

MANUAL PART NUMBER

MEP7721A-3

## AUDIO ANALYZER

---

VP-7721A

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

Printed in Japan

[illegible]

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.

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

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.

## SAFETY SYMBOLS

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

**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.

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.

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

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

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.

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

|      |                                                         |      |
|------|---------------------------------------------------------|------|
| 4.4  | Cautions to be observed during Actual Measurement ..... | 4-21 |
| 4.5  | Distortion Measurement using Internal Oscillator .....  | 4-29 |
| 4.6  | Distortion Measurement of an External Source .....      | 4-31 |
| 4.7  | Level Measurement .....                                 | 4-32 |
| 4.8  | S/N Measurement .....                                   | 4-33 |
| 4.9  | Preset Application .....                                | 4-34 |
| 4.10 | Remote Control .....                                    | 4-34 |
| 5.   | MAINTENANCE AND STORAGE .....                           | 5-1  |
| 5.1  | Cleaning .....                                          | 5-1  |
| 5.2  | Replacement of Protective FUSE (S) .....                | 5-1  |
| 5.3  | Calibration and Service .....                           | 5-2  |
| 5.4  | Storage .....                                           | 5-2  |
| 5.5  | Removal of memory backup battery .....                  | 5-3  |

## 1. GENERAL

### 1.1 Outline

The Model VP-7721A Audio Analyzer is a versatile audio measurement system that combines a low-distortion signal source with three functions in one unit as illustrated in Fig. 1-1.

Since the distortion measurement frequency is tuned to the oscillator frequency, the instrument is most effectively used as an automatic tuning distortion measurement set.

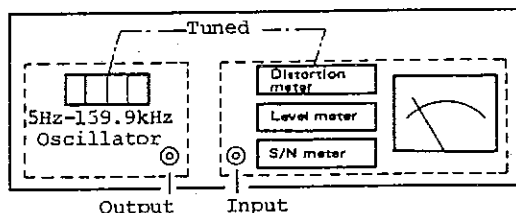


Fig. 1-1 Functional construction of the VP-7721A

Besides the normal mode of operation using digital displays and auto ranging meters, the VP-7721A can perform preset operations. The VP-7721A stores sixteen front panel setups and recalls them at a time whenever needed.

The operational ease has been largely improved by microprocessor control, however, the analyzer is compact in size measuring only 10 cm high and 35 cm deep. It is convenient for use in the production or inspection line and on service benches as well as research and development of audio equipment.

### 1.2 Oscillator

Signal source used in the VP-7721A is a "bridged-T" oscillator which provides a sine-wave signal from 5 Hz to 159.9 kHz. It attains a distortion factor of 0.002% or less in the range of 50 Hz to 20 kHz. The maximum output voltage is 1.58 V rms into a 600-ohm load (3.16 V rms open-circuited) and can be attenuated in 0.1-dB steps by an attenuator with a total attenuation of 79.9 dB. Either display in dBm (0 dBm = 1 mW into 600-ohm) or dB (0 dB = 1 V rms, into 600-ohm) is selectable. The direct reading range covers -73.7 dBm to 6.2 dBm or -75.9 dB to 4.0 dB (0.16 mV to 1.58 V rms).

The four 7-segment LED's indicate frequencies up to four digits and output amplitudes up to three digits (with a minus sign). The lower

three digits of the frequency or output amplitude can be incremented or decremented by the up/down keys located beneath each digit. The lower two digits can also be controlled by a rotary encoder. Frequency ranges are automatically switched when the numeral on the digital frequency indicator passes through each cross point (concerned with 1599 or 16). The current range can be known by reading the range indicator (LEDs) and the decimal point on display. The indicator displays frequencies or output amplitudes, whichever selected to be controlled. The display can be switched manually, however, the setting reverts to the previous one in the following up or down keystroke.

### 1.3 Distortion Meter

Distortion meter section of the VP-7721A contains a tracking rejection filter which is tuned to the oscillator frequency. A multi-stage filter circuit achieves a wide and steep frequency response, permitting signals with some frequency shift to be measured and a distortion factor of down to 0.001% to be displayed. The meter measures total harmonic distortion from 0.003% full scale to 100% full scale in ten ranges that can be switched automatically.

Since the distortion meter utilizes the Ratio Calculating Method\*, the operator is released from the tedious set-level procedure. The amplitude of the input signal is monitored on the other meter. If the amplitude deviates from the range suitable for measuring the distortion factor, an annunciator lights. The distortion meter can be adapted for automatic range switching, in which the appropriate range is automatically selected. Figure 1-2 shows a conceptional block diagram of the VP-7721A.

---

\* A conventional distortion meter determines distortion factors by dividing the (amplitude of the signal which excludes the fundamental component) by the (total signal amplitude).

It requires that the total signal amplitude be set to a reference value (set-level) before the distortion factor can be read directly from the amplitude of the signal which excludes the fundamental component. However, direct reading of the calculated ratio between these two types of signals eliminates the need of the set-level procedure. It was developed by Matsushita and has been used in the VP-7702 series and later.

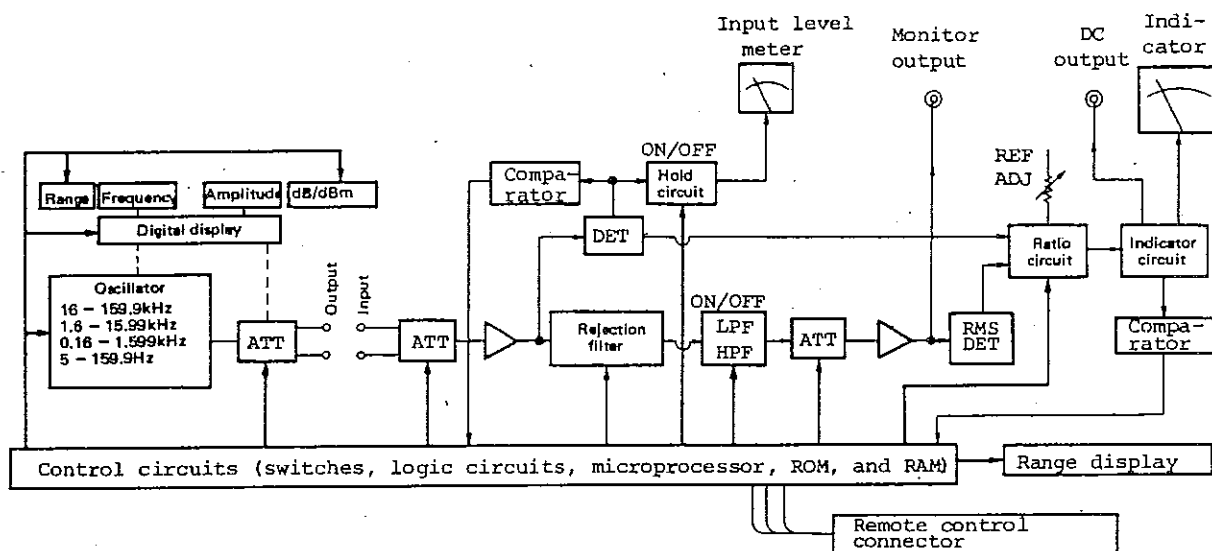


Fig. 1-2 Simplified block diagram of the VP-7721A

The distortion meter measures the true rms values. A high-pass filter and two low-pass filters built in the circuit assure accurate measurements, free from unwanted frequencies or noise. Distortion characteristics of the input signal can be monitored at the Monitor output with external equipment (oscilloscope or spectrum analyzer) to provide additional analysis of the distortion products.

