At a carrier frequency of 150kHz, for example, the maximum modulation frequency that can be used with 30% modulation is 3kHz.
4. When the FM carrier frequency is below 3MHz, the FM deviation display covers the range between 0.0 and 300 kHz, but performance is only guaranteed between 0.0 and 30.0 kHz (RF < 0.3MHz), between 0.0 and 99.5 kHz (0.3MHz ≤ RF < 3MHz). Any setting above this range will not provide quantitative modulation with the stated performances.

4-8 CONNECTION WITH STEREO MODULATOR

(1) Setting range for external AF input level and modulation degree

Fig. 4-5 shows the relationship between external AF input level and FM deviation.

Press the MODULATION SELECTOR FM EXT key ㉗ making the light in the key on. The EXT INPUT UNDER light ③ then comes on. Connect the external AF signal to the EXT MOD input ㉘ with a coaxial or unshielded cable. Adjust the output level of the signal source until both the EXT INPUT OVER and UNDER lights ③ go out. The light respond to the peak values for either single or composite signal.

The FM deviation changes linearly with the input level. (See Fig. 4-5.) If FM is first set to 75.0 kHz (100%) deviation, for example, attenuating the AF input level by 20 dB reduces the deviation to 7.5 kHz (10%) leaving the display as it was, i.e. 75 kHz. The EXT INPUT UNDER light comes on in this case. (See NOTES on page 4-16.)

(2) Connection with stereo modulator VP-7633A

When the NATIONAL stereo modulator VP-7633A is used, the operation procedure is:

(a) Connect the modulator output terminal to EXT MOD INPUT connector ㉘ with a coaxial cable.

(b) Press MODULATION SELECTOR FM EXT key ㉗ making the light in the key on. The EXT INPUT UNDER light comes on.

(c) First, set L = R signal level to 90% and the pilot signal level to 10%. Then, set the modulator output mode to MONO. Adjust the composite output level until both the EXT INPUT OVER and UNDER lights ③ go out. Switch the output mode to L = R and turn the pilot signal ON.

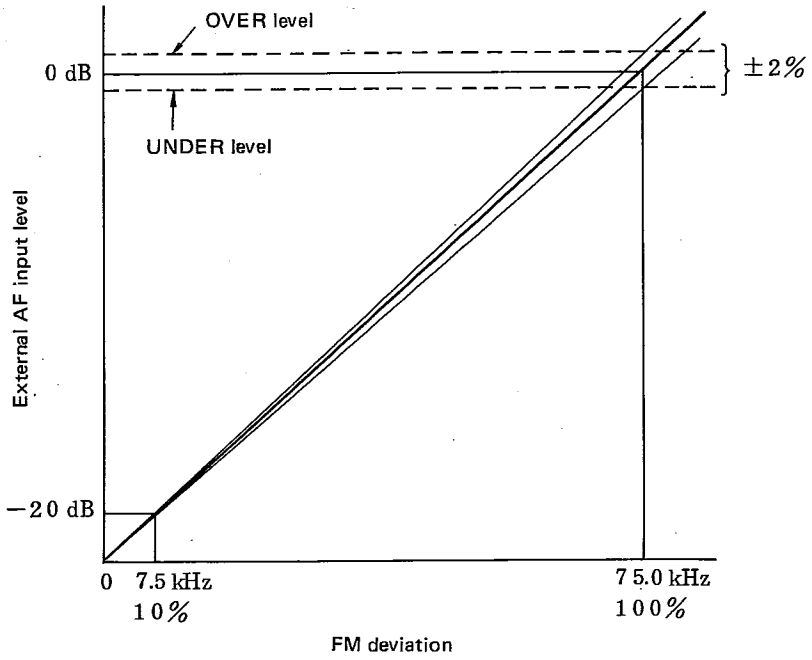


Fig. 4-5 Relationship between external AF input level and FM deviation setting

(d) Turn on MOD ON/OFF key and set FM deviation to 75 kHz to obtain a 100% modulated FM stereo composite signal with L = R and pilot signals of 67.5 kHz and 7.5 kHz, respectively. Turning the pilot signal off makes the EXT INPUT UNDER light on, but provides a normal 67.5 kHz modulation by the L = R signal leaving the modulation readout displaying 75 kHz.

(e) Press the modulator's REDUCED key making the light in the key on and reduce the L = R signal deviation to 20.25 kHz (67.5 kHz x 30%). Adding the pilot signal yields one of 27.75 kHz (= 20.25 + 7.5 kHz).

(f) Switch the modulator output mode to select L = R, L, R, or L = -R as desired for receiver measurements.

NOTES

1. The FM deviation displays read 75.0 kHz throughout Steps (d) to (f) regardless of the EXT INPUT annunciator's status.
2. Even though the modulator has been set to extinguish both the OVER and UNDER lights in the MONO output mode, switching it to L = R L, R, and L = -R may sometimes light one of them. Since this is due to the extremely narrow OVER/UNDER discrimination range, the error is negligible for practical use.
3. For further details on receiver test methods, refer to the VP-7633A Instruction Manual.

4-9 ASSORTED PRESET OPERATION

Fig. 4-6 shows the panel controls related to the assorted preset operation.

(1) General

The assorted preset function of the VP-8191A stores up to 100 setups of frequency, output level, modulation degree, modulation type, and ON/OFF setting in the memory for instant recall whenever required.

(a) Each setup consists of:

Frequency

- Contents of seven-digit frequency display

Output level

- Contents of four-digit output level display
- Display unit (dB EMF or dBm)

Modulation

- Current state (ON or OFF) of modulation signal sources (FM EXT, FM INT, AM EXT, or AM INT) or combinations thereof.
- MOD ON/OFF key state
- INT FREQ (1 kHz or 400 Hz) key state
- Contents of three-digit modulation degree display
- Display unit (kHz or %)

(b) Selected memory address

Each set of assorted preset data is labeled with a 2-digit number on the memory display ⑦ .

(2) Store Operation

The procedure for data storage is shown below:

(a) Perform the panel operation to the desired parameters and check each display.

(b) Press the STO key ㉓ . The ENTRY light ⑳ flashes to prompt for numeric key input.

(c) Enter the required memory address with the numeric input keys ㉒ , and check the number on the panel display. The displayed number may be corrected by pressing the STO key a second time and reentering.

(d) Press the ENTRY key ⑲ . The ENTRY light ⑳ goes out once the data has been stored.

As an actual example, store the data shown in the table below.

Item	Value/state to be stored
Memory address	15
Frequency	83.0000 MHz
Output level	76.0, dB EMF
Modulation • Signal source • Modulation ON/OFF • Internal frequency • Frequency deviation	 FM INT ON 1 kHz 75.0 kHz

Step	Procedure
1	Register the frequency of 83 MHz: • FUNCTION keys ..... Press the FREQ key. • Numeric input keys ..... Input 83.0000. • ENTRY key ..... Press.
2	Register the output level of 76.0 dB EMF: • FUNCTION keys ..... Press the LEVEL key. • Unit display ..... Select dB EMF. • Numeric input keys ..... Input 76.0. • ENTRY key ..... Press.
3	Register the modulation state: • FUNCTION keys ..... Press the FM key. • Modulation signal source .... Press the FM INT key. • Numeric input keys ..... Input 75.0. • ENTRY key ..... Press. • INT FREQ key ..... Select 1 kHz.
4	Register 15 as the address number: • STO key ..... Press. • Numeric input keys ..... Input 15. • ENTRY key ..... Press.

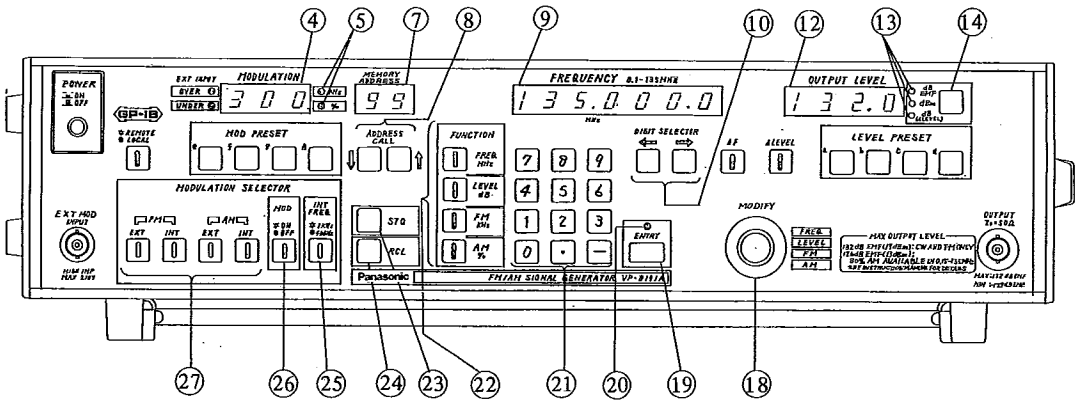


Fig. 4-6 Panel controls for assorted preset

(3) Single Recall Operation (Basic operation)

(a) Press the RCL key ㉔ .

(b) Enter the two-digit number for the address to be recalled with the numeric input keys ㉑ .

(c) Check the number on the panel display.

The panel display can be adjusted with the ADDRESS CALL keys ⑧ instead of entering a new number with the RCL key ㉔ .

NOTE

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

(4) Sequential Recall Operation

It is also possible to restrict the range so that pressing either of the ADDRESS CALL keys ⑧ sequentially recalls the data stored between two preset start and end addresses rather than all one hundred 00 to 99.

(a) Setting the limits

The start and end addresses are assigned with the following type of sequence: .

[STO] key → [·] key → Numeric keys (Start address) → [·] key

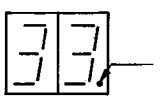
→ Numeric keys (End address) → [ENTRY] key (Setting end)

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.

(b) Sequential recall display

When recall range is restricted, a decimal point lights to the right of the number.



(c) Releasing the function

Assigning the same number for the start and end addresses (e.g. 12) releases the function.

	Start address			End address		
STO key →	· key →	1 key →	2 key →	· key →	1 key →	2 key

→ ENTRY key (Restriction released)

Pressing the RCL key ㉔ and assigning an address outside the restricted range extinguish the decimal point and temporarily release the sequential recall function. Once the display returns--by operations with ADDRESS CALL, or RCL key-- within the restricted range, however, it is reactivated.

4-10 INDEPENDENT PRESET OPERATION

Fig. 4-7 shows the panel controls related to the independent preset operation.

(1) Independent output level preset

The output level of this Signal Generator can be adjusted over the entire range with the MODIFY control alone. The independent output level preset function, however, simplifies the setting procedure. It is especially helpful when some particular output levels are repeatedly used. Up to four such levels may be stored. The procedure is explained with an actual example.

(a) Choose the preset levels.

This example assigns levels of 120, 80, 20, and 0 dB EMF to the LEVEL PRESET keys a, b, c, and d, respectively. Press the unit changeover key ⑭ to light the dB EMF light of the dB EMF/dBm/dB (⊿LEVEL) unit display ⑬ .

(b) Set the output level display ⑫ to 120 dB using either the numeric input keys (see paragraph 4-6, (3)) or the MODIFY control (see paragraph 4-6, (4)).

(c) Press the STO key ㉓ .

(d) Press "a" key of the LEVEL PRESET keys ⑯ .

(e) Press the ENTRY key ⑲ . When the ENTRY light goes out, the operation is complete.

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

(g) Recall operation

Pressing one of the LEVEL PRESET keys "a" to "d" immediately recalls the output level assigned to the key to the OUTPUT LEVEL display and changes the signal level at the OUTPUT connector ⑮ .

Store operation

Step	Procedure
1	Choose the preset levels. 120 dB key "a" 80 dB key "b" 20 dB key "c" 0 dB key "d"
2	Set the output level to 120.0 dB EMF. • FUNCTION keys ..... Press the LEVEL key. • Unit display ..... Select dB EMF. • Numeric input keys ..... Enter 120.0. • ENTRY key ..... Press.
3	[□ STO] key ..... Press.
4	LEVEL PRESET [a] [□] key ..... Press.
5	ENTRY key ..... Press the key and check that the ENTRY light goes out.
6	LEVEL PRESET Assign levels of 80, 20, and 0 dB to the keys "b", "c", and "d", respectively.

Recall operation

Step	Procedure
1	LEVEL PRESET [a] [□] key ..... Press.
2	OUTPUT LEVEL [120.0] [o dB EMF] ..... Displayed providing the output.

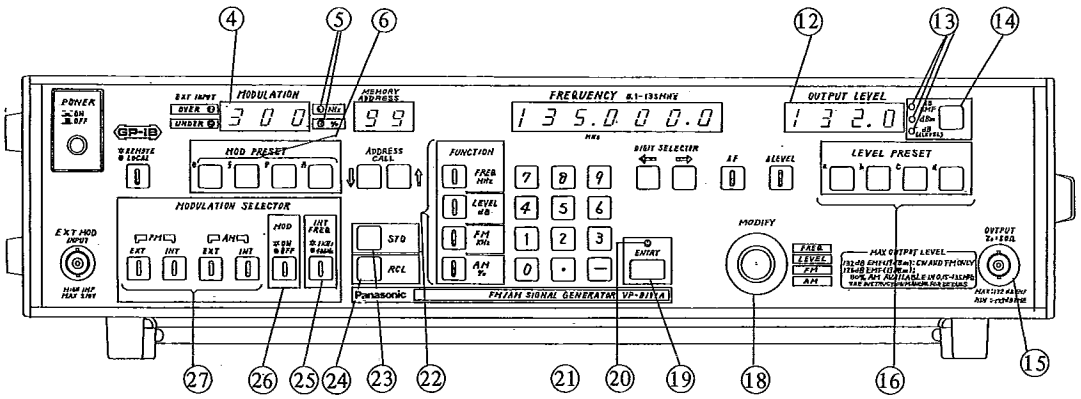


Fig. 4-7 Independent output level preset controls

(2) Independent Modulation Preset

Similarly, the independent modulation preset function simplifies the task of setting the modulation functions (modulation on/off, modulation type, internal modulation frequency, and modulation degree). This preset function is especially helpful when some particular modulation settings are repeatedly used. Up to four such setups--either single or mixed FM-AM modulation--can be stored. The operation procedure is explained below with an actual example.

(a) Choose the preset modulation functions.

This example assigns modulation functions of FM INT, 1 kHz, 99.5 kHz, and modulation ON to the key "e".

(b) Set modulation functions according to the basic operation procedure described in Table 4-2.

(c) Press the STO key ㉓ .

(d) Press "e" key of the MOD PRESET keys ⑥ .

(e) Press the ENTRY key ⑲ . When the ENTRY light goes out, the operation is complete.

(f) Recall operation

Pressing the key "e" immediately recalls the preset modulation functions and changes the output from the OUTPUT connector ⑮ . The keys "f", "g", and "h" operate in exactly the same way.

Store operation

Step	Procedure
1	Choose the modulation functions. FM INT, 1 kHz, 99.5 kHz and MODULATION ON "e" key
2	Assign the setups to the key "e". • FUNCTION keys ..... Press the FM key. • Modulation signal source .... Press the FM INT key. • Numeric input keys ..... Enter 99.5. • ENTRY key ..... Press. • INT FREQ key ..... Select 1 kHz.
3	[□ STO] key ..... Press.
4	MOD PRESET e □ key ..... Press.
5	ENTRY key ..... Press it and check that the ENTRY light goes out.
6	The keys "f", "g", and "h" operate in exactly the same way.

Recall operation

Step	Procedure
1	MOD PRESET e □ key ..... Press.
2	MODULATION [99.5] [o kHz] ..... Displayed providing the output.
3	The keys "f", "g", and "h" operate in exactly the same way.

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.