#### 1.4 Level Meter

The AC level meter section of the VP-7721A measures the true rms value of input voltage from 0.1 mV full scale to 100 V full scale at 1, 3 and 10 steps in 13 ranges. The meter has dual scales of dB (0 dB = 1 V rms) and dBm (600 ohms, 1 mW), and it can be used over the range of 30  $\mu$ V to 112 V, -98 dBm to 43 dBm, and -100 dB to 41 dB including the extended scale above the rated full scale. Ranges can be switched manually or automatically. The REF ADJ (reference adjustment) control is used conveniently for measuring signal levels relative to a reference level on the meter. The monitor output is used when this instrument is used as a high-sensitivity preamplifier.

### 1.5 S/N Meter

The Ratio calculating method described in Section 1.3 can be used to measure signal-to-noise ratios also. The hold circuit in Fig. 1-2 retains the level of the signal, which is divided by the noise level (rms) for direct reading of the S/N value. The oscillator output of the VP-7721A is suppressed during noise level measurement for use as a signal source for S/N measurement.

The S/N indicator ranges can be switched automatically. High-pass filter and low-pass filters can be inserted in the circuit wherever necessary. The monitor output connector is used for noise component analysis.

### 1.6 Presetting

Presetting is useful when specific settings are used repeatedly. For example, the following seven settings can be stored in register A-1 and can be recalled at a time simply by pressing keys A and 1.

- |                               |                   |
|-------------------------------|-------------------|
| (1) Frequency                 | 1 kHz             |
| (2) Output amplitude          | 0 dB              |
| (3) Measurement function      | Distortion factor |
| (4) Low-pass filter frequency | 80 kHz            |
| (5) Range switching mode      | Manual            |
| (6) Input level meter range   | 3V full scale     |
| (7) Indicator range           | 0.1% full scale   |

A maximum of sixteen similar setups can be stored and recalled. Settings can be revised after they are recalled. The additional sixteen registers are provided for expansion up to 32 in remote-control operation.

### 1.7 Remote Control

The VP-7721A has a remote control connector on the rear panel. The function includes a maximum of 32 front panel setups to be recalled, modification with a rotary encoder, digital display selection, and HPF/LPF on/off control.

### 1.8 Microprocessor Control

The bold arrows in Fig. 1-2 indicate microprocessor control path in the VP-7721A. Benefits from the use of a microprocessor are described later. One inconvenience was the interference that might be caused by clock signals, which the VP-7721A has successfully overcome by ceasing clock signals during measurement.

### 1.9 Floating Input

The input terminals of the measurement section in the VP-7721A can be arranged for both floating and non-floating connection. The floating connection permits measurement of amplifiers with floating output configuration such as so-called BTL (balanced, transformer-less) type amplifier.



## 2. SPECIFICATIONS

The rated or reference full-scale deflection of 1.0 on the 0 - 1.12 scale of the Model VP-7721A is described merely as f.s.d. hereinafter throughout this instruction manual. The point of 1.0 is marked with a small green arrow on the meter panel.

### DISTORTION

#### Fundamental Frequency Range

5Hz to 159.9 kHz in 4 ranges

Frequency display and range indicator are common with the oscillator section.

#### Distortion Measurement Range

0.003 % to 100 % f.s.d. (-90 dB to 0 dB) in 10 ranges

#### Meter Indication

Distortion indicator : True rms detection

Meter reads dB and % THD.

Input level indicator : Average detection

Meter reads input level in V rms, dB and dBm.

#### Fundamental Rejection

5 Hz to 15.99 kHz  $\geq 100$  dB

16 kHz to 50 kHz  $\geq 90$  dB

50 kHz to 159.9 kHz  $\geq 86$  dB

#### Second Harmonic Accuracy

5Hz to 15.99 kHz Within  $\pm 1.5$  dB

16 kHz to 50 kHz Within  $\pm 2.5$  dB

50 kHz to 159.9 kHz Within  $\pm 2.5$  dB, -4 dB

#### Residual Noise and Distortion

Depend on input frequency range, input level and detection bandwidth as listed in Tables 2-1 and 2-2.

Table 2-1 Residual noise and distortion for unfloated input  
(V in rms, 0 dB=100 % distortion factor)

| Input range        | $\geq 3$ V    | 1 V                     | 0.3 V                     | Detection<br>Bandwidth BW |
|--------------------|---------------|-------------------------|---------------------------|---------------------------|
| Input signal level | $E_{in} > 1V$ | $1V \geq E_{in} > 0.3V$ | $0.3V \geq E_{in} > 0.1V$ |                           |
| 10Hz-15.99kHz      | $< -95dB$     | $< -85dB$               | $< -75dB$                 | 80kHz BW                  |
| 5Hz-50kHz          | $< -85dB$     | $< -75dB$               | $< -65dB$                 | 500kHz BW                 |
| 50kHz-159.9kHz     | $< -65dB$     | $< -65dB$               | $< -60dB$                 | 500kHz BW                 |

Table 2-2 Residual noise and distortion for floated input  
(V in rms, 0 dB=100 % distortion factor)

| Input range        | $\geq 3$ V    | 1 V                     | 0.3 V                     | Detection<br>Bandwidth BW |
|--------------------|---------------|-------------------------|---------------------------|---------------------------|
| Input signal level | $E_{in} > 1V$ | $1V \geq E_{in} > 0.3V$ | $0.3V \geq E_{in} > 0.1V$ |                           |
| 10Hz-15.99kHz      | $< -90dB$     | $< -80dB$               | $< -70dB$                 | 80kHz BW                  |
| 5Hz-50kHz          | $< -80dB$     | $< -75dB$               | $< -65dB$                 | 500kHz BW                 |
| 50kHz-159.9kHz     | $< -65dB$     | $< -65dB$               | $< -60dB$                 | 500kHz BW                 |

#### Input Level

Tables 2-1 and 2-2 also show the limitation for the distortion measurement range.

Input level indicator : 0.3 V to 100 V f.s.d. in 6 ranges, accurate within  $\pm 5$  % of f.s.d.

#### Common Mode Rejection (at 50 Hz, Common for all measurement functions)

40 dB for differential input voltage of 3 V rms or less

#### Input Impedance (Common for all measurement functions)

100 kilohms shunted by  $< 150$  pF (each input to common)

#### Maximum Allowable Input Voltage (Common for all measurement functions)

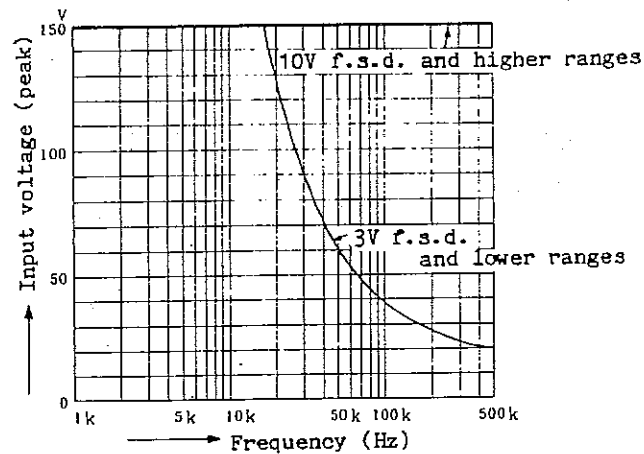
Maximum allowable input voltage between A (or B) terminal and common connection.

10 V to 100 V f.s.d. ranges : 150 V (DC + AC peak)

3 V f.s.d. or lower ranges : 150 V (DC + AC peak) for AC component of 17 kHz or lower.

See Fig.2-1 for higher frequencies.

Fig. 2-1 Maximum allowable input voltage  
(AC component only)



Maximum Floating Voltage (Common for all measurement functions)

150 V peak

Filters (Common for all measurement functions)

|           | -3dB cutoff freq. | rolloff       |
|-----------|-------------------|---------------|
| 30kHz LPF | 30kHz $\pm$ 5kHz  | 60dB / decade |
| 80kHz LPF | 80kHz $\pm$ 10kHz | 60dB / decade |
| 400Hz HPF | 400Hz $\pm$ 50Hz  | 60dB / decade |

Monitor Output

Provides scaled presentation of input after fundamental is rejected.

Output Voltage : Approx. 1 V rms, open circuit, both meters at f.s.d.

Output Resistance : 1 kilohm  $\pm$  10 %

DC Output (Common for all measurement functions)

Output Voltage : Approx. 1 V, open circuit, meter (LEVEL, S/N, DISTORTION) at f.s.d.

Output Resistance : 1 kilohm  $\pm$  10 %

**VOLTMETER**

Voltage Range

0.1 mV to 100 V rms f.s.d. in 13 ranges.

### Meter Indication

True rms detection. Meter reads (m) V rms, dB (0 dB=1 V rms) and dBm into 600 ohms.

### Accuracy

Within  $\pm 3$  % of f.s.d. at 1 kHz.

### Flatness (1 kHz reference)

20 Hz to 100 kHz Within  $\pm 0.5$  dB

5 Hz to 500 kHz Within  $\pm 3$  dB

### Residual Noise

10  $\mu$ V rms or less

### Relative Reference Adjustment Range

10 dB or more

### Monitor Output

Provides scaled presentation of input signal.

Output Voltage : Approx. 1 V rms, open circuit, meter (LEVEL, S/N, DISTORTION) at f.s.d.

## **SIGNAL-TO-NOISE**

### S/N Range

0 dB to 90 dB in 10 ranges

### Meter Indication

S/N indicator : True rms detection

Meter reads signal-to-noise ratio in dB

Input (S component) indicator : Average detection. Meter reads input signal (S) level in V rms, dB and dBm.

### S Level for S/N Measurements

Tables 2-3 and 2-4 show the limitation for the S/N measurement range.

Input (S component) level indicator :

0.3 V to 100 V f.s.d. in 6 ranges,  
accurate within  $\pm 5$  % of f.s.d.

Table 2-3 S/N measurement limit for unfloated input  
(V in rms, values with dB are S/N)

| Input range       | $\geq 3$ V | 1 V                  | 0.3 V                  | Detection bandwidth BW |
|-------------------|------------|----------------------|------------------------|------------------------|
| S component level | $E_s > 1V$ | $1V \geq E_s > 0.3V$ | $0.3V \geq E_s > 0.1V$ |                        |
| 5Hz-15.99kHz      | 100dB      | 90dB                 | 85dB                   | 80kHz BW               |
|                   | 90dB       | 85dB                 | 75dB                   | 500kHz BW              |
| 16kHz-159.9kHz    | 80dB       | 75dB                 | 60dB                   | 500kHz BW              |

Table 2-4 S/N measurement limit for floated input  
(V in rms, values with dB are S/N)

| Input range       | $\geq 3$ V | 1 V                  | 0.3 V                  | Detection bandwidth BW |
|-------------------|------------|----------------------|------------------------|------------------------|
| S component level | $E_s > 1V$ | $1V \geq E_s > 0.3V$ | $0.3V \geq E_s > 0.1V$ |                        |
| 5Hz-15.99kHz      | 95dB       | 85dB                 | 80dB                   | 80kHz BW               |
|                   | 85dB       | 80dB                 | 70dB                   | 500kHz BW              |
| 16kHz-159.9kHz    | 75dB       | 70dB                 | 60dB                   | 500kHz BW              |

#### Accuracy

Within  $\pm 1$  dB of S/N reading at meter deflection from -1 to +1 dB

#### Flatness

Same as voltmeter

#### Monitor Output

Provides scaled presentation of noise component only.

Output Voltage : Approx. 1 V rms, open circuit, both meters at f.s.d.

Output Resistance : 1 kilohm  $\pm 10\%$

#### OSCILLATOR

##### FREQUENCY

Display 4 digits

Frequency Range 5Hz to 159.9 kHz in 4 ranges

Accuracy Within  $\pm 3\%$  of reading  
Within  $\pm 2\%$  of reading in 0.16 kHz to 15.99 kHz range

## OUTPUT AMPLITUDE

|                          |                                                                            |                     |
|--------------------------|----------------------------------------------------------------------------|---------------------|
| <u>Display</u>           | 3 digits and a minus sign                                                  |                     |
| <u>Units</u>             | dBm (600 ohms)<br>dB (0dB=1 V rms, into 600 ohms)                          |                     |
| <u>Range</u>             | Variable from 6.2 dBm to -73.7 dBm (4.0 dB to -75.9 dB)<br>in 0.1 dB steps |                     |
| <u>Accuracy</u>          | 6.2 dBm to -33.7 dBm<br>(4.0 dB to -35.9 dB)                               | Within $\pm 0.5$ dB |
|                          | -33.8 dBm to -73.7 dBm<br>(-36.0 dB to -75.9 dB)                           | Within $\pm 0.8$ dB |
| <u>Flatness</u>          | (1 kHz reference, across 600-ohm load)                                     |                     |
|                          | Within $\pm 0.3$ dB                                                        |                     |
|                          | Within $\pm 0.1$ dB in 20 Hz to 20 kHz range                               |                     |
| <u>Output Resistance</u> | 600 ohms within $\pm 5$ %                                                  |                     |

|            |                              |                 |
|------------|------------------------------|-----------------|
| DISTORTION | Full range (500 kHz BW)      | 0.03 % or less  |
|            | 30 Hz to 40 kHz (500 kHz BW) | 0.005 % or less |
|            | 50 Hz to 20 kHz (80 kHz BW)  | 0.002 % or less |

## PRESET

### Number of memory registers

16

Expandable up to 32 in remote control mode

### Stored setups

- 1) Frequency range of the oscillator
- 2) Frequency of the oscillator
- 3) Output amplitude of the oscillator
- 4) Display of the oscillator, frequency or output amplitude
- 5) Measurement functions, level, S/N or distortion
- 6) Fundamental frequency range for distortion measurement
- 7) Fundamental frequency for distortion measurement
- 8) Input level range for S/N and distortion measurements

- 9) Level, S/N or distortion range
- 10) Selection of auto or manual ranging
- 11) Selection of LPF and HPF

#### REMOTE

##### Remote control Items

- 1) Recall operation of 32 memory registers
- 2) Frequency or amplitude modification control
- 3) Display selection, frequency or amplitude
- 4) Selection of LPF and HPF

#### OTHERS

##### Ambient

|                              |                                |
|------------------------------|--------------------------------|
| Operable                     | 0 °C to 40 °C, RH 90 % or less |
| With guaranteed performances | 5 °C to 35 °C, RH 85 % or less |

##### Power Requirements

100, 120, 220, and 240 V  $\pm$  10 %, 50 or 60 Hz, Approx. 30 VA

##### Dimensions

426 mm wide x 99 mm high x 350 mm deep

##### Weight

Approx. 10 kg

#### ACCESSORIES FURNISHED

- 1 ..... Power cable
- 2 ..... BNC adaptor
- 1 ..... Spare Fuse (Power supply)
- 2 ..... Spare Fuse (1A, Circuit protection)
- 1 ..... Instruction manual

### 3. INSTALLATION

#### 3.1 Power Requirements

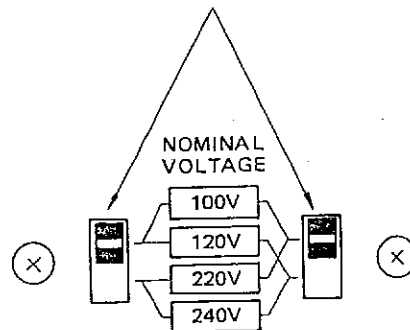
The Model VP-7721A can be operated from any power source supplying 100 V, 120 V, 220 V and 240 V (nominal values), 50 or 60 Hz. Power consumption is less than 40 VA.