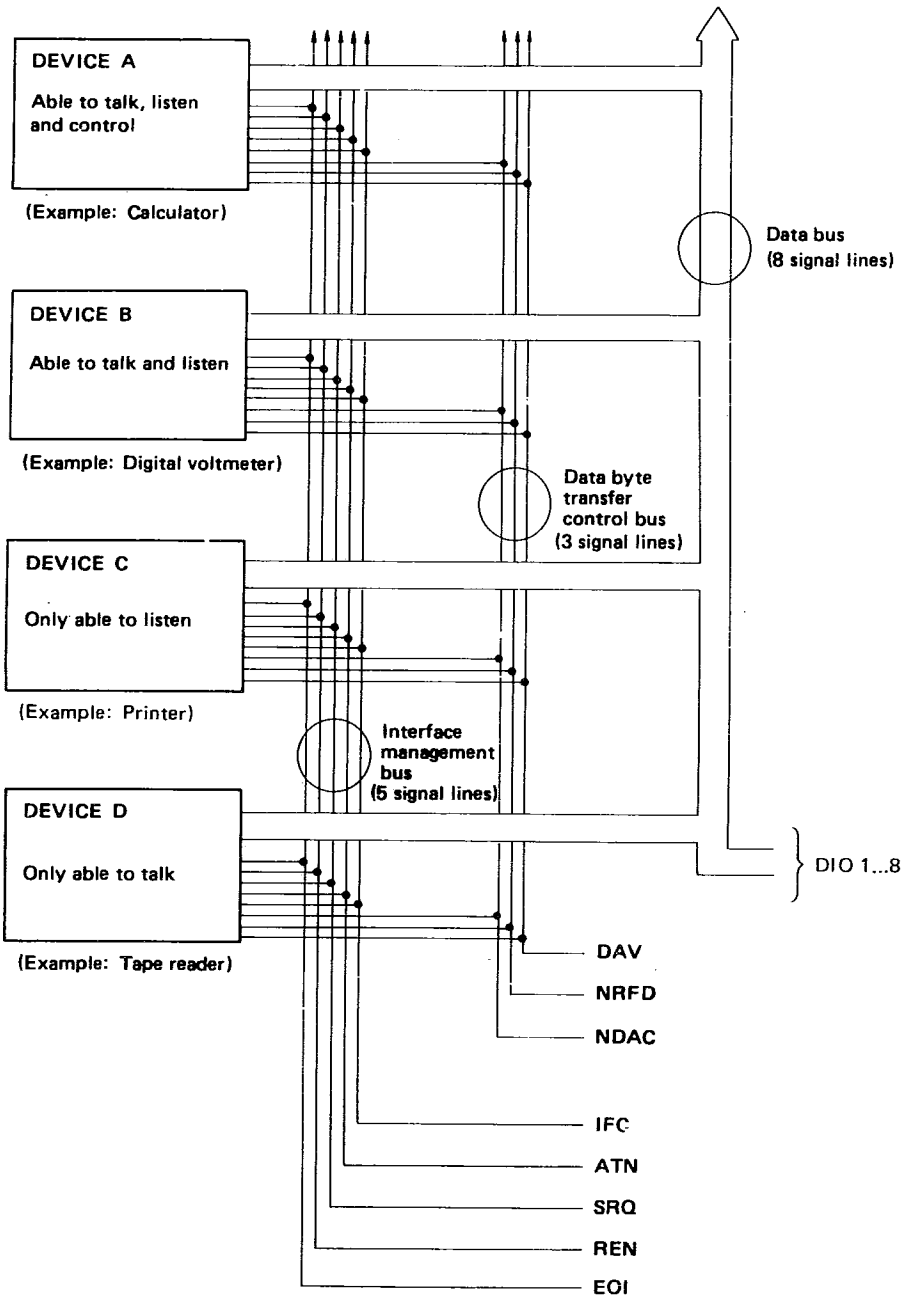


Fig. 5-1 Interface connection and bus structure

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.

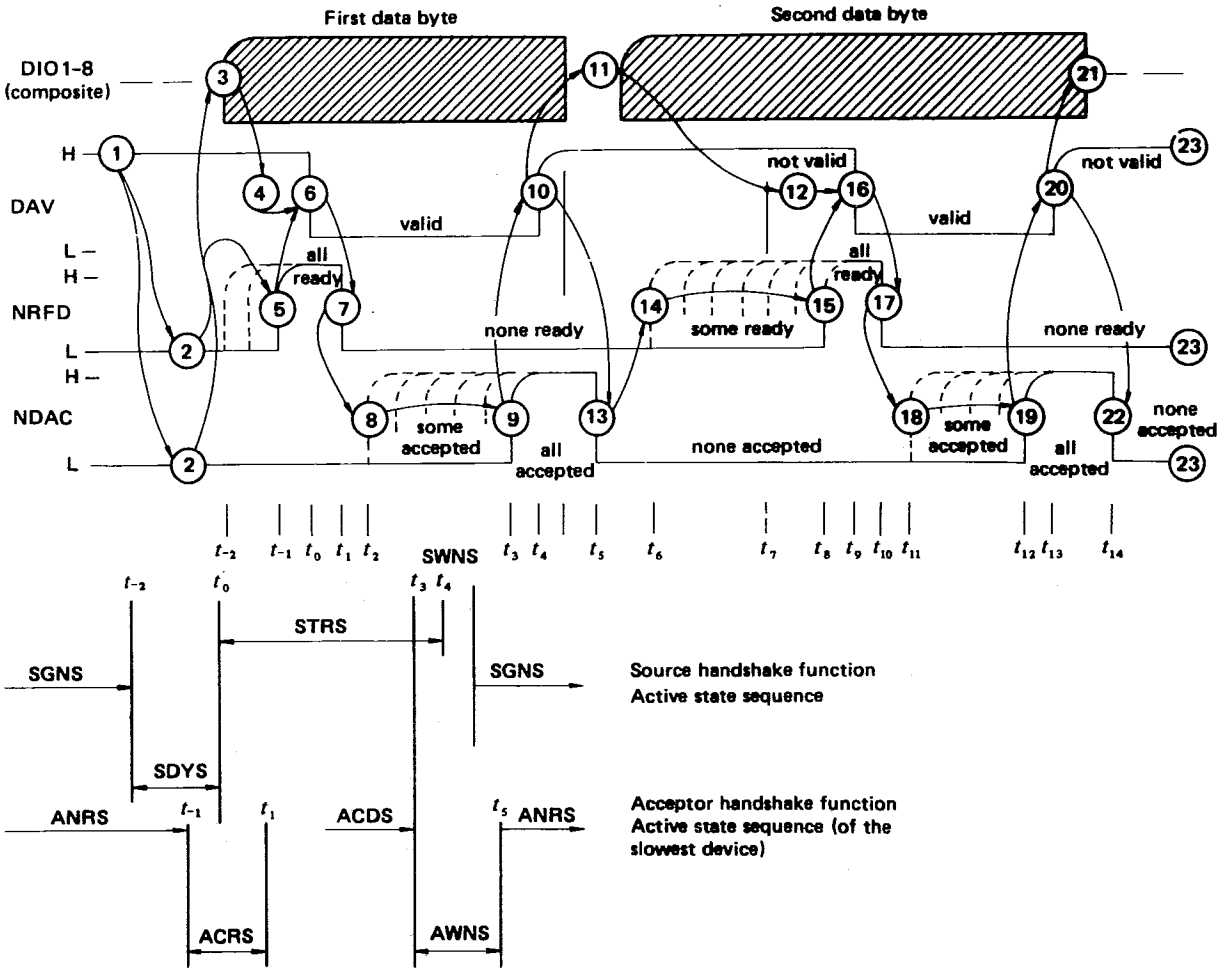


Fig. 5-2 Timing chart for handshaking

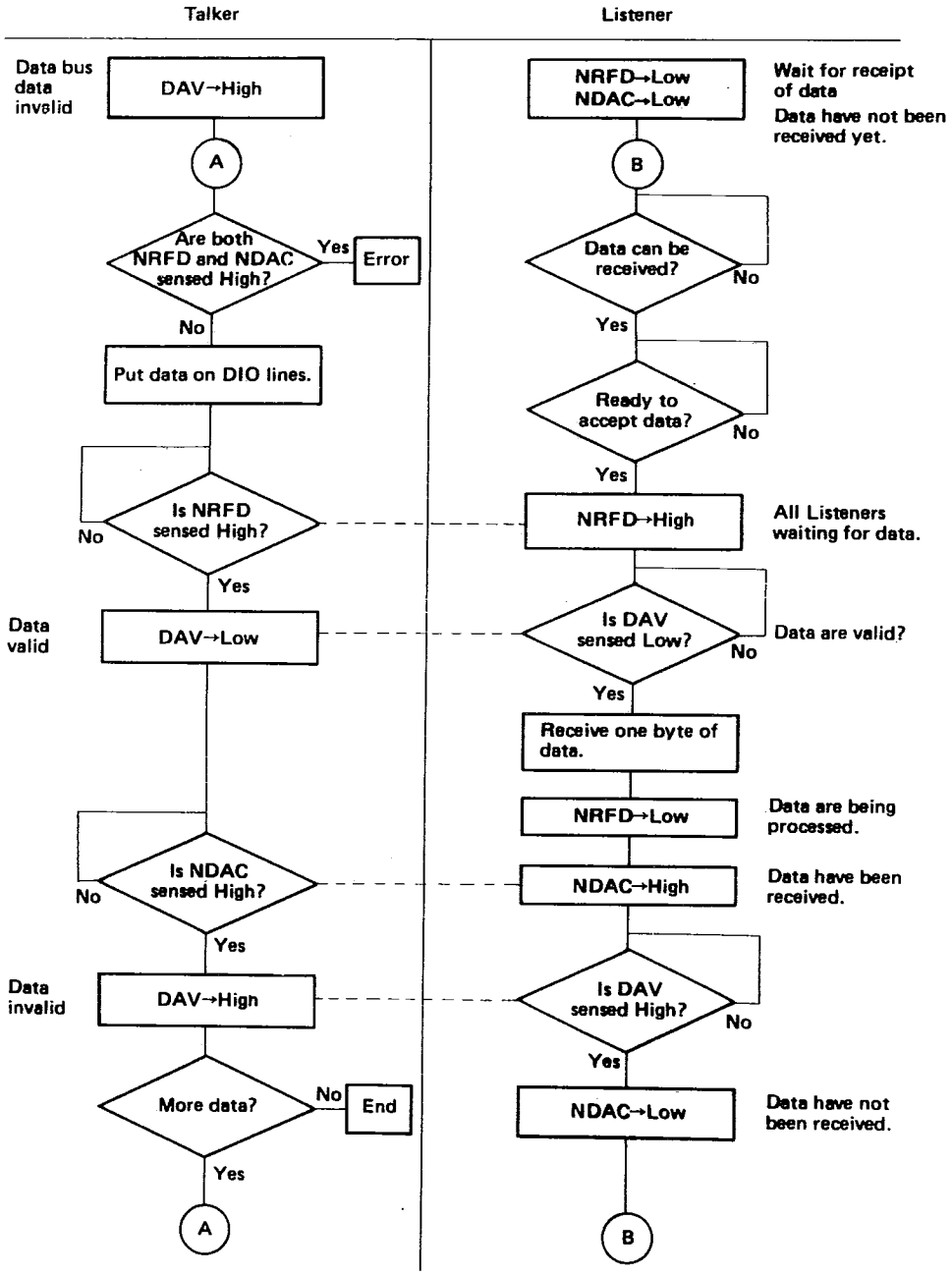


Fig. 5-3 Flowchart for handshaking according to the IEEE488 standard

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 Handshaking lines (DAV, NRFD, NDAC) Interface management lines (ATN, REN, IFC, SRQ, EOI)	8 lines
-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

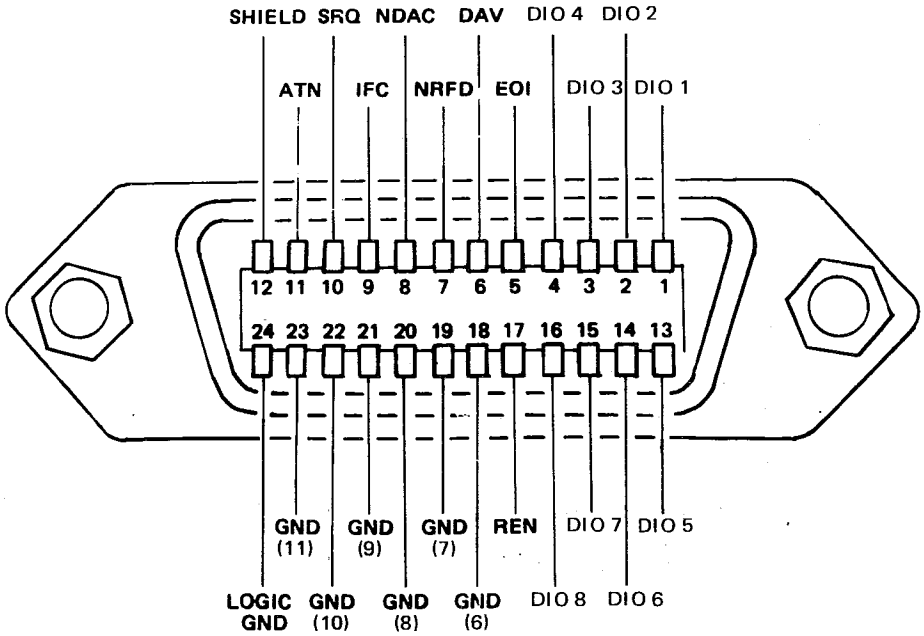


Table 5-1 Connector contact assignment

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	18	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 / ② b4 b3 b2 b1 / Column Row →	0_0	① MSG	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
	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	PPC ③	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	

MLA assigned to device

MLA assigned to device

MTA assigned to device

MTA assigned to device

Meaning defined by PCG code

Meaning defined by PCG code

Addressed command group (ACG)

Universal command group (UCG)

Listen address group (LAG)

Talk address group (TAG)

Primary command group (PCG)

Secondary command group (SCG)

NOTES: ① MSG = INTERFACE MESSAGE

② b_1 = DIO 1 ... b_7 = DIO 7

③ REQUIRES SECONDARY COMMAND

SECTION VI
GP-IB INTERFACE

6-1 GENERAL

The GP-IB interface allows the VP-8191A to operate under programmable control with the frequency, output level, modulation, memory, and other function set by program codes sent from an external device. The setup of the Signal Generator can be sent, so control programming is easy.

6-2 GP-IB INTERFACE CAPABILITY

Table 6-4 lists the interface capabilities of the VP-8191A's GP-IB implementation which provides the basic listener/talker, remote/local, and device clear functions.

6-3 DEVICE ADDRESS SETTING

The device address is set with DIP switches 2 to 6 labeled ADDRESS on the rear panel. (See Table 6-5.)

NOTES

1. Set the GP-IB device address before turning on the power supply since the GP-IB address changes only at instrument power-up.
   The address "31" (all switches ON) is prohibited. It automatically disables GP-IB interface operation.
2. Use a shielded GP-IB cable and connector that comply with FCC, CISPR, VDE, and other standards for interference suppression.

6-4 DEVICE CLEAR FUNCTION

A DCL or SDC signal sets this Signal Generator to the initial state shown in Table 6-1.

Table 6-1 Device clear function

Frequency	100.0000 MHz
Output level	0.0 dB
dB EMF/dBm/dB (⊿LEVEL) unit	dB EMF
Modulation degree FM	0.0 kHz
Modulation degree AM	0.0 %
Modulation selection	FM INT, AM INT
kHz / %	kHz
MOD ON/OFF	OFF
INT FREQ	400 Hz
Memory address	00
FUNCTION	FREQ
DIGIT SELECTOR	
Frequency	100 Hz (rightmost digit)
Output level	0.1 dB (rightmost digit)

6-5 FUNCTIONS ALLOWING REMOTE CONTROL

The functions accessible through the GP-IB interface are shown in Table 6-2; the function not controllable, in Table 6-3.

Table 6-2 Functions accessible through GP-IB interface

Frequency setting	0.0800 to 136.0000 MHz
Output level setting	dB EMF -17.9 to 132.0 dB
	dBm -130.9 to 19.0 dBm
Modulation signal setting	
FM	0.0 to 300 kHz
AM	0.0 to 99.5 %
FM INT, FM EXT, AM INT, AM EXT selection	
FM EXT + AM INT, FM INT + AM EXT selection	
INT FREQ 1 kHz/400 Hz selection	
MOD ON/OFF selection	
Assorted preset STO/RCL	

Table 6-3 Function not accessible through GP-IB

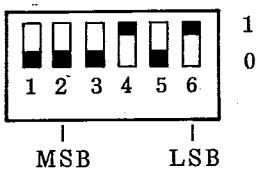
FUNCTION key selection

Table 6-4 Interface functions

Function	Code	Description
Source handshake	SH1	Complete capability
Acceptor handshake	AH1	Complete capability
Talker	T8	Basic talker, and talker release by MLA
Listener	L4	Basic listener, and listener release by MTA
Service request	SP0	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

Table 6-5 Device address setting

(The device address with this setting is 5.)



[0: ADDRESS switch OFF
1: ADDRESS switch ON]

Switch No.	2	3	4	5	6
Device address (Decimal)	MSB				LSB
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
≈	≈	≈	≈	≈	≈
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0

6-6 REMOTE/LOCAL FUNCTION

The remote/local function is controlled by the system controller and REMOTE/LOCAL key ② on the front panel. The VP-8191A is always in one of the three following states:

(1) Local Mode

The VP-8191A enters the local mode when:

i) The power is turned on.

ii) The REMOTE/LOCAL key ② is pressed, making the light in the key 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-8191A 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 REMOTE/LOCAL key ② .
2. The transition from the local to remote mode does not change any of the panel settings.

(3) Remote Mode with Lockout

This variant of the remote mode disables returning to the local mode by pressing the REMOTE/LOCAL key ② .

The VP-8191A stays in the remote mode, until it receives a GTL address command, the REN line turns false, or the power is turned off and reapplied.

6-7 RESPONSE TO COMMANDS

Table 6-6 summarizes the commands and the Signal Generator's response to them.

Table 6-6 Response of VP-8191A to commands

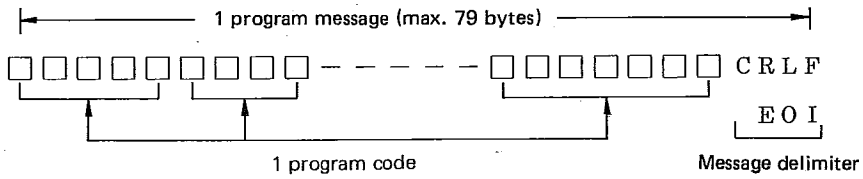
Type	Name	Description	Response
Unaddress commands	UNL	Releases specified listener	yes
	UNT	Releases specified talker	yes
Addressed commands	IFC	Uniline commands.	yes
	REN		yes
	ATN		yes
	DCL	Clears all devices.	yes
	SPE	Enables serial polling.	no
	SPD	Clears serial polling.	no
	PPU	Clears parallel polling.	no
	LLO	Puts all devices in local lock-out state to inhibit manual operation.	yes
Universal commands	SDC	Clears specified device.	yes
	GTL	Puts specified device in local mode.	yes
	PPC	In parallel polling, enables parallel polling line assignment to specified listener.	no
	GET	Provides triggering to specified device.	no
	TCT	Transfers bus control to the talker-specified controller (when the system has two or more controllers).	no

6-8 PROGRAM CODE INPUT FORMAT

(1) Input Program Message Format

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-8191A through the GP-IB interface. The VP-8191A is able to receive up to 79 ASCII bytes long (including the terminating carriage return line feed pair or EOI) for one program message.

The message format is:



The individual program words may be written continuously or delimited with commas (,) or spaces (␣). Table 6-9 lists the individual input formats.

Example: The following three sequences all set the frequency to 100.0000 MHz, the output level to 7.0 dBm, and the % AM to 30.0%.

1. With nothing between program words:

FR100.0000	LE7DM	AM30.0	CRLF
Frequency	Output level	AM modulation degree	Delimiter

2. With commas (,) between program words:

FR100.0000	,	LE7DM	,	AM30.0	CRLF
Frequency		Output level		AM modulation degree	Delimiter

3. With spaces (␣) between program words:

FR100.0000	␣	LE7DM	␣	AM30.0	CRLF
Frequency		Output level		AM modulation degree	Delimiter

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, and a data code (usually a number).

Example: The following sequence sets the frequency to 135.0000 MHz.

FR	135.0000
Header	Data code

(a) Frequency setting

The frequency can be set in MHz, anywhere between 0.0800 MHz and 136.0000 MHz with the header FR and the frequency expressed as a fixed-point decimal number.

Example: The following sequence sets the frequency to 123.4567 MHz.
FR123.4567

NOTES

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

(b) Output level setting

The output level can be set anywhere between -17.9 dB EMF and 132.0 dB EMF (or -130.9 dBm and 19.0 dBm) with the header LE, and data specification consisting of an optional negative sign (-) and numerals (0 to 9) and the unit code DB or DM.

Examples:

1. The following sequence sets the open-end output (dB EMF) to 100.0 dB.
   LE100.0DB
2. The following sequence sets the output (dBm) to -13.0 dBm.
   LE-13.0DM

NOTES

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

(c) Modulation degree setting

Table 6-7 shows the ranges for modulation degree settings.

The header is either FM for FM modulation or AM for AM modulation. The data consists of numerals (0 to 9) and the decimal point (.).

Table 6-7 Modulation degree setting ranges

Type	Range	Frequency range
FM modulation	0.0 to 300 kHz	3.0000 to 136.0000 MHz
	0.0 to 99.5 kHz	0.3000 to 2.9999 MHz
	0.0 to 30.0 kHz	0.0800 to 0.2999 MHz
AM modulation	0.0 to 99.5 %	0.1500 to 136.0000 MHz

NOTES

1. Performance cannot be guaranteed for FM modulation settings outside the range 0.1000 to 135.0000 MHz.
2. Performance cannot be guaranteed for AM modulation settings above 80.0%.
3. Performance cannot be guaranteed for AM modulation setting for output level above 13 dBm (126 dB EMF).

NOTES

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

Example 1: The following sequences set FM deviation to 75.0 kHz.
FM75.0 or FM75

Example 2: The following sequences set % AM to 30.0 %.
AM30.0 or AM30

(d) MOD ON/OFF selection

The header is MO; the data code, 0 or 1.

MO1 . . . . . MOD ON

MO0 . . . . . MOD OFF

NOTE

A command with a number other than 0 and 1 is ignored.

(e) Modulation signal source selection

Table 6-8 lists the modulation signal sources and source combination available. The header is IS; the data code, a one- or two-digit number.

Table 6-8 Modulation signal source selection

Signal source(s)	Header and data code	Modulation type
FM EXT FM INT	IS1 IS2	FM modulation
AM EXT AM INT	IS3 IS4	AM modulation
FM EXT + AM INT FM INT + AM EXT	IS14 IS23	Mixed FM-AM modulation

NOTE

A command other than those listed above is ignored.

(f) INT FREQ 1 kHz/400 Hz selection

The VP-8191A provides two internal tone signal frequencies: 1 kHz and 400 Hz. The header is TO; the data code, 1 or 4.

TO1 . . . . . 1 kHz selection

TO4 . . . . . 400 Hz selection

NOTE

A command with a number other than 1 and 4 is ignored.

(g) Preset Data Store

The VP-8191A has memory area for storing panel settings--100 (00 to 99) for assorted preset, 4 (A to D) for independent output preset, and 4 (E to H) for independent modulation preset--which are accessible through the GP-IB interface.

The header is ST; the data code, two-digit number (00 to 99) for the assorted preset or a signal uppercase letter (A to H) for the independent preset.

Examples:

1. The following sequence stores the current panel settings--frequencies, output levels, and modulation functions--at the assorted preset address 15.

   ST15

2. The following sequence assigns the current output levels to the independent output level preset key "a".

   STA

3. The following sequence assigns the current modulation state to the independent output level preset key "f".

   STF

(h) Preset Data Recall

Similarly, these presets may also be recalled. The header is RC; the data code, one of those used for storing.

Examples:

1. The following sequence recalls the assorted data preset stored at memory address 15.

   RC15

2. The following sequence recalls the independent output level preset assigned to key "a".

   RCA

3. The following sequence recalls the independent modulation preset assigned to key "f".

   RCF

NOTE

A command with a number other than 00 to 99 or a letter other than A to H is ignored.

Table 6-9 Input format list

Item	Header	Data code	Description
Frequency	FR	0.0800 to 136.0000	Select a frequency between 0.0800 and 136.0000 MHz.
Output level	LE	-17.9DB to 132.0DB -130.9DM to 19.0DM	Set the output level in dB (EMF) unit. Set the output level in dBm unit.
Modulation degree	FM AM	0.0 - 300 0.0 - 99.5	Set the FM frequency deviation (0.0 to 300 kHz) Set the AM modulation degree (0.0 to 99.5%)
MOD ON·OFF	MO	0 1	Switches modulation OFF Switches modulation ON
Modulation signal source	IS	1 2 3 4 14 23	FM EXT FM INT AM EXT AM INT FM EXT - AM INT } Mixed FM - AM FM INT - AM EXT }
INT FREQ 1 kHz·400 Hz	TO	4 1	400 Hz 1 kHz
Store (STO)	ST	00 - 99 A - D E - H	Store assorted preset at specified memory address (00 to 99) Assign independent output preset to specified key (a to d) Assign independent modulation preset to specified key (e to h)
Recall (RCL)	RC	00 - 99 A - D E - H	Recall assorted preset from specified address (00 to 99) Recall independent output preset (a to d) Recall independent modulation preset (e to h)

6-9 PROGRAM CODE OUTPUT FORMAT

The VP-8191A has the basic talker function. When it is designated as the talker, it sends all settings to the controller (listener). Use of this function enables control programming without the need to master the individual input formats of VP-8191A.

The output data is sent in the order frequency, output level, modulation degree, modulation signal source, internal tone frequency (1 kHz/400 Hz), and modulation ON/OFF divided with spaces (␣). As the delimiter, EOI and LF are provided simultaneously.

(Example)

The following sequence indicates that the Signal Generator is currently set to a frequency of 83.0000 kHz, and output level of 75.0 dB, an FM deviation of 75.0 kHz (FM INT mode), and an INT FREQ of 1 kHz and that the modulation signal is ON.

FR83.0000␣LE75.0DB␣FM75.0 IS2␣TO1␣MO1 CRLF EOI
Delimiter

6-10 PROGRAM EXAMPLES

The programs below, written for the Matsushita's C-7000 personal computer, illustrate GP-IB control of the VP-8191A.

Example 1

Sample program 1 sets the frequency to 98.0000 MHz, output level to 103 dB (EMF), FM deviation to 22.5 kHz (FM INT mode), and internal frequency to 1 kHz and turns modulation ON.

```
100 !
110 !******** SAMPLE PROGRAM 1 *******
120 !
130 !*** SET DATA SIZE & OPEN GPIB FILE ***
140 !
150         DIM DATA$*63
160         OPEN #1:$IB0,VARIABLE(63)
170 !
180 !*** SEND INTERFACE CLEAR ***
190 !
200         IFC #1
210 !
220 !*** INPUT DEVICE ADDRESS ***
230 !
240         INPUT PROMPT "ADDRESS= ":A
250         CONNECT #1:30=A
260 !
270 !*** SEND DATA FOR DEVICE ***
280 !
290 !         ++++++++++++++++++++++++++++++++++++++++++++++
300 !         +                                            +
310 !         +      FREQUENCY          98.0000 MHz        +
320 !         +      OUTPUT LEVEL       103.0   dBuV       +
330 !         +      FREQUENCY MOD       22.5   KHz        +
340 !         +      TONE FREQENCY         1    KHz        +
350 !         +      FM - INT, MOD ON                      +
360 !         +                                            +
370 !         ++++++++++++++++++++++++++++++++++++++++++++++
380 !
390         DATA$="FR98.0000LE103.0DBFM22.5T01IS2M01"
400         OUTPUT #1:DATA$
410 !
420 !*** CLOSE GPIB FILE ***
430 !
440         CLOSE #1
450         END
```

Example 2

Sample program 2 makes use of the VP-8191A's talker function to create a control program file: It reads the panel settings in the specified order and stores them in the same order in the control file.

```
100 !
110 !****** SAMPLE PROGRAM 2 *****
120 !
130 ! *** SET DATA SIZE & GPIB FILE OPEN ***
140 !
150         DIM DATA$(100)*63
160         OPEN #1:$IB0,VARIABLE(63)
170 !
180 !*** SEND INTERFACE CLEAR ***
190 !
200         IFC #1
210 !
220 !*** INPUT DEVICE ADDRESS ***
230 !
240         INPUT PROMPT "ADDRESS= ":A
250 !
260 !*** LOOP COUNTER INITIAL & SEND DEVICE CLEAR ***
270 !
280         I=0
290         DCL #1
300 !
310 !*** SET PANNEL DATA ***
320 !
330         GTL #1
340           PRINT "SET DATA "
350           LINPUT PROMPT "SET OK ? or END (Y/N/END) ":A$
360           IF A$="END" THEN 510
370           IF A$<>"Y" THEN 350
380 !
390 !*** RECIEVE PANNEL DATA ***
400 !
410           I=I+1
420           CONNECT #1:30=A
430           CONNECT #1:A=30
440           INPUT #1:DATA$(I)
450           IF I>=100 THEN 510
460           CONNECT #1:30=A
470         GOTO 310
480 !
490 !*** MAKE DATA FILE DIRECTRY & OPEN FILE ***
500 !
510         LINPUT PROMPT "DATA FILE EXIST ? (Y/N)":B$
520         IF B$="N" THEN 550
530         IF B$<>"Y" THEN 510
540         DELETE "DATA.D1/1"
550         CREATE "DATA.D1/1",LINKED
560         OPEN #2:"DATA.D1/1",OUTPUT,VARIABLE(63)
570 !
580 !*** SAVE DATA ***
590 !
600         OUTPUT #2:I
610         FOR J=1 TO I
620           OUTPUT #2:DATA$(J)
630         NEXT J
640 !
650 !*** CLOSE DATA FILE & GPIB FILE ***
660 !
670         CLOSE #2
680         CLOSE #1
690         END
```

Example 3

Sample program 3 reads the file prepared by sample program 2 and uses it to control VP-8191A operation.

```
100 !
110 !***** SAMPLE PROGRAM 3 *****
120 !
130 !*** SET DATA SIZE & OPEN GPIB FILE ***
140 !
150         DIM DATA$(100)*63
160         OPEN #1:$IB0,VARIABLE(63)
170 !
180 !*** SEND INTERFACE CLEAR ***
190 !
200         IFC #1
210 !
220 !*** INPUT DEVICE ADDRESS ***
230 !
240         INPUT PROMPT "ADDRESS= ":A
250 !
260 !*** OPEN DATA FILE & LOAD DATA ***
270 !
280         OPEN #2:"DATA.D1/1",INPUT,VARIABLE(63)
290         INPUT #2:N
300         FOR I=1 TO N
310           INPUT #2:DATA$(I)
320         NEXT I
330 !
340 !*** SEND DATA FOR DEVICE ***
350 !
360         INPUT PROMPT "INPUT DATA No. ":I
370         IF I>N OR I<1 THEN 360
380         CONNECT #1:30=A
390         OUTPUT #1:DATA$(I)
400         LINPUT PROMPT "NEXT or END ":A$
410         IF A$<>"END" THEN 360
420 !
430 !*** CLOSE DATA FILE ***
440 !
450         CLOSE #2
460 !
470 !*** CLOSE GPIB FILE ***
480 !
490         CLOSE #1
500         END
```

Example 4

Sample program 4 copies the contents of an operator-specified subset of the assorted preset memory addresses (00 to 99) from one VP-8191A to another via the GP-IB.

```
100 !
110 !***** SAMPLE PROGRAM 4 *****
120 !
130 !*** SET DATA SIZE & OPEN GPIB FILE ***
140 !
150         DIM DATA$*63
160         OPEN #1:$IB0,VARIABLE(63)
170 !
180 !*** SEND INTERFACE CLEAR ***
190 !
200         IFC #1
210 !
220 !*** SEND DEVICE CLEAR ***
230 !
240         DCL #1
250 !
260 !*** INPUT DEVICE ADDRESS ***
270 !
280         INPUT PROMPT "INPUT SOURCE DEVICE ADDRESS =":AS
290         INPUT PROMPT "INPUT DESTINATION DEVICE ADDRESS =":AD
300 !
310 !*** INPUT MEMORY ADDRESS ***
320 !
330         INPUT PROMPT "START & END ADDRESS INPUT (START,END) ":SA,EA
340 !
350 !*** RECIEVE DATA FROM DEVICE ***
360 !
370         FOR I=SA TO EA
380           CONNECT #1:30=AS
390           OUTPUT #1:"RC"&STR$(I)
400           CONNECT #1:AS=30
410           LINPUT #1:DATA$
420 !
430 !*** SEND DATA FOR DEVICE ***
440 !
450           CONNECT #1:30=AD
460           OUTPUT #1:DATA$
470           OUTPUT #1:"ST"&STR$(I)
480         NEXT I
490         LINPUT PROMPT "END ? Y/N ":D$
500         IF D$="Y" THEN 550
510         GOTO 330
520 !
530 !*** CLOSE GPIB FILE ***
540 !
550         CLOSE #1
560         END
```

SECTION VII
MEMORY CONTROL

7-1 GENERAL

The VP-8191A allows remote control of the assorted preset data recall as well as the frequency and output level modification explained in Paragraph 4-9. This function is called memory control for this Signal Generator.