#### 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    |
|---------|----------|
| 100V    | 90-112V  |
| 120V    | 106-132V |
| 220V    | 196-244V |
| 240V    | 214-250V |

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.

17

4-88-0202





### 3.3 Fuse

Verify that the proper fuse is installed in the fuse holder.

Ratings of the fuse are noted on the rear panel and listed below with Matsushita part numbers.

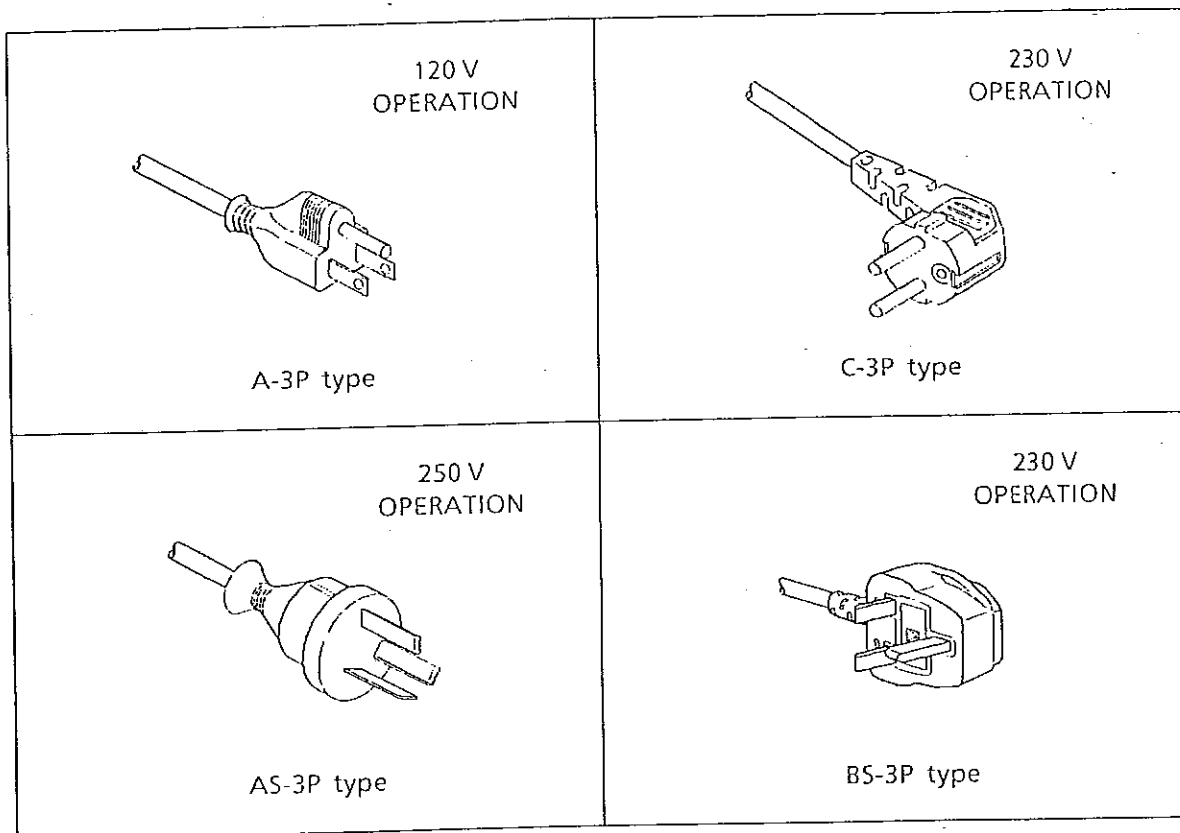
| Nominal voltage | Fuse      |
|-----------------|-----------|
| 100V            | 250V 1A   |
| 120V            | IEC1A     |
| 220V            | 250V 0.5A |
| 240V            | IEC500MA  |

#### WARNING

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

### 3.4 Power Cable

The VP-7721A 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 cable available with Matsushita part numbers..



### 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 24-pin connector.

Particular consideration should be required for floating connection. See section 4.4 for detail.

#### NOTE:

The 24-pin connectors should only be connected to the remote control fixture prepared specifically for this instrument.

### 3.6 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.

### 3.7 Rack Mounting

The VP-7721A may be rack mounted by using the Rack Mount Kit H100 (Part number VQ-069H10). The kit contains two rack flanges, four screws and conversion instructions. It will fit 480 mm wide racks conforming JIS C 6010.

### 3.8 Preparation for use

(1) Adjustment of meter mechanical zero

With the power switch off, adjust the pointer of each meter to exact zero by turning the mechanical zero adjustment screw just beneath each meter on the front panel.

(2) Memory back-up battery

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.

ATTENTION  
(in the USA only)

The product contains a rechargeable battery. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local solid waste officials for details in your area for recycling options or proper disposal.

If removal of the battery is required, contact the dealer or representative from which you have purchased the product. Removal of the battery should be performed only by a qualified person.

(3) Warm-up

Allow a warm-up period of fifteen minutes before using the instrument.

## 4. OPERATION

### 4.1 Outline

The functions of the VP-7721A are based on the distortion meter that links with the low-distortion oscillator as a source of measuring signal for audio equipment. The distortion meter can operate as a level meter and, in particular, operate as the S/N meter in the VP-7721A. Descriptions on each operating procedure will appear as follows.

|                                                                                            | Section | (Page) |
|--------------------------------------------------------------------------------------------|---------|--------|
| ° Front panel (to be referred to the panel layout diagram at the end of this manual) ..... | 4.2     | (4-1)  |
| ° Basic operation (first-time operation) .....                                             | 4.3     | (4-7)  |
| ° Warnings to be observed during actual measurement .....                                  | 4.4     | (4-21) |
| ° Distortion measurement using internal oscillator .....                                   | 4.5     | (4-29) |
| ° Distortion measurement of an external source .....                                       | 4.6     | (4-31) |
| ° Level measurement .....                                                                  | 4.7     | (4-32) |
| ° S/N measurement .....                                                                    | 4.8     | (4-33) |
| ° Preset application .....                                                                 | 4.9     | (4-34) |
| ° Remote control .....                                                                     | 4.10    | (4-34) |

Numbers in a circle in the panel layout diagram appear in Sections 4.2 and other parts of this manual. Section 4.3 contains a description of full operation of this instrument for familiarization. Sections 4.5 and after are written for readers who are familiar with the basic operations in Section 4.3. Readers should review Section 4.3 and the description of parts in Section 4.2 whenever necessary.

### 4.2 Description of the Front Panel

See the panel layout diagram at the end of this manual.

#### ① POWER switch

Press this switch to turn on the VP-7721A and release it to turn off.