Table 7-1 lists the memory control functions.

Table 7-1 Memory control functions

Memory control function	Control contents	Remarks
Single assorted preset data recall	⇧ UP function ⇩ DOWN function	Increment/decrement memory location (between 00 and 99)
	CLR function	Set the memory location pointer to 00.
Sequential assorted preset data recall	⇧ UP function ⇩ DOWN function	Recall all data in the memory locations between the start and end addresses.
	CLR function	Set the memory location pointer to the start address.
Frequency modification	MODIFY control function	Increment/decrement last digit accessed
Output level modification in 0.1 dB (1 or 10 dB) steps	MODIFY control function	Increment/decrement last digit accessed

7-2 MEMORY CONTROL OPERATION

(1) Basic operation

(a) Set GP-IB REMOTE/LOCAL key ② to LOCAL.

(b) Register the following items on the front panel:

* Start and end addresses for sequential recall of assorted preset data (see paragraph 4-9, (4)).
* Digit to be altered for frequency modification (see paragraph 4-5, (3)).
* Digit to be altered for output level modification (see paragraph 4-6, (4)).

(c) Connect the cable to the MEMORY CONTROL connector on the rear panel. Fig. 7-1 shows the connector pin assignment. Use a 14-pin shielded plug--AMPHENOL-DDK plugs (Part No. 57FE-314-202W) with 2-meter flat cable, for example.

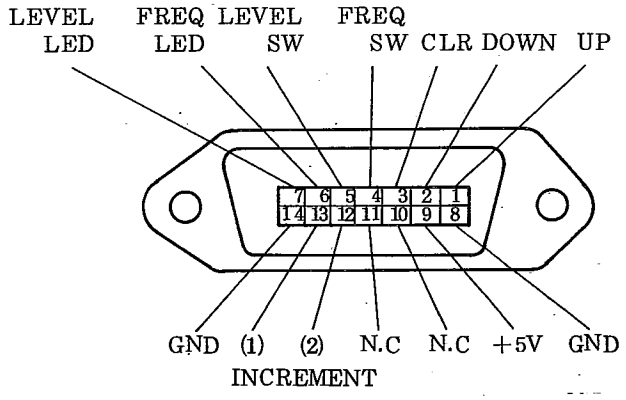


Fig. 7-1 Connector pin assignment

(2) Function of each terminal

(a) UP, DOWN and CLR terminals

Each function is activated by pulling the corresponding terminal LOW.

(HIGH = +5V, LOW = 0V)

A pulse on the UP or DOWN terminal increments or decrements the stored memory address used for single and sequential recall of assorted preset data (paragraph 4-9, (3) and (4)). A pulse on CLR terminal sets the memory address to 00 for single recall of assorted preset data or to the start address for restricted sequential recall of assorted preset data. Fig. 7-2 shows the requisite timing for these control signals.

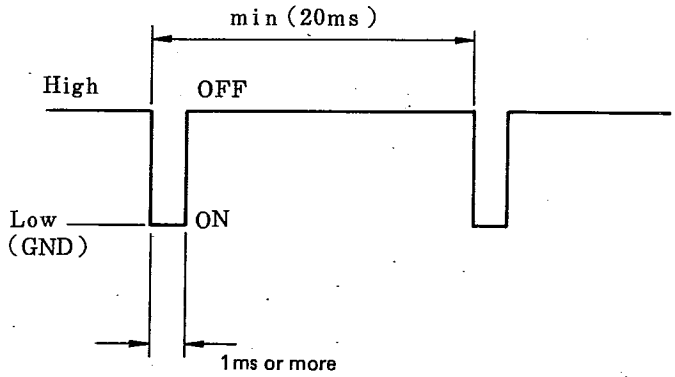


Fig. 7-2 Control signal timing for UP, DOWN, CLR, FREQ SW, and LEVEL SW terminals

(b) FREQ SW and LEVEL SW terminals

Each function is activated by pulling the corresponding terminal LOW. These functions are equivalent to pressing the FUNCTION keys FREQ and LEVEL. (see paragraph 4-5, (3) and 4-6, (3).) The control signal timing is shown in Fig. 7-2.

(c) FREQ LED and LEVEL LED terminals

These are output terminals for external LEDs. Connecting the LED cathodes to these terminals and their anodes via resistors to +5 V duplicates the LED displays of the FUNCTION keys FREQ and LEVEL.

FREQ LED: Lights when FREQ is selected.

LEVEL LED: Lights when LEVEL is selected.

The output voltages and current are:

LOW V ≒ 0 V HIGH V ≒ 5 V I_{OL} = -8 mA (max.)

The LEDs selected and external circuit must conform to these specifications.

(d) MODIFY ① and ② terminals

Signals to these terminals modifying the frequency setting or the output level in 0.1 dB (1 or 10 dB) steps. The direction is determined by the relative timing with which the rotary encoder terminals ① and ② rise from the terminal ③ (GND) level. (see Fig. 7-3.)

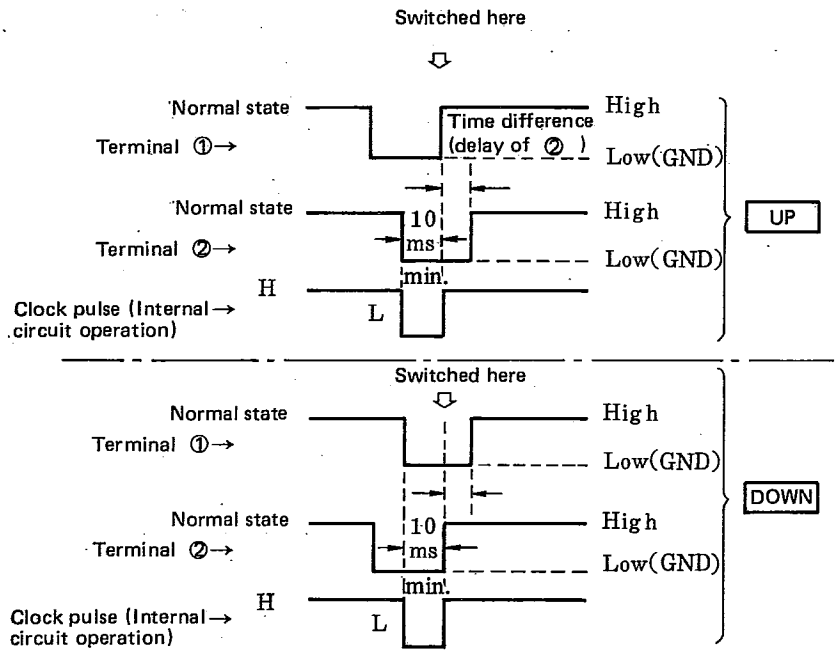


Fig. 7-3 Up/Down timing

Note: The Low level shall be connected to the GND through a resistance of 10 kΩ or less, or its potential above the GND shall be 0.5 V or less.
The High level shall be the open state with an insulation resistance of 1 MΩ or more with respect to the GND, or a current of 1 μA or less.

(3) Control Unit Example

Fig. 7-4 shows an example of a control unit capable of reproducing all the VP-8191A panel functions listed in Table 7-1.

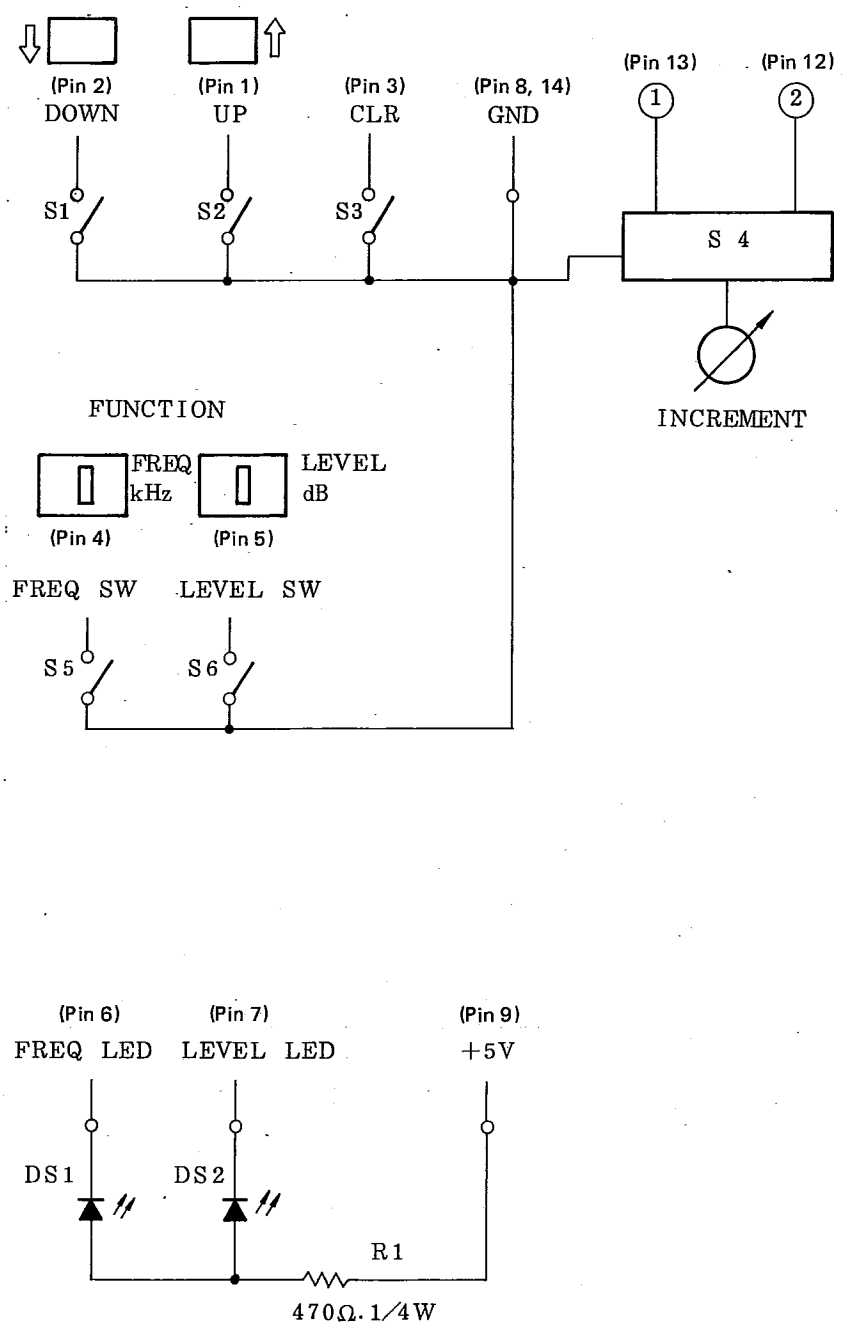


Fig. 7-4 Control unit example

Note 1: The pin Nos in parentheses are the connector terminal Nos.

Note 2: Use momentary ON switches which are normally OFF and stay ON only while pressed, for S1, S2, S3, S5, and S6.

Note 3: The rotary encoder S4 produces the signals shown in Fig. 7-3. To order, ask for Part Nos:

84R01: Shaft length 25 mm, 81R16: Shaft length 20 mm

Note 4: The +5 V output (pin 9) is meant for the type of control shown in the Figure. There is not sufficient current capacity for other purposes.

Note 5: DS1 and DS2 are the LEDs built in the FREQ (S5) and LEVEL (S6) keys.

Note 6: R1 is a fixed resistor limiting the current flowing to LEDs DS1 and DS2. At 470 Ω, the current is 5.5 mA.

SECTION VIII
MAINTENANCE

8-1 CLEANING

Clean panels and covers with a dry soft cloth. Do not use a chemically treated cloth or 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.

VP-8191A CIRCUIT DIAGRAMS

NOTES

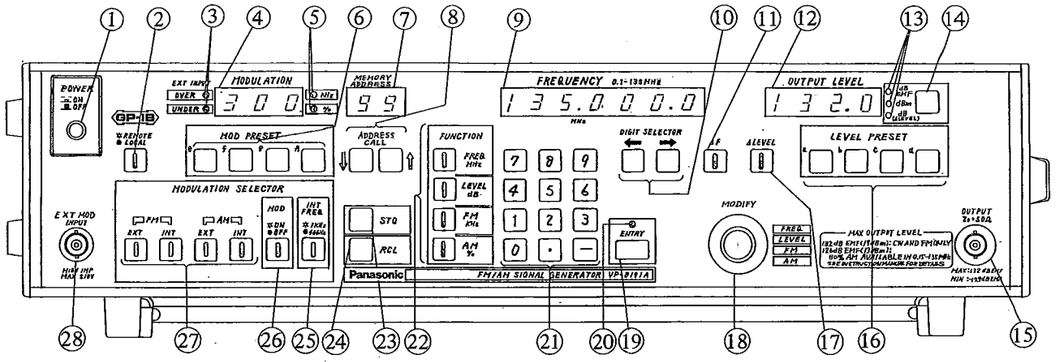
▷ WHEN THE CIRCUIT IS DIVIDED INTO SOME UNITS AND AN IDENTIFYING NUMBER IS ASSIGNED TO EACH UNIT, REFERENCE DESIGNATORS IN EACH CIRCUIT DIAGRAM ARE GIVEN IN ABBREVIATED FORM. PREFIX WITH EACH IDENTIFYING NUMBER FOR COMPLETE DESCRIPTION.
EXAMPLES; A1C1, A6R3.

▷ RESISTANCE VALUES IN OHMS AND CAPACITANCE IN PICOFARADS(FROM 1 TO 9,999) OR MICROFARADS (FROM 0.01 TO 0.99) UNLESS OTHERWISE NOTED.

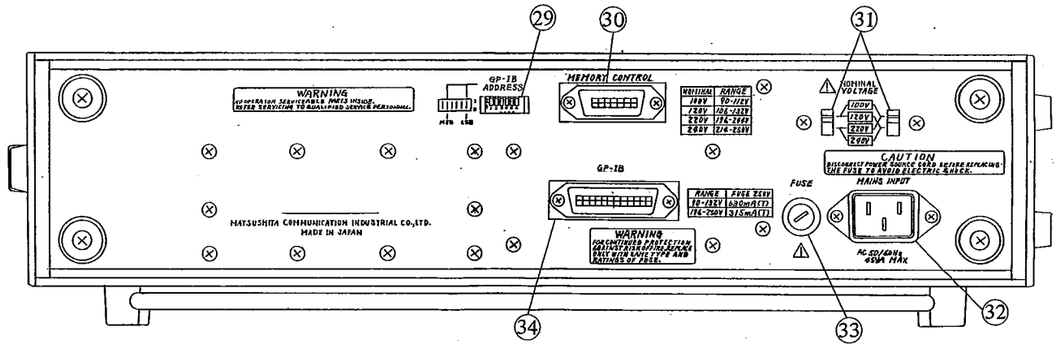
▷ POWER RATINGS AND RESISTANCE TOLERANCES OF FIXED RESISTORS ARE 1/4 WATTS AND ±5% UNLESS OTHERWISE NOTED.

▷ ☆ FACTORY REWORKED OR CHECKED COMPONENTS.

▷ ※ VALUE SELECTED AT FACTORY, NOMINAL VALUE SHOWN.



Front panel



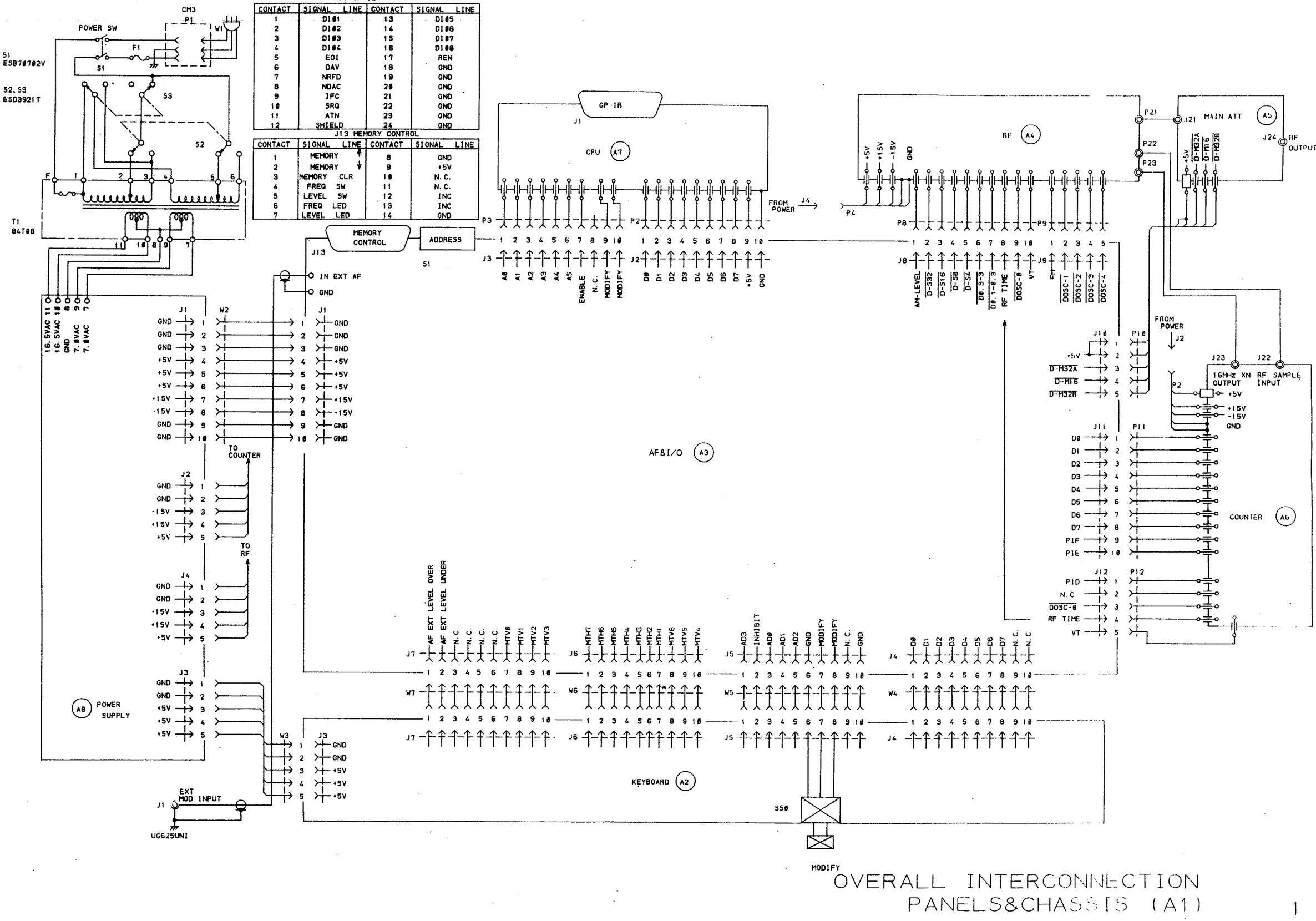
Rear panel

J1 GP-IB

CONTACT	SIGNAL LINE	CONTACT	SIGNAL LINE
1	DIØ1	13	DIØ5
2	DIØ2	14	DIØ6
3	DIØ3	15	DIØ7
4	DIØ4	16	DIØ8
5	EOI	17	REN
6	DAV	18	GND
7	NRFD	19	GND
8	NDAC	20	GND
9	IFC	21	GND
10	SRQ	22	GND
11	ATN	23	GND
12	SHIELD	24	GND

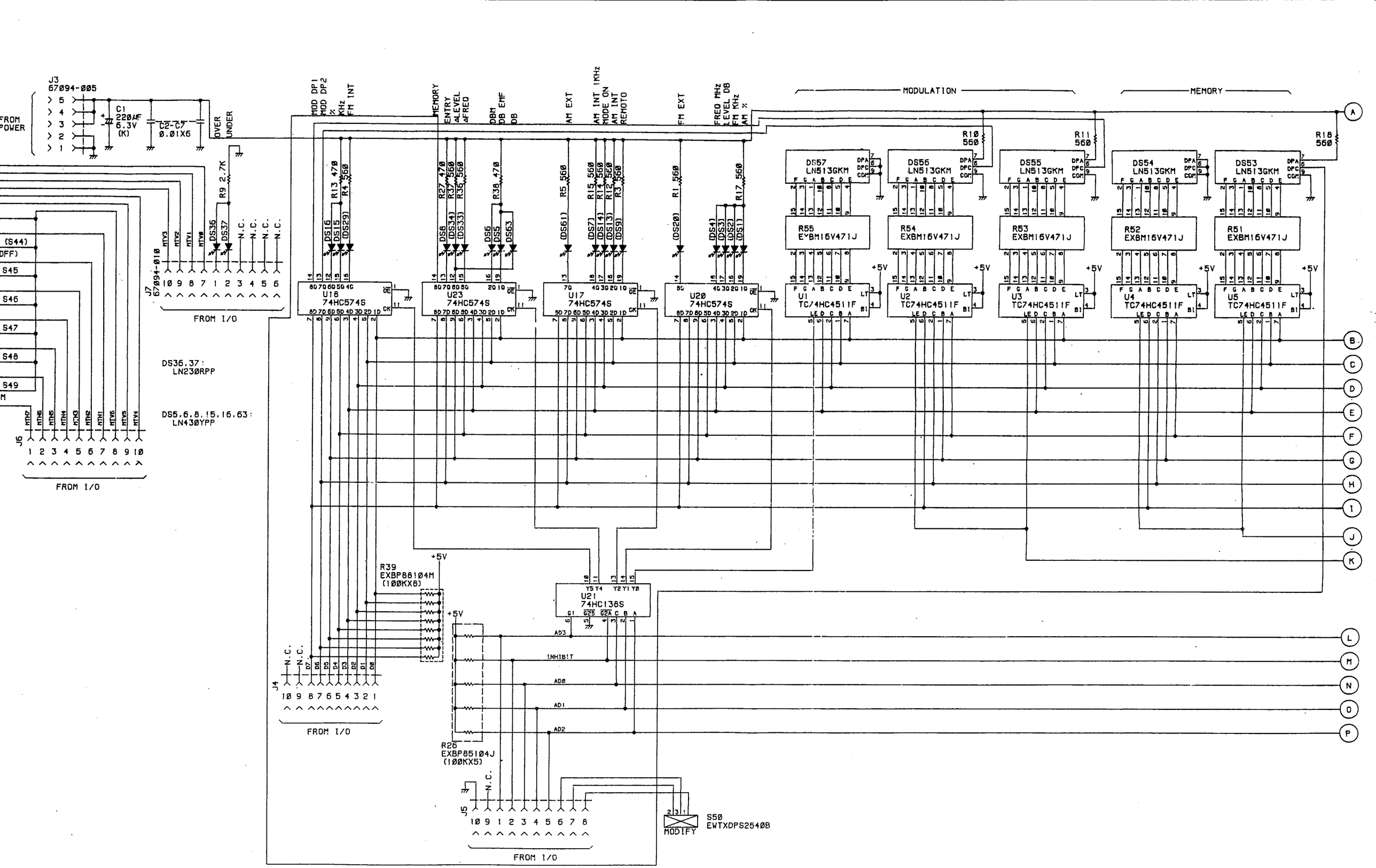
J13 MEMORY CONTROL

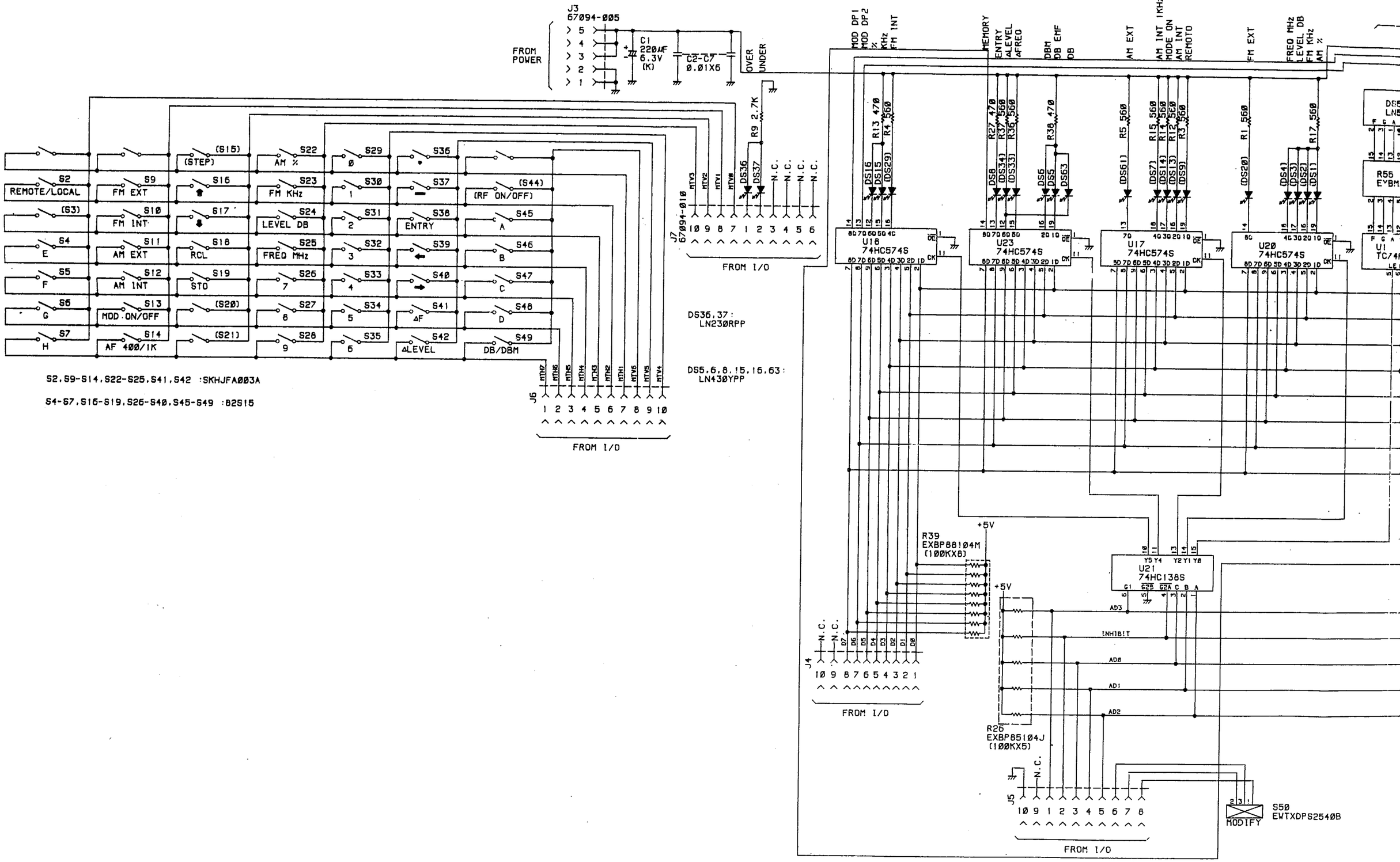
CONTACT	SIGNAL LINE	CONTACT	SIGNAL LINE
1	MEMORY ↑	8	GND
2	MEMORY ↓	9	+5V
3	MEMORY CLR	10	N. C.
4	FREQ SW	11	N. C.
5	LEVEL SW	12	INC
6	FREQ LED	13	INC
7	LEVEL LED	14	GND