#### ② FREQ RANGE LED's

One of the four LED's lights to indicate the selected frequency range. The frequency is indicated on the digital FREQUENCY/AMPLITUDE display (the units - Hz or kHz - are determined from the position of the decimal point).

- ③ FREQUENCY/AMPLITUDE display  
LED's indicate frequency in four digits and amplitude in three digits and a minus sign (if needed). The displayed frequency is the frequency of the oscillator in this instrument and also the tuning frequency of the distortion meter. The amplitude indicates the output level provided by the built-in oscillator defined across a 600-ohm load.
- ④ Amplitude unit indicator  
One of the two LED's lights to indicate the unit (dB or dBm) of the indicated output amplitude.
- ⑤ DISPLAY key  
Selects frequency or amplitude alternately; frequency is indicated when the LED in the key is off, and amplitude is indicated when the LED is on. The LED on/off is dominated by the mode selector keys ②②, however, this key can work alone at any time.
- ⑥ MEASUREMENT keys  
Three keys select the measurement functions: level, S/N, or distortion. The LED in the selected key lights.
- ⑦ INPUT LEVEL meter  
Indicates the level of the signal input to the measurement section. This meter is used for monitoring input levels during S/N or distortion measurement. A meter with an average responding characteristic has been calibrated for the rms value of a sine wave.
- ⑧ Meter range indicator LED's  
These 16 LED's indicate selected meter ranges. In level measurement, one out of 16 lights will be on to indicate the range of the meter on the right ⑨. In S/N or distortion measurement; one of the upper six LED's lights to indicate the range of the input level meter on the left, and one of the remaining 10 lights to indicate the range of the meter ⑨ on the right.
- ⑨ Indicator  
The level, S/N, distortion are indicated by this meter which measures true rms values.

- 24
- (10) REF ADJ (relative reference adjustment)  
Control (variable resistor) with a pull switch. This control is disabled when the pull switch is pressed. When the switch has been pulled, the control changes the deflection of the meter (9) by about 10 dB during level measurement. This control shifts the reference point on the scale when only the relative level ratio is measured. This control is disabled during S/N or distortion measurement. Usually keep this control pushed in.
- (11) UNCAL light  
Annunciator light to indicate that the REF ADJ control (10) is pulled making the meter (9) uncalibrated in level measurement function.
- (12) MONITOR OUTPUT connector  
A BNC receptacle which provides an AC output proportional to the deflection on meter (9).
- (13) MEASUREMENT RANGE select keys  
Two keys select the range for indicator (9). The up (▲) and the down (▼) arrows indicate direction in which the range indicator LED's (8) light when respective key is pressed. A single press of the key changes the range by one. If the key is held, the range will shift continuously after a slight delay.
- (14) RANGING key  
The key containing an LED, alternately selects automatic ranging (the LED is off ... AUTO) or manual ranging (the LED is on ... MANUAL). When AUTO is selected, ranges for both meters (7) and (9) are selected automatically.
- (15) INPUT RANGE OVER/UNDER keys  
A pair of keys each containing a red LED. The keys have no effect in level measurement. In S/N or distortion measurement, the LED lights to warn the user an excessive (OVER) or insufficient (UNDER) input signal level. Use the keys to select ranges on meter (7). Warning is suppressed when automatic ranging has been selected. In manual ranging, press the key in which the warning LED lights and select an appropriate range. The selected range will be indicated by one of the upper six of the meter range indicator LED's (8). Function of the two keys marked with arrows and how ranges are switched are the same as described for keys (13).

①⑥ Floating/unfloating selector switch  
Slide switch to select floating or unfloating input arrangement of the measurement section.

①⑦ Input connectors A and B  
Floating connection can be made using two BNC receptacles, INPUT A and B, with the slide switch ①⑥ in its left position. With the slide switch ①⑥ in its right position, unfloating connection can be made using only the INPUT A receptacle. The input supplied to the INPUT B receptacle is disconnected from the internal circuit in this arrangement.

25



- (18) **WEIGHTING key**  
An on/off key with an LED that works only when the internal circuit is equipped with a weighting filter. If fitted, the circuit provides a weighting characteristic with the LED in the key on.
- (19) **80 kHz LPF key**  
On/off key with an LED. When this key is on, the LED is lit and a low-pass filter that passes frequencies below 80 kHz is inserted into the circuit.
- (20) **30 kHz LPF key**  
This key functions like (19) but it passes frequencies below 30 kHz. (Keys (19) and (20) turn on and off independently of each other, though they do not turn on at the same time (toggle operation).)
- (21) **400 Hz HPF key**  
On/off key with an LED. When this key is on, a high-pass filter that passes frequencies above 400 Hz is inserted into the circuit and the LED lights.
- (22) **MODE select keys**  
A set of four keys with LED's. The instrument assumes the following modes according to the settings of these keys.

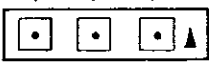
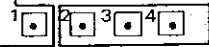
Table 4-1 Mode switch functions

| Key with lighting LED       | Operation                                           | Mode        |
|-----------------------------|-----------------------------------------------------|-------------|
| FREQ $\uparrow \downarrow$  | Increases or decreases frequencies                  | Normal mode |
| AMPTD $\uparrow \downarrow$ | Increases or decreases output amplitudes            |             |
| RCL                         | Recalls 16 memory registers from A-1 to D-4         | Preset mode |
| STO (WRITE)                 | Stores data in 16 memory registers from A-1 to D-4. |             |

(23), (24), (25), (26) setting keys

Eight keys each containing an LED. Their names and use depend on the mode as follows.

Table 4-2 Functions of setting keys

| Mode        | Keys to be used<br>(Conditions)                                                                                   | Name                       | Use according to the mode                                                                                  |                            |
|-------------|-------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------|----------------------------|
| Normal mode |                                                                                                                   |                            | FREQ key ▲ lights.                                                                                         | AMPTD key ▲ lights.        |
|             | (23) <br>(Not lit.)              | FREQ/AMPTD<br>up keys      | Increment the digits<br>above them and<br>carries up to the<br>more significant<br>digit.                  | Same as<br>left.           |
|             | (24) <br>(Not lit.)              | FREQ/AMPTD<br>down keys    | Decrements the digits<br>above them and<br>borrows down from the<br>more significant<br>digit.             | Same as<br>left.           |
|             | (25) FREQ RANGE<br> (Not lit.) | FREQ range<br>up key       | Shifts the frequency<br>range upward.                                                                      | Invalid                    |
|             | (26)  (Not lit.)               | FREQ range<br>down key     | Shifts the frequency<br>range downward.                                                                    |                            |
| Preset mode |                                                                                                                   |                            | RCL key lights.                                                                                            | STO (WRITE)<br>key lights. |
|             | (23) (One LED lights.)                                                                                            | Letter<br>keys<br>A,B,C,D  | The preset memory register<br>address is determined by combi-<br>nations of two lit keys.<br>(A-1 to D-4). |                            |
|             | (24)                           |                            |                                                                                                            |                            |
|             | (25)                           |                            |                                                                                                            |                            |
|             | (26) (One LED lights.)                                                                                            | Numeral<br>keys<br>1,2,3,4 |                                                                                                            |                            |

(27) MODIFY digit select switch

2-position slide switch to select the digit to be incremented.

The least significant digit or the next digit can be selected.

(28) MODIFY control

Rotary encoder with 50 detents per revolution. The control increments or decrements the displayed frequency or amplitude at the digit select switch (27). The control is particularly useful for modifying preset values after they are recalled in the preset mode.

- (29) **Amplitude unit select switch**  
Slide switch that selects dB or dBm as the output level display unit. The selected unit is indicated by LED (4).
- (30) **Measuring earth terminal**  
A terminal that connects directly the chassis of other instrument or the outer braid of a shielded wire.
- (31) **Output connector**  
A BNC receptacle which provides the output signal of the internal oscillator. The maximum level is 6.2 dBm or 4.0 dB (1.58 V rms) into a 600 ohm load. The level will be double (3.16 V rms) at an open end.

#### 4.3 Basic Operation

##### Notes for safety

- 1) Because care should be taken for safety of the mains supply, read the Item Installation section of this manual before turning on the power for the first time.

##### Turning on the power

- 2) Turn on the power by pressing the POWER switch (1); it will lock in place. When power is on, the FREQUENCY/AMPLITUDE display (3) will light.

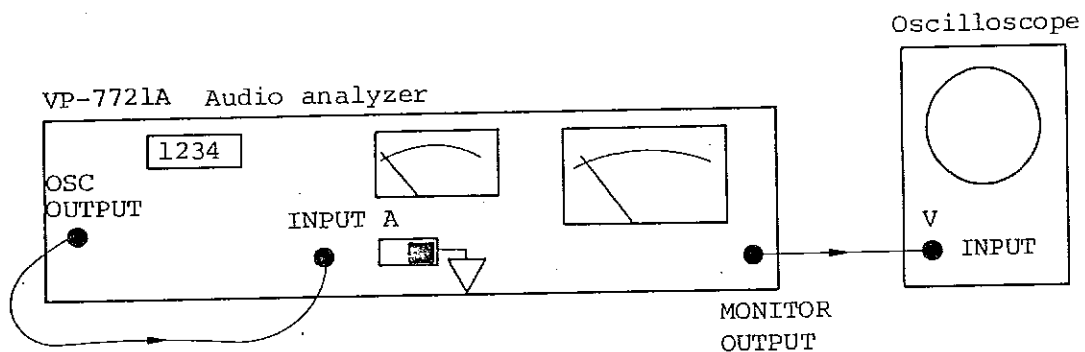


Fig. 4-1 Connection for checking VP-7721A

### Connection

- 3) Connect the OSC OUTPUT connector to the INPUT A connector of the measurement section to place the analyzer in the self-diagnosis mode. (See Fig. 4-1.) A coaxial cable with BNC plugs is recommended. Set the slide switch (16) to the right for unfloating connection.
- 4) Connect an oscilloscope (1 MHz bandwidth is adequate), to the MONITOR OUTPUT connector (12) as shown in Fig. 4-1. Observing waveforms will help you understand the operation of the analyzer.
- 5) Do not connect the DC OUTPUT and REMOTE CONTROL connectors on the rear panel to anything.
- 6) Press the LEVEL key of the MEASUREMENT keys (6) (the LED in the key will light) to select level measurement function.

#### NOTE

As described under S/N measurement, the internal oscillator produces no signal during S/N measurement (the S/N key of the MEASUREMENT keys (6) is pressed). In this state, the oscillator frequency and output amplitude are ordinarily displayed on the digital display, and up/down operation is effective but no signals appear at the output connector (31). When using the internal oscillator as a low-frequency oscillator, press the LEVEL or DISTN key with the corresponding LED in the key on.

### Oscillator frequency setting

- 7) Press the FREQ  key of the MODE select keys (22) with the LED in the key on. In this state, the oscillator frequency can be switched up or down. One of the four FREQ RANGE LED's (2) lights to indicate the selected range. The FREQUENCY/AMPLITUDE display (3) displays the frequency currently generated.

#### NOTE

The vp-7721A does not display the frequency counted by the frequency counter; rather, it controls the oscillator so that it generates the frequency displayed. Accuracy is merely 2 to 3 percent of the displayed value (see the Specification in this manual), however, the S/N ratio of the signal source is kept high. (The LED digit numeral devices are statically lit and  $\mu$ P clocks are ceased during measurement.)

- 8) Press each of the three frequency-up keys (23). Pressing a key increments the digit above it by 1, and holding the key causes the digit to advance continuously with a slight delay. Check individual key operation. The frequency range can be automatically incremented up to 159.9 kHz.
- 9) Press each of the three frequency-down keys (24). In contrast with the frequency-up keys, the digit is decreased, thereby causing the frequency range to be decremented automatically down to 5.0 Hz.
- 10) Turn the MODIFY control (28) clockwise to increase the frequency and counterclockwise to decrease the frequency step by step. One rotation of this knob represents 50 detents. Since it can be turned endlessly, the frequency can be varied through all ranges. Carry up, borrow down, and automatic range switching can be performed. The digit to be changed is selected by the MODIFY digit select switch (27).

NOTE

As described in 8), 9) and 10), the frequency can be controlled by either six up/down keys (23), (24) or the MODIFY control in the normal mode.

The MODIFY rotary switch is named so because it is used to modify the values when the up/down keys have been disabled after recall in the preset mode.

- 11) The frequency range-up key (25) and frequency range-down key (26) switch the frequency range. The frequency is multiplied or divided by 10 each time a key is pressed, thus changing the frequency rapidly by a large amount. In the lowest range (5 to 159.9 Hz) the range-up/down key may have to be pressed twice in some cases since the ratio of this range exceeds 10.

Example: 12.0 Hz, 120.0 Hz, 1.200 kHz, 12.00 kHz, 120.0 kHz.

(These keys can be called the decade-up/down keys.)

NOTE

The frequency range does not change in the case when the next step will be supposed to cause the frequency beyond the specified limits from 5 Hz to 159.9 kHz. Similar operation will be observed in frequency up/down key-stroke except the least significant digit. That is, if the next step of incrementing or decrementing a value with these keys will be supposed to cause it to overflow the allowable frequency range, the up/down operation would stop.

Proceed to the next operation after setting the frequency to 1.000 kHz.

Output amplitude setting

- 12) Press the AMPTD  key of the MODE select keys (22) with the LED in the key on. This operation enables the normal up/down operation of the output amplitude of the oscillator. The FREQUENCY/AMPLITUDE indicator (3) displays the level of the output signal supplied to the output connector (31).

NOTE

The analyzer does not display a value as measured by the digital voltmeter but rather the output level reduced by the built-in attenuator from the maximum oscillator output, which is maintained at a constant amplitude.

- 13) As with the frequency operation, the three amplitude-up keys (23) and three amplitude-down keys (24) or the MODIFY control (28) can be used for increasing or decreasing the displayed value. The difference is that the range-up/down keys (25) and (26) are disabled.
- 14) Determine whether the output signal level is displayed by the voltage (dB) (0 dB = 1 V rms into 600  $\Omega$  load) or by the available power (dBm) (600  $\Omega$ , referred to 1 mW) by the amplitude unit select switch (29). This is shown by the amplitude unit indicators (4) to the right of the digital display.

Check that the display of output signal level can be varied from 6.2 to -73.7 dBm and 4.0 to -75.9 dB.

NOTE

As explained in item 7) and 12), the FREQUENCY/AMPLITUDE display indicates the frequency when the FREQ  $\uparrow$  key is pressed, and it indicates the output amplitude when the AMPTD  $\downarrow$  key is pressed. That is, whatever is to be incremented/decremented (frequency or amplitude) is automatically indicated on the digital display. Use the DISPLAY key (5) if it is desired to change the frequency display to the output amplitude display and vice versa. The LED in the DISPLAY key is off for frequency display and on for output amplitude display. This key does not normally need to be operated since it is dominated by the selection of FREQ  $\uparrow$  key and AMPTD  $\downarrow$  key. After the display has been changed by hand, operation of a frequency or amplitude UP/DOWN key returns the current display to the original display. The MODIFY control (28) only varies the current display.