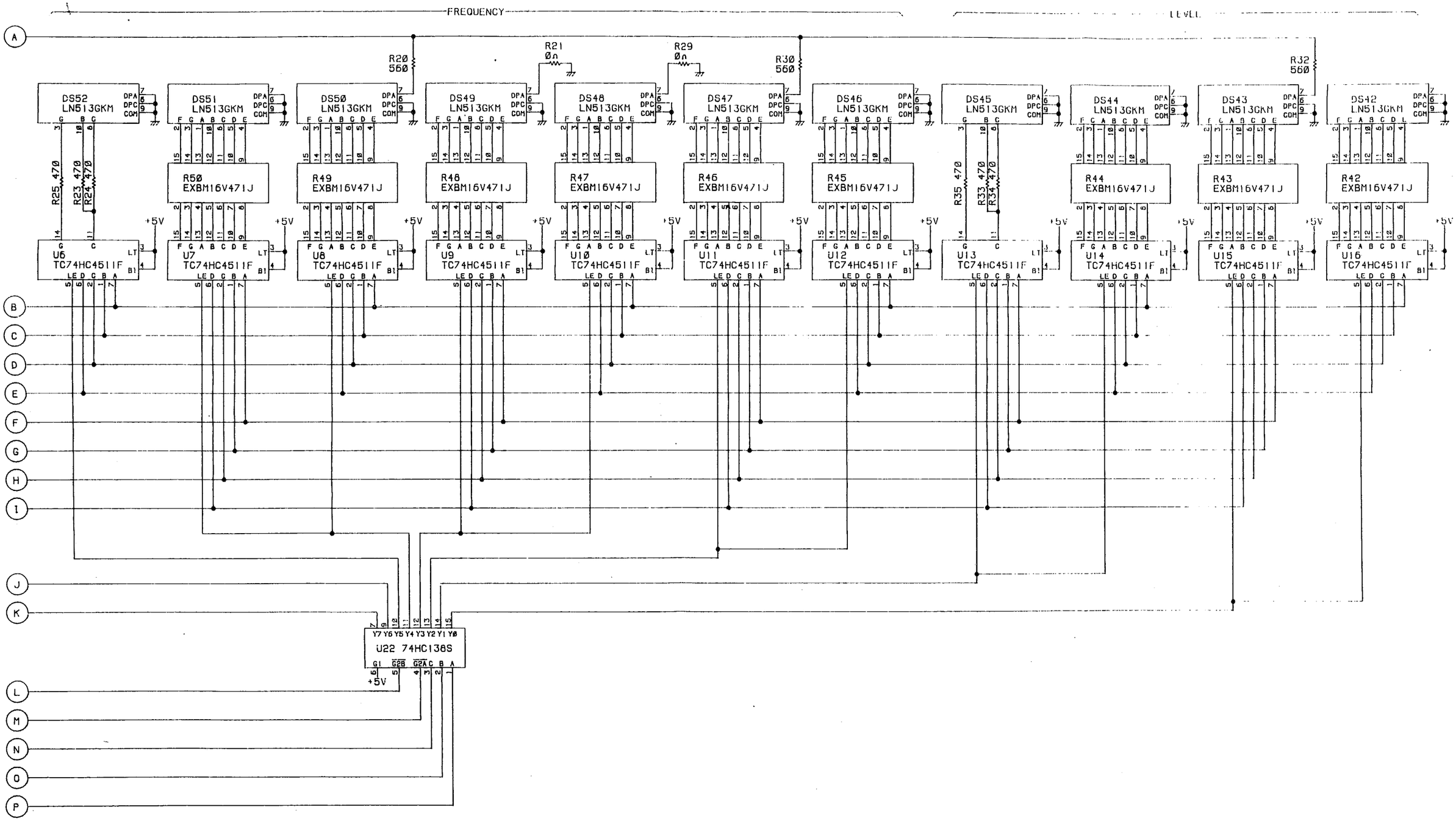


VP-8191A

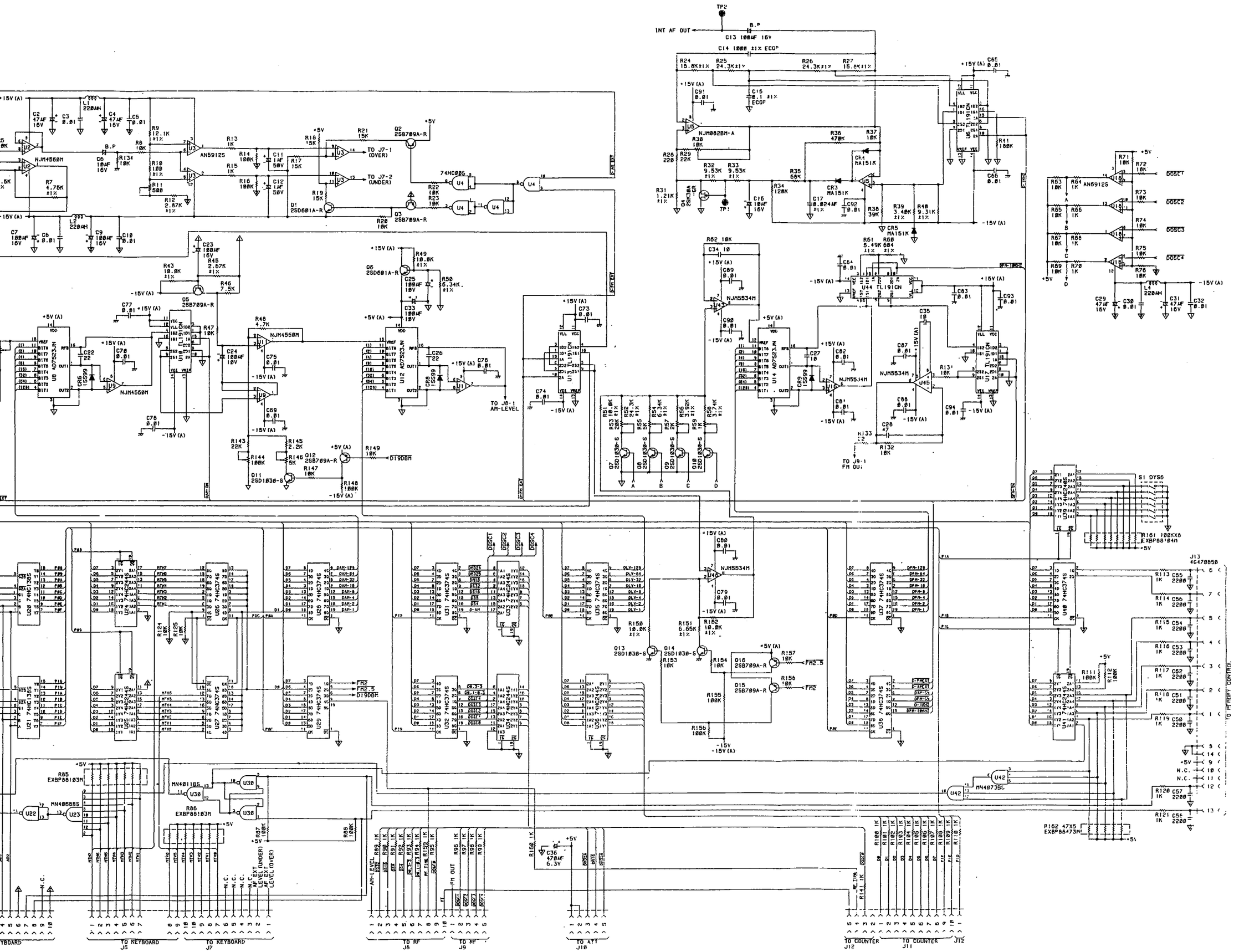
OVERALL INTERCONNECTION PANELS&CHASSIS (A1)

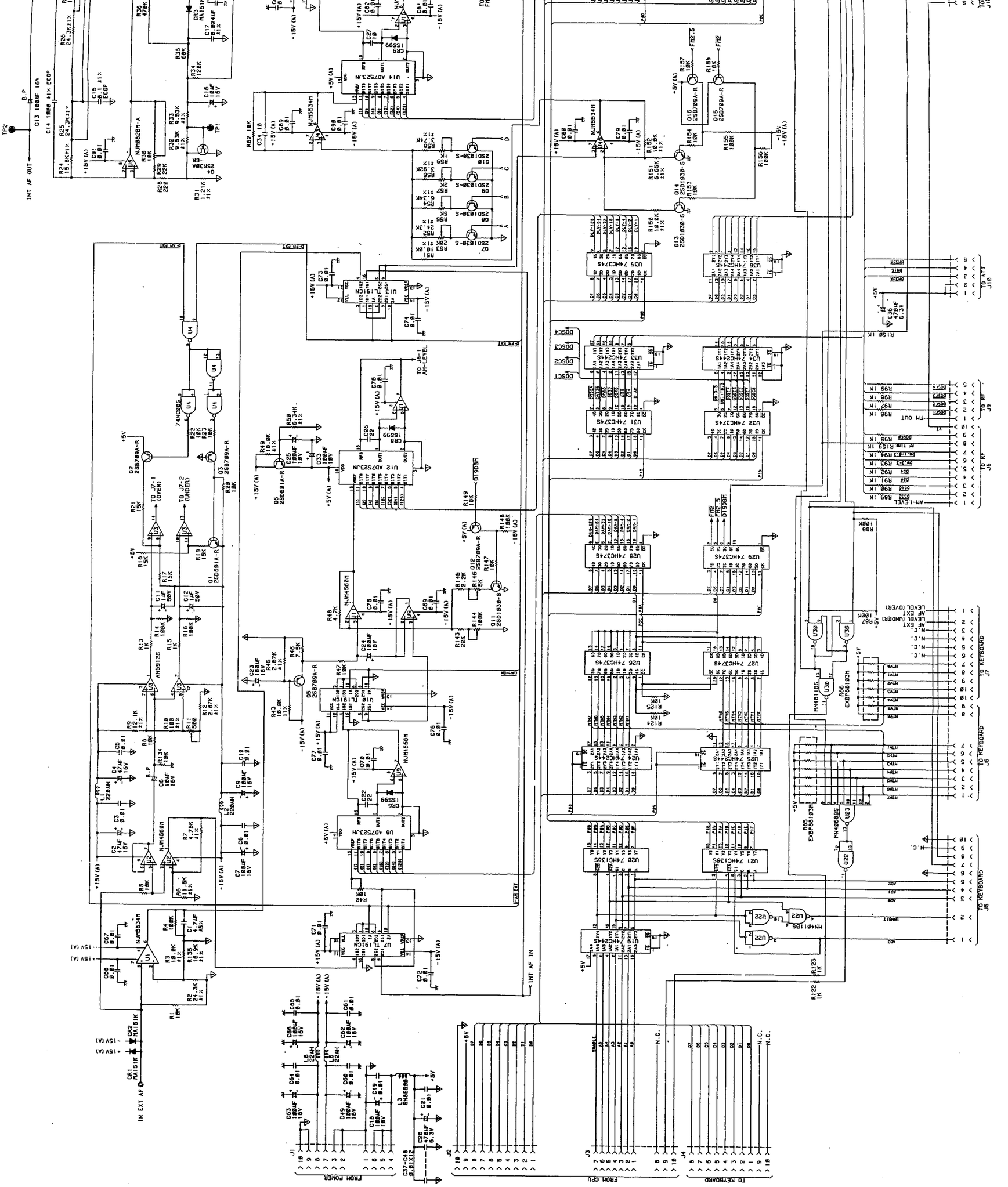

MODULATION
MEMORY
MOD DP1
MOD DP2
% KHz FM INT
MEMORY ENTRY ΔLEVEL ΔFREQ
DBM DB EMF DB
AM EXT
AM INT 1KHz MODE ON AM INT REMOTO
FM EXT
FREQ MHz LEVEL DB FM KHz AM %
J3 67094-005
FROM POWER
C1 220μF 6.3V (K)
C2-C7 0.01X6
OVER
UNDER
R9 2.7K
DS36 DS37 N.C. N.C. N.C. N.C.
J7 67094-010
FROM I/O
R13 470
R4 560
DS16 DS15 (DS29)
R27 470
R37 560
R36 560
DS8 (DS34) (DS33)
R38 470
DS6 DS5 DS63
R5 560
(DS61)
R15 560
R14 560
R12 560
R3 560
(DS7) (DS14) (DS13) (DS9)
R1 560
(DS20)
R17 560
(DS4) (DS3) (DS2) (DS1)
R10 560
R11 560
R18 560
DS57 LN513GKM
DS56 LN513GKM
DS55 LN513GKM
DS54 LN513GKM
DS53 LN513GKM
R55 EXBM16V471J
R54 EXBM16V471J
R53 EXBM16V471J
R52 EXBM16V471J
R51 EXBM16V471J
+5V
U1 TC74HC4511F
U2 TC74HC4511F
U3 TC74HC4511F
U4 TC74HC4511F
U5 TC74HC4511F
U18 74HC574S
U23 74HC574S
U17 74HC574S
U20 74HC574S
DS36,37: LN230RPP
DS5,6,8,15,16,63: LN430YPP
J6
FROM I/O
R39 EXBP88104M (100KX8)
J4
FROM I/O
R26 EXBP85104J (100KX5)
J5
FROM I/O
U21 74HC138S
AD3
!NH1B!T
AD0
AD1
AD2
S50 EWTXDPS2540B
MODIFY
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

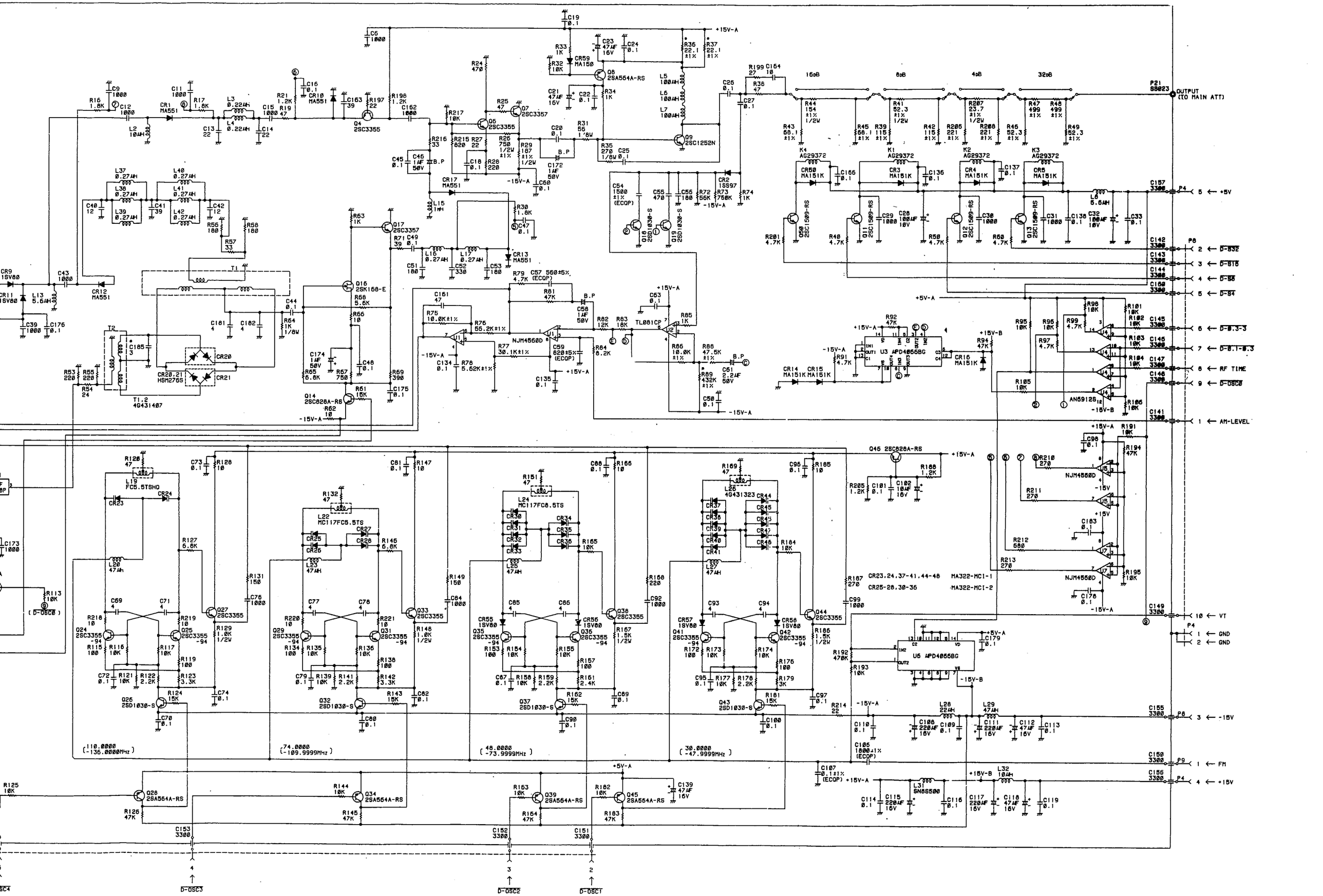

J3
67094-005
FROM POWER
C1
220µF
6.3V
(K)
C2-C7
0.01X6
OVER
UNDER
R9 2.7K
J7
67094-010
FROM I/O
S2 REMOTE/LOCAL
S9 FM EXT
(S15) (STEP)
S22 AM %
S29 0
S36 .
S3
S10 FM INT
S17
S24 LEVEL DB
S31 2
S38 ENTRY
S4 E
S11 AM EXT
S18 RCL
S25 FREQ MHz
S32 3
S39
S5 F
S12 AM INT
S19 STO
S26 7
S33 4
S40
S6 G
S13 MOD ON/OFF
(S20)
S27 8
S34 5
S41 ΔF
S7 H
S14 AF 400/1K
(S21)
S28 9
S35 6
S42 ΔLEVEL
S23 FM KHz
S30 1
S37 -
(S44) (RF ON/OFF)
S45 A
S46 B
S47 C
S48 D
S49 DB/DBM
S2,S9-S14,S22-S25,S41,S42 :SKHJFA003A
S4-S7,S15-S19,S26-S40,S45-S49 :82S15
J6
FROM I/O
DS36,37:
LN230RPP
DS5,6,8,15,16,63:
LN430YPP
MOD DP1
MOD DP2
% KHz
FM INT
MEMORY
ENTRY
ΔLEVEL
ΔFREQ
DBM
DB EMF
DB
AM EXT
AM INT 1KHz
MODE ON
AM INT
REMOTO
FM EXT
FREQ MHz
LEVEL DB
FM KHz
AM %
R13 470
R4 560
R27 470
R37 560
R36 560
R38 470
R5 560
R15 560
R14 560
R12 560
R3 560
R1 560
R17 560
DS16
DS15
DS29
DS8
DS34
DS33
DS6
DS5
DS63
DS61
DS7
DS14
DS13
DS9
DS20
DS4
DS3
DS2
DS1
U18
74HC574S
U23
74HC574S
U17
74HC574S
U20
74HC574S
R39
EXBP88104M
(100KX8)
+5V
U21
74HC138S
Y5 Y4 Y2 Y1 Y0
G1 G2B G2A C B A
AD3
INHIBIT
AD0
AD1
AD2
R26
EXBP85104J
(100KX5)
J4
N.C. N.C. D7 D6 D5 D4 D3 D2 D1 D0
10 9 8 7 6 5 4 3 2 1
FROM I/O
J5
N.C.
10 9 1 2 3 4 5 6 7 8
FROM I/O
S50
EWTXDPS2540B
MODIFY


FREQUENCY
LEVEL
R20 560
R21 0Ω
R29 0Ω
R30 560
R32 560
DS52 LN513GKM
DS51 LN513GKM
DS50 LN513GKM
DS49 LN513GKM
DS48 LN513GKM
DS47 LN513GKM
DS46 LN513GKM
DS45 LN513GKM
DS44 LN513GKM
DS43 LN513GKM
DS42 LN513GKM
DPA DPC COM
R25 470
R23 470
R24 470
R50 EXBM16V471J
R49 EXBM16V471J
R48 EXBM16V471J
R47 EXBM16V471J
R46 EXBM16V471J
R45 EXBM16V471J
R35 470
R33 470
R34 470
R44 EXBM16V471J
R43 EXBM16V471J
R42 EXBM16V471J
+5V
U6 TC74HC4511F
U7 TC74HC4511F
U8 TC74HC4511F
U9 TC74HC4511F
U10 TC74HC4511F
U11 TC74HC4511F
U12 TC74HC4511F
U13 TC74HC4511F
U14 TC74HC4511F
U15 TC74HC4511F
U16 TC74HC4511F
LT BI
LE D C B A
F G A B C D E
U22 74HC138S
Y7 Y6 Y5 Y4 Y3 Y2 Y1 Y0
G1 G2B G2A C B A
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

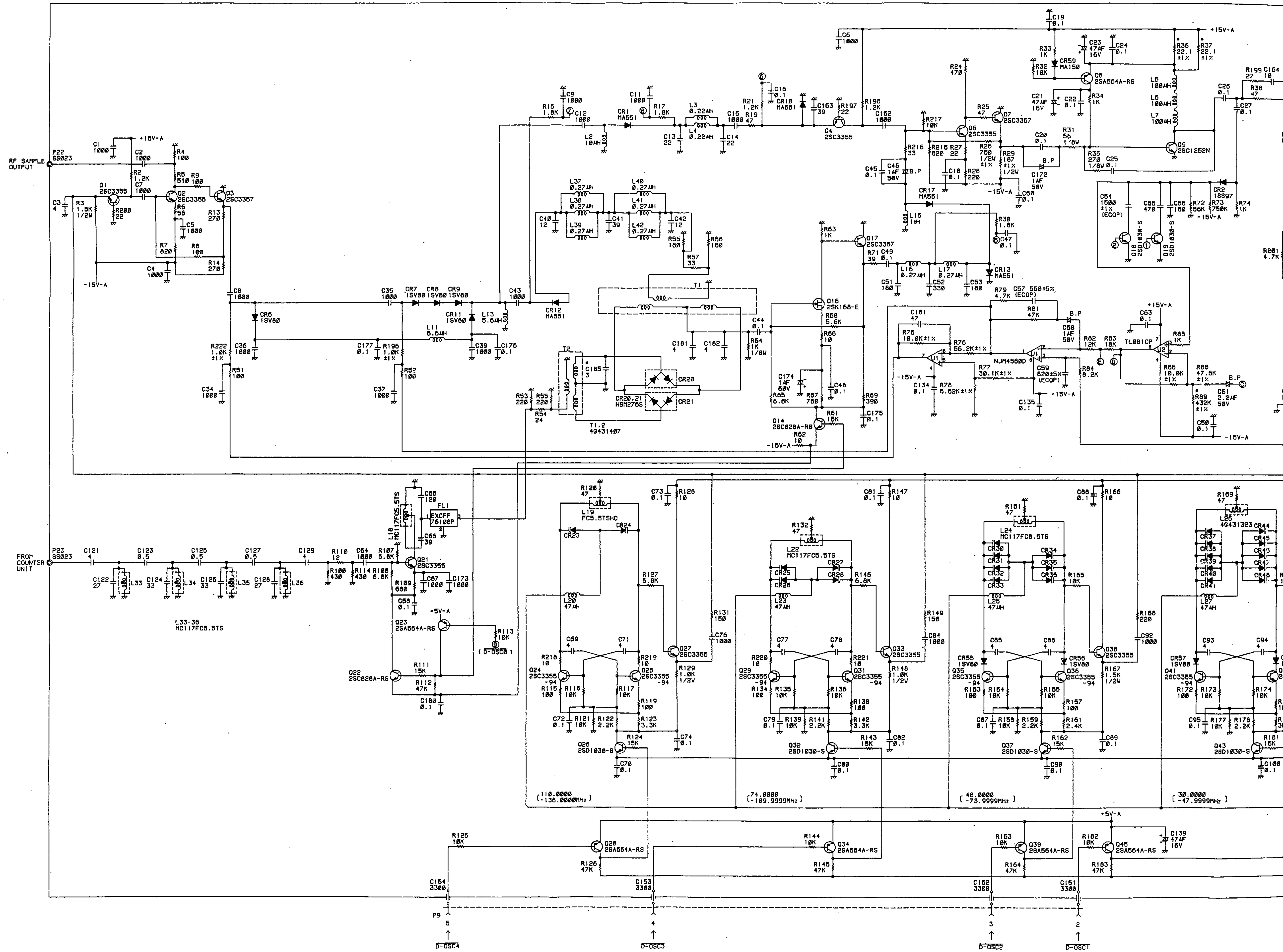
VP-8191A

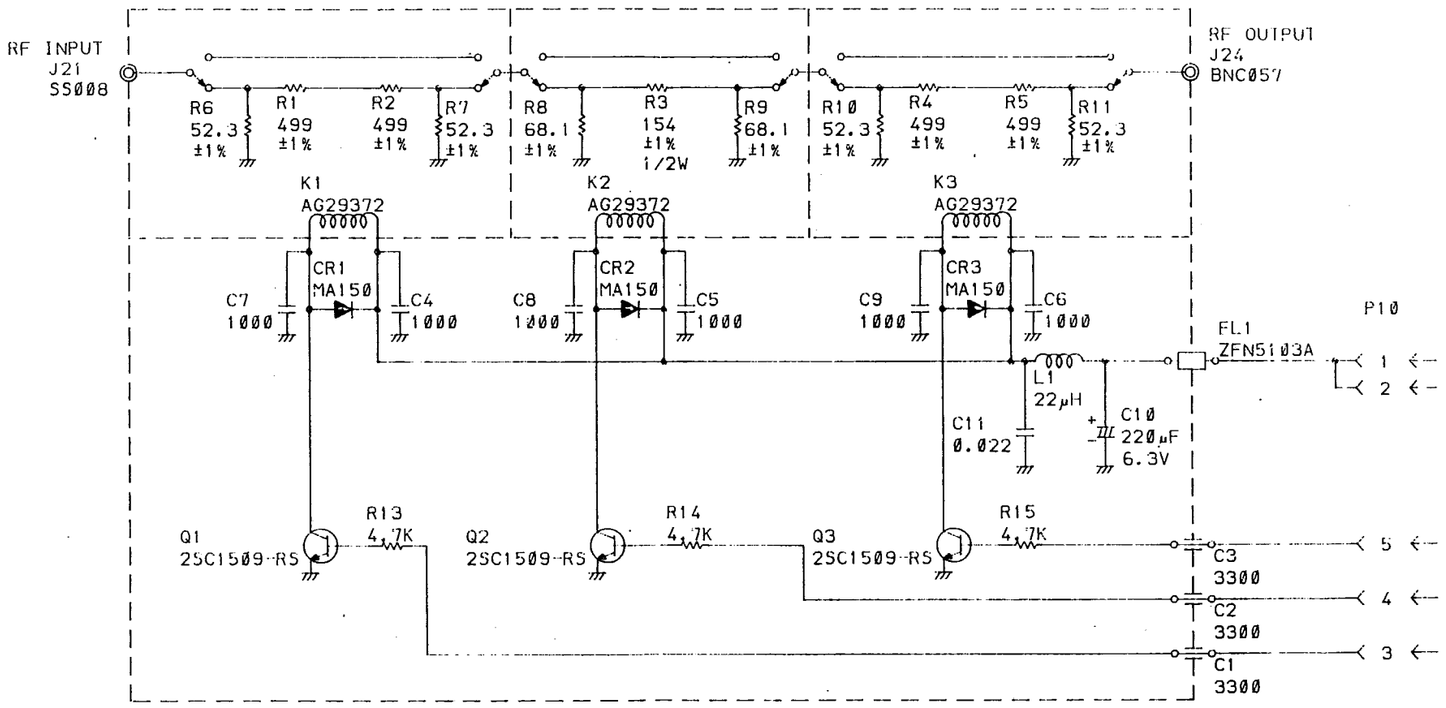

INT AF OUT
TP2
TO J7-1 (OVER)
TO J7-2 (UNDER)
TO J8-1 AM-LEVEL
TO J9-1 FM OUT
TO KEYBOARD J6
TO KEYBOARD J7
TO RF J8
TO RF J9
TO AFT J10
TO COUNTER J12
TO COUNTER J11
TO MAIN CONTROL J13
AF&I/O (A3)
4


INT AF OUT
TO J8-1 AM-LEVEL
TO J7-1 (OVER)
TO J7-2 (UNDER)
IN EXT AF
INT AF IN
FROM POWER
FROM CPU
TO KEYBOARD
TO KEYBOARD
TO KEYBOARD
TO KEYBOARD
TO RF
TO RF
TO ATT
AM-LEVEL
LEVEL (OVER)
LEVEL (UNDER)
FM OUT
DOSC1
DOSC2
DOSC3
DOSC4

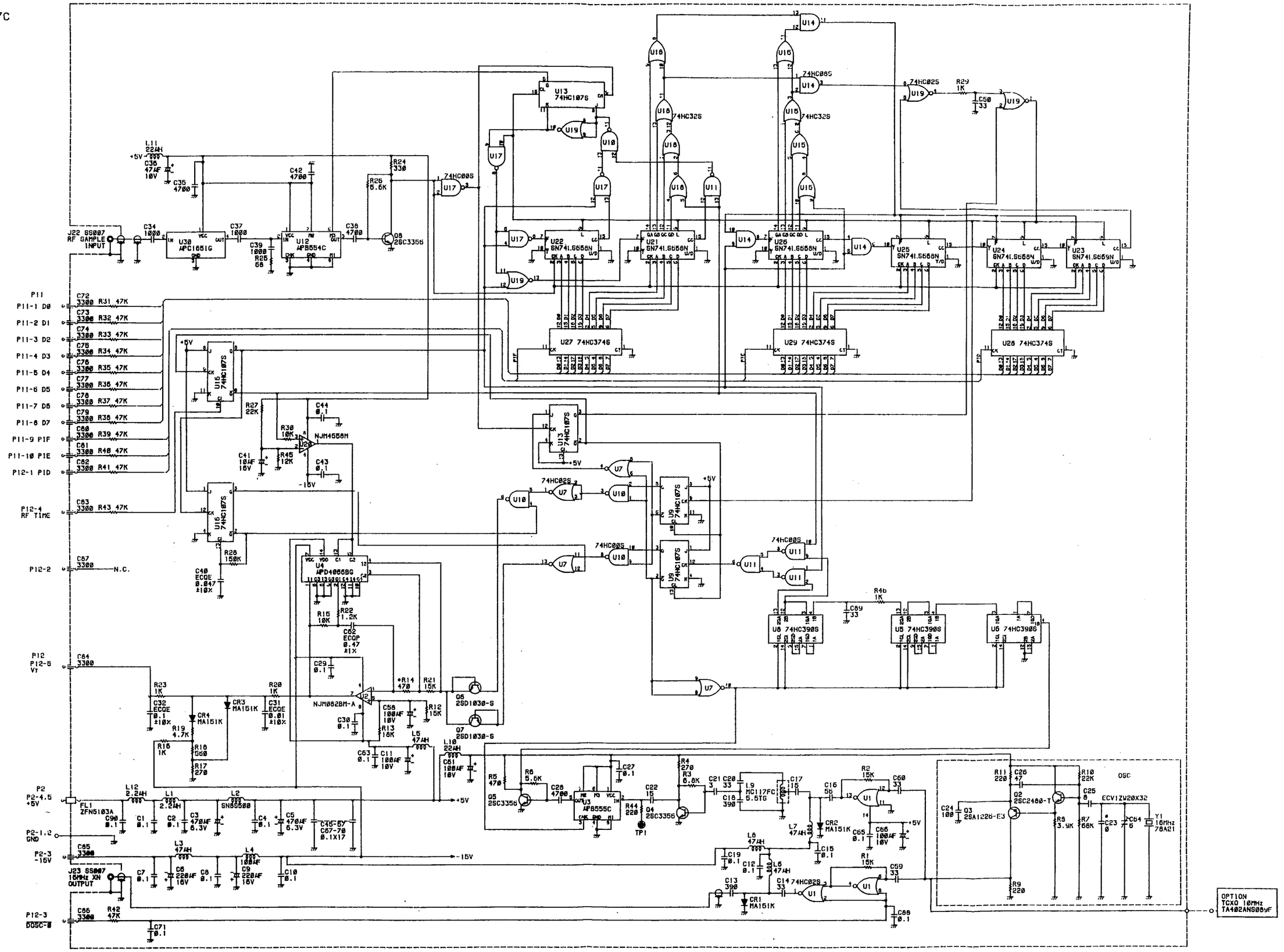

+15V-A
-15V-A
+5V-A
-15V-B
+15V-B
16dB
8dB
4dB
32dB
OUTPUT (TO MAIN ATT)
P21 88023
K4 AG29372
K1 AG29372
K2 AG29372
K3 AG29372
U3 μPD4066BG
U5 μPD4066BG
U6 μPD4066BG
NJM4560D
AN59126
TL081CP
NJM4558BG
T1,2 4G431407
L19 FC5.5TSHO
L22 MC117FC5.5TS
L24 MC117FC5.5TS
L26 4G431323
(110.0000 (-136.0000MHz)
(74.0000 (-109.9999MHz)
(48.0000 (-73.9999MHz)
(30.0000 (-47.9999MHz)
CR23,24,37-41,44-48 MA322-MC1-1
CR25-28,30-36 MA322-MC1-2
P4 5 ← +5V
P8 2 ← D-B32
3 ← D-B16
4 ← D-B8
5 ← D-B4
6 ← D-B2-3
7 ← D-B1-B3
8 ← RF TIME
9 ← D-OSC8
1 ← AM-LEVEL
P8 10 ← VT
P4 1 ← GND
2 ← GND
P8 3 ← -15V
P9 1 ← FM
P4 4 ← +15V
4 ← D-OSC3
3 ← D-OSC2
2 ← D-OSC1