The output amplitude operation described above will also be used for level measurement below.

Level measurement

- 15) Press the LEVEL key of the MEASUREMENT keys (6) with the LED in the key on. The analyzer is now set to measure voltage levels. (Because the LEVEL key was pressed in step 6) and remains there, this instrument provides the level measurement function with which you have been able to measure the oscillator output level with the measurement setup in Fig. 4-1.)
- 16) Use the RANGING key (14) to determine whether the indicator range is switched automatically or manually. The lamp of this key turns on or off alternately each time it is pressed. Turn off the RANGING key to select AUTO. One of the 16 meter range indicators (8) will light and indicates the range of the meter (9) to read the input level.
- 17) Keep the REF ADJ knob (10) depressed.
- 18) Read the levels by operating the output amplitude of the oscillator according to steps 13) and 14).

# NOTE

Because connection is made as shown in Fig. 4-1, output from the oscillator is not terminated with a 600-ohm load. Inserting a 600-ohm termination pad at the INPUT A connector causes the level meter to read the value displayed on the digital display in dB or dBm. Otherwise, the level meter indicates a value 6 dB higher than the value displayed on the digital display for both dB and dBm. That is, the unloaded output of the oscillator is measured.

- 19) Use the meter (9) at the right to measure the level. Ignore the small meter (7), which reads the same as the large meter in the 0.3 V (-10 dB) range or higher.
- 20) The range is switched automatically near the points indicated by the arrows (↓) in Fig. 4-2.

Visually check the meter pointer to see if the output amplitude of the oscillator on the analyzer can be changed over many ranges.

- 21) Press the RANGING key (14) to select the range manually with the LED in the key on. The MEASUREMENT RANGE select keys (▲ and ▼) (13) are used to shift the range upward or downward respectively.

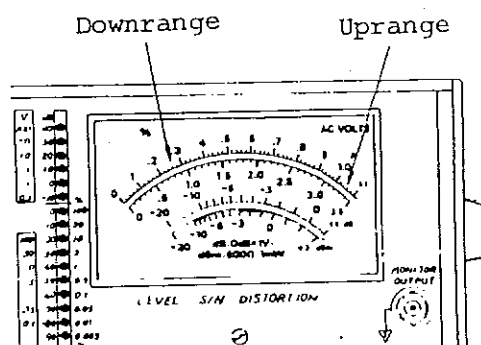


Fig. 4-2 Range switching points

Pressing a key causes the range to be switched by one range; and holding a key causes the range to be switched continuously with a slight delay.

The INPUT RANGE OVER/UNDER keys (15) of the same type are disabled since they are not required for level measurement.

- 22) When an oscilloscope is connected through the MONITOR OUTPUT connector (12), the waveform of a level measured signal (in this case, the 1-kHz sine wave output from the oscillator) can be observed. Make sure that the monitor output amplitude varies proportionally



with the deflection of the meter and 1 V rms (about 2.8 Vp-p) is displayed when the meter reads the rated full scale.

- 23) Pull and rotate the REF ADJ control (10). The meter is now uncalibrated. The meter deflection can be increased continuously by about 10 dB. The UNCAL light (11) will be on in this case. Set the output amplitude display of the oscillator to -10.0 dB. Press the RANGING key (14) to set the AUTO mode, and rotate the REF ADJ knob (10) so that the meter reads 0 dB. Then proceed to the next step.
- 24) The HPF and LPF do not affect the operation because the oscillator frequency is set to 1.000 kHz. Changing the frequency, the filter effect can be checked.  
Press the FREQ  key of the MODE select keys (22) to place the analyzer in the frequency-up/down mode and to display the frequency.
- 25) Turn off the HPF 400 Hz (21), LPF 30 kHz (20), and LPF 80 kHz (19) keys with the LED in each key off. The HPF key (21) is turned on and off independently. The LPF keys (20), (21) are toggled, so pressing only the key with the LED on turns both LED's off.
- 26) The WEIGHTING key (18) is effective only when the optional weighting filter is installed within the analyzer. If fitted, turn it off. The key has no effect and remains off in a standard model.
- 27) Check the deflection of the level meter, changing the oscillator frequency from 5 Hz to 159.9 kHz. The deviation from 0 dB set in step 23) indicates the output amplitude characteristics of the analyzer. (For stringent checking, a 600-ohm termination pad should be inserted at the INPUT A connector).
- 28) Turn each of the three filters on and read the meter, varying the oscillator frequency to check the characteristics of each filter. The characteristics of the weighting filter can also be checked if it is installed.

- 32) Turning on the LPF 80 kHz (19) or LPF 30 kHz (20) key decreases the noise component, thereby decreasing the distortion factor. This state can be visually checked by observing the monitor output with an oscilloscope. The monitor output provides the distortion and noise components excluding the fundamental component.
- 33) Measure the distortion factor, varying the frequency and amplitude of the oscillator. It will be found very easy to use - neither the frequency nor the meter range need to be set. The range can also be selected manually, in which case the OVER and UNDER annunciators of the INPUT RANGE OVER/UNDER keys (15) warn the operator of excessive input or too little input. If either LED comes on, select the appropriate range to turn it off.

#### NOTES

- (1) The input signal levels below 1 V will limit the selectable ranges for distortion measurement. Detailed information will be described later in paragraph 4.5.
- (2) The use of the LPF and HPF restricts the frequency of the measurable fundamental wave as follows:
- |             |       |                |
|-------------|-------|----------------|
| LPF 80 kHz  | ..... | 20 kHz (max.)  |
| LPF 30 kHz  | ..... | 7.5 kHz (max.) |
| HPF 400 kHz | ....  | 500 Hz (min.)  |

This is the last step in measuring the distortion. Turn off all filters and turn off the RANGING key, placing the analyzer in the AUTO mode. Set the oscillator frequency to 1.000 kHz, and the output amplitude to 4.0 dB.

#### S/N measurement

- 34) When the S/N measurement function is enabled with the connection (Fig. 4-1) kept as is and the set state unchanged, the S/N of the analyzer itself will be indicated. The S/N in this case implies the degree of residual noise content.

To measure the S/N ratio, press the S/N key of the MEASUREMENT keys (6) with the LED in the key on. The meter range indicator (8) shifts, and after a pause the range will shift again and will be stable. The large meter (9) at the right indicates the S/N ratio. Both the INPUT LEVEL meter (7) and indicator (9) are in the

automatic ranging mode; therefore, the appropriate range is selected and the S/N ratio is indicated. The meter ranges of 3 V (10 dB) or 10 V (20 dB) and -90 dB will be selected. The meter range LED associated with 3 V or 10 V indicates the range of the INPUT LEVEL meter (7) indicating the S (signal) component and the LED of -90 dB indicates the range of the S/N meter (9) during S/N measurement.

NOTE

The S/N ratio is indicated in dB. The ranges below 0 dB are used for S/N measurement ignoring minus signs (ten ranges from 0 dB to 90 dB). The S/N meter uses only the dB scale in green (-20 to +1 dB), and the plus and minus signs should be inverted for reading.

Example: Range display      -90 dB  
                                          Meter reading      -6 dB      } S/N = 96 dB

- 35) The S/N ratio is calculated as the ratio of the S (signal) component to N (noise) component. The meter (9) indicates the result. Pressing the S/N key causes the analyzer to operate as shown in Fig. 4-3.