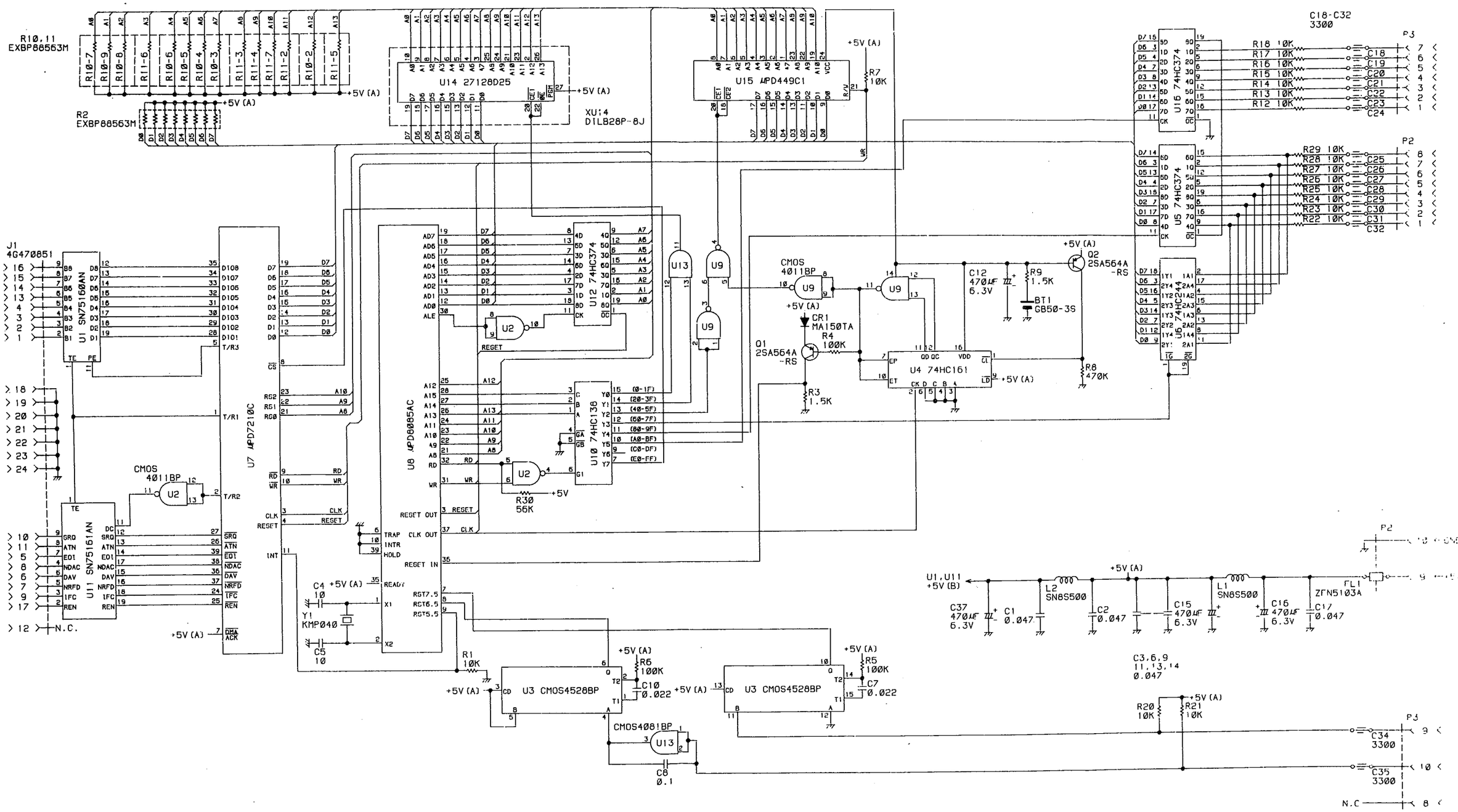
3G-13-147705D

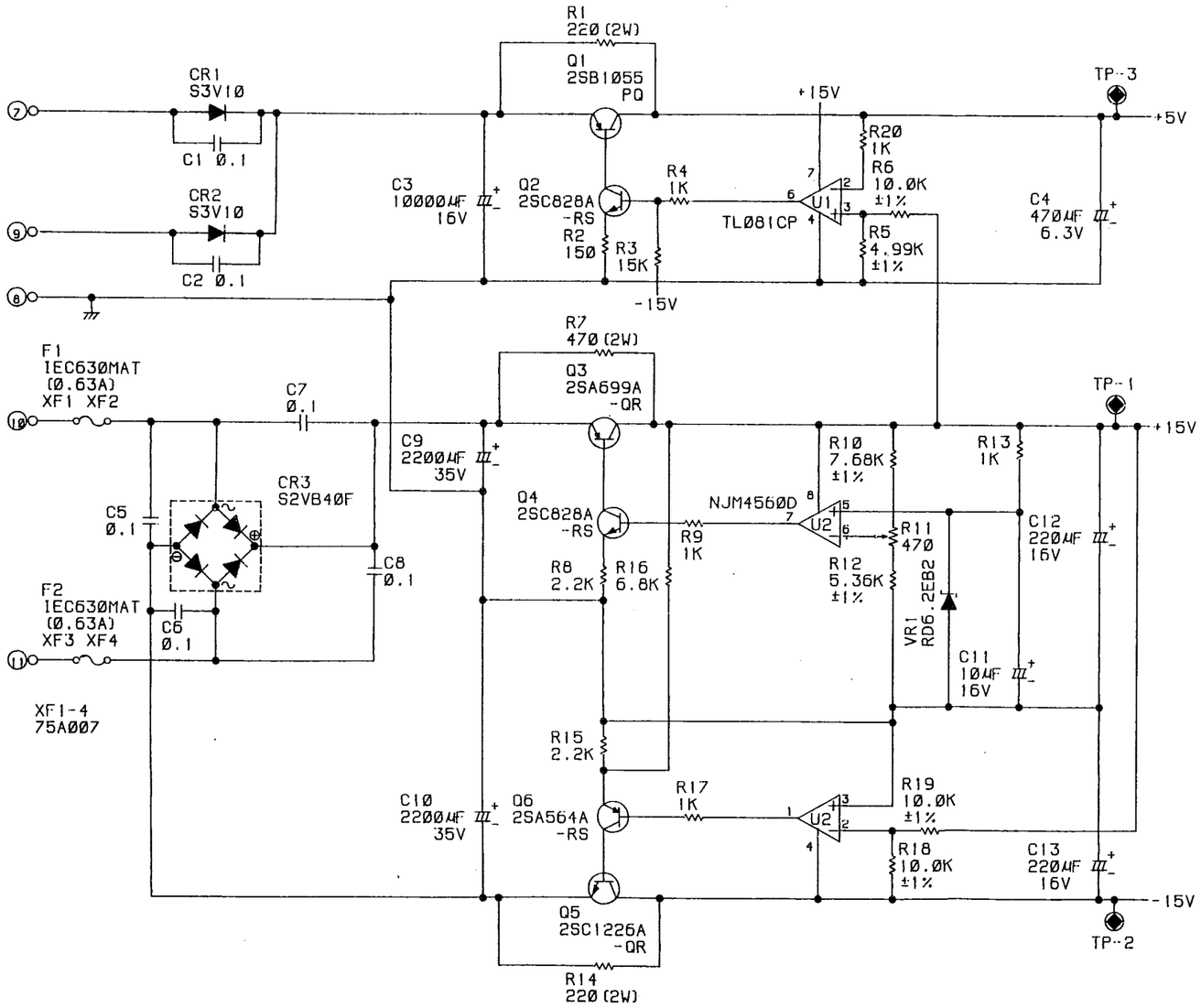


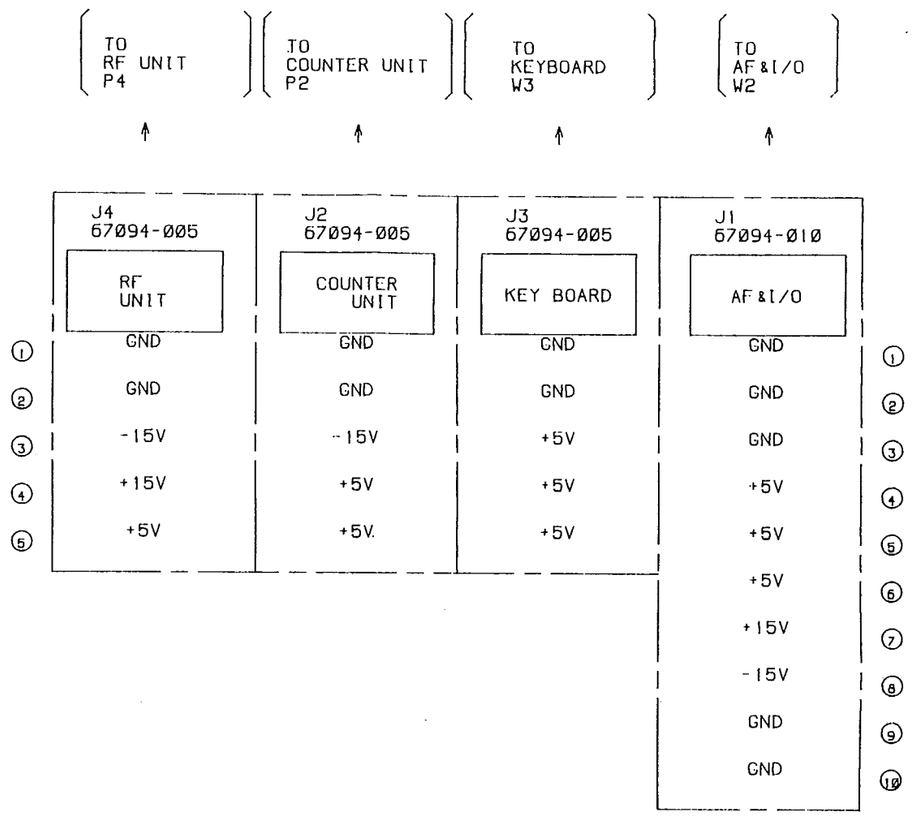

RF INPUT
J21
SS008
RF OUTPUT
J24
BNC057
R6
52.3
±1%
R1
499
±1%
R2
499
±1%
R7
52.3
±1%
R8
68.1
±1%
R3
154
±1%
1/2W
R9
68.1
±1%
R10
52.3
±1%
R4
499
±1%
R5
499
±1%
R11
52.3
±1%
K1
AG29372
K2
AG29372
K3
AG29372
CR1
MA150
CR2
MA150
CR3
MA150
C7
1000
C4
1000
C8
1000
C5
1000
C9
1000
C6
1000
FL1
ZFN5103A
P10
1
2
L1
22μH
C11
0.022
C10
220μF
6.3V
Q1
2SC1509-RS
R13
4.7K
Q2
2SC1509-RS
R14
4.7K
Q3
2SC1509-RS
R15
4.7K
C3
3300
C2
3300
C1
3300
5
4
3

VP-8191A


P11
P11-1 D0
P11-2 D1
P11-3 D2
P11-4 D3
P11-5 D4
P11-6 D5
P11-7 D6
P11-8 D7
P11-9 P1F
P11-10 P1E
P12-1 P1D
P12-4 RF TIME
P12-2
N.C.
P12
P12-5 Vr
P2
P2-4,5 +5V
P2-1,2 GND
P2-3 -15V
P12-3 OSC-B
J22 SS007 RF SAMPLE INPUT
J23 SS007 16MHz XN OUTPUT
U30 APC1651G
U12 APB554C
U13 74HC107S
U14
U15
U16
U17
U18
U19
74HC00S
74HC02S
74HC32S
U22 SN741.6668N
U21 SN741.6668N
U26 SN741.6668N
U25 SN741.6668N
U24 SN741.6668N
U23 SN741.6669N
U27 74HC374S
U29 74HC374S
U28 74HC374S
U4 APD4066BG
U3 APB555C
NJM4558M
NJM082BM-A
U5 74HC390S
U6 74HC390S
U8 74HC390S
Q5 2SC3356
Q6 2SC3356
Q4 2SC3356
Q7 2SD1030-S
Q8 2SC3356
Q5 2SD1030-S
Q2 2SC2468-T
Q3 2SA1226-E3
FL1 ZFN5103A
SN65560
MC117FC
TP1
CR1 MA151K
CR2 MA151K
CR3 MA151K
CR4 MA151K
OSC
ECV1ZV20X32
16MHz 78A21
OPTION
TCXO 10MHz
TA482ANS06yF


R10,11
EXBP88563M
R2
EXBP88563M
+5V (A)
U14 27128D25
XU;4
DILB28P-8J
U15 μPD449C1
R7
10K
C18-C32
3300
P3
P2
R18 10K
R17 10K
R16 10K
R15 10K
R14 10K
R13 10K
R12 10K
C18
C19
C20
C21
C22
C23
C24
R29 10K
R28 10K
R27 10K
R26 10K
R25 10K
R24 10K
R23 10K
R22 10K
C25
C26
C27
C28
C29
C30
C31
C32
U16 74HC374
U5 74HC374
U6 74HC244
J1
4G470851
U1 SN75160AN
U11 SN75161AN
U7 μPD7210C
U8 μPD8085AC
U12 74HC374
U10 74HC138
U13
U9
U2
REGET
CMOS
4011BP
Q1
2SA564A
-RS
CR1
MA150TA
R4
100K
R3
1.5K
U4 74HC161
C12
470μF
6.3V
R9
1.5K
BT1
GB50-3S
Q2
2SA564A
-RS
R8
470K
T/R1
T/R2
T/R3
N.C.
RD
WR
CLK
RESET
INT
REGET OUT
TRAP
INTR
HOLD
RESET IN
READY
RST7.5
RST6.5
RST5.5
C4
10
Y1
KMP040
C5
10
R1
10K
R30
56K
+5V
U3 CMOS4528BP
R6
100K
C10
0.022
R5
100K
C7
0.022
CMOS408!BP
C8
0.1
C3,6,9
11,13,14
0.047
R20
10K
R21
10K
C34
3300
C35
3300
N.C
U1,U11
+5V (B)
L2
SN8S500
L1
SN8S500
FL1
ZFN5103A
C37
470μF
6.3V
C1
0.047
C2
0.047
C15
470μF
6.3V
C16
470μF
6.3V
C17
0.047


CR1
S3V10
C1 0.1
CR2
S3V10
C2 0.1
R1
220 (2W)
Q1
2SB1055
PQ
+15V
TP-3
+5V
C3
10000μF
16V
Q2
2SC828A
-RS
R4
1K
R2
150
R3
15K
-15V
U1
TL081CP
R20
1K
R6
10.0K
±1%
R5
4.99K
±1%
C4
470μF
6.3V
F1
IEC630MAT
(0.63A)
XF1 XF2
C7
0.1
R7
470 (2W)
Q3
2SA699A
-QR
TP-1
+15V
C9
2200μF
35V
CR3
S2VB40F
C5
0.1
C8
0.1
Q4
2SC828A
-RS
NJM4560D
U2
R9
1K
R10
7.68K
±1%
R13
1K
R11
470
R12
5.36K
±1%
C12
220μF
16V
R8
2.2K
R16
6.8K
VR1
RD6.2EB2
F2
IEC630MAT
(0.63A)
XF3 XF4
C6
0.1
C11
10μF
16V
XF1-4
75A007
R15
2.2K
C10
2200μF
35V
Q6
2SA564A
-RS
R17
1K
R19
10.0K
±1%
R18
10.0K
±1%
C13
220μF
16V
-15V
Q5
2SC1226A
-QR
TP-2
R14
220 (2W)


TO
RF UNIT
P4
TO
COUNTER UNIT
P2
TO
KEYBOARD
W3
TO
AF&I/O
W2
J4
67094-005
RF
UNIT
J2
67094-005
COUNTER
UNIT
J3
67094-005
KEY BOARD
J1
67094-010
AF&I/O
GND
GND
-15V
+15V
+5V
GND
GND
-15V
+5V
+5V
+5V
GND
GND
+5V
+5V
+5V
+15V
-15V
GND
GND
1
2
3
4
5
6
7
8
9
10