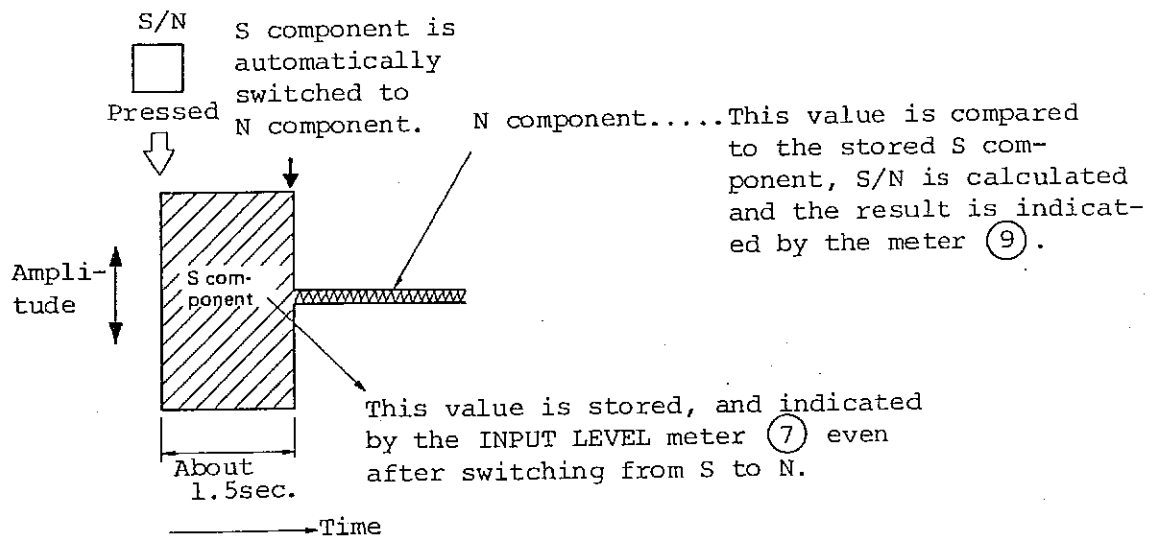


Fig. 4-3 S/N measurement

- 36) As shown in Fig. 4-3, pressing the S/N key causes the output of the oscillator to be stored as the S component. (In this case, 10-dB signal is applied to the measurement circuit because the output amplitude of 4.0 dB is displayed, and the output is not terminated with a 600-ohm load.) The INPUT LEVEL meter (7) goes into the 10-dB range and indicates 10 dB (3.2 V). The S/N meter (9) is placed in the 0-dB range. The operation described above is performed for 1.5 seconds as shown in Fig. 4-3. The S component is then eliminated and only the N component is left. (The S component input level of 10 dB is stored and the INPUT LEVEL meter (7) retains the deflection.) Because the oscillator provides no output, most of the N component is the residual noise within the measurement circuit. The S/N ratio is calculated from the stored S level and the residual N level; the range of the meter (9) automatically changes, and the meter provides direct indication of the S/N ratio.
- 37) The REF ADJ knob (10) has no effect while the S/N ratio is measured.
- 38) The LPF's and HPF are used for limiting the bandwidth in which the N component is detected. Turning on the 30 kHz or 80 kHz LPF key decreases the deflection of the S/N meter because the S/N ratio is increased. The residual noise can be checked by observing the monitor output with an oscilloscope.
- 39) The meter range can be switched manually by pressing the RANGING key (14) with the LED in the key on indicating MANUAL mode. In this mode, after the S/N key is pressed and the S component stored, the 0-dB meter range display LED is lit if the input meter range is appropriate for the input S component level. To read the S/N ratio, lower the range to the desired level by pressing the  $\nabla$  key of the MEASUREMENT RANGE select keys (13). If an incorrect input meter range is selected, either LED built in the INPUT RANGE OVER/UNDER keys (15) annunciates, indicating excessive input (OVER) or too little input (UNDER) for 1.5 seconds of S component measurement period. Select another range by pressing the key until the annunciator goes off during S component measurement. When the key is pressed, S/N will be measured without the need of pressing the S/N key again.
- After S component has been removed in S/N measurement, the UNDER light will be on. Note that this is not a warning but a normal state measuring N component.

NOTES

- (1) The input signal levels (S components) below 1 V will limit the selectable ranges for S/N measurement. Detailed information will be described later in paragraph 4.8.
- (2) In principle, the S/N key is pressed once more when the frequency or amplitude of the S component (in this case, the signal output from the oscillator) changes. With a restriction that the S/N measurement is made using the internal oscillator, the analyzer is designed so that the same operation as the S/N key is repressed is executed internally just after the frequency or amplitude setting key strokes. In manual ranging mode, however, the S/N meter range does not return to 0dB as described in step 39).
- (3) The S component is stored by charging a capacitor. The stored value gradually decreases with time; however, its accuracy is not affected within three minutes. Repress the S/N key if the S/N ratio measurement prolongs for three minutes or more.
- (4) As described above, the oscillator does not provide the normal output signal while the S/N key is on. In this state, the frequency or output amplitude is indicated normally in the digital display. The display merely indicates the value within 1.5 seconds immediately after the S/N key is pressed. When the oscillator of the analyzer is to be used as an audio frequency oscillator only, the LEVEL or DISTN key of the MEASUREMENT keys (6) must be kept on.

39  
The operations in the preceding description (oscillator frequency, output amplitude, level measurement, distortion measurement, and S/N measurement) are basic to this instrument. These operations are called "normal operation" because setting of each operation is done when necessary.

In addition to these operations, the analyzer can be preset to any of 16 setups. The following describes how to preset the analyzer.

#### Preset

- 40) Preset is a facility that enables to store various setups for measurements and to recall them with simple keystrokes. The following are the basic procedure.

##### Basic procedure for storing

- a. To set up a required state, do normal operations for individual functions.
- b. Press the STO (WRITE) key of the MODE select keys (22); this will cause the blinking of two keys [a] and [1].
- c. Specify a preset address with a pair of keys (example: [C] [3]). Keys [A] and [1] go off and the specified keys begin to blink.
- d. Press the STO (WRITE) key. The specified two keys stop blinking and remain lit. This implies the setup has been stored.

##### Basic procedure for recalling

- a. Press the RCL key of the MODE select keys (22); two keys [A] and [1] will be lit. The contents stored at address [A] [1] are recalled.
- b. Press the keys for a specific address (example: [C] [3]). The selected two keys light, then the contents at that address are recalled.

- 41) Data on the following items can be stored:

- a. Frequency range ... Both the oscillator frequency range and the fundamental frequency range for the distortion measurement
- b. Frequency ..... Both the oscillator frequency and the fundamental frequency for the distortion measurement
- c. Output amplitude of the oscillator
- d. Display of the oscillator (frequency or amplitude)

- e. Measurement function (level meter, distortion meter, or S/N meter)
  - f. Indicator ranging (manual or automatic)
  - g. Input level meter range
  - h. Indicator range
  - i. On/off of LPF, HPF, and WEIGHTING (if fitted)
- 42) Controls that can be set mechanically (MODIFY digit select switch (27), amplitude unit select switch (dB/dBm) (29), and REF ADJ control (10)) cannot be stored. They can be operated at any time.
  - 43) Do setting of level measurement of the normal operation according to steps 15) to 28), and store the setting according to step 40), specifying addresses A 1 to A 4, and B 1 to B 4.
  - 44) Return to normal operation. Do setting for distortion measurement according to steps 29) to 39), and store the setting in addresses C 1 to C 4.
  - 45) Return to normal operation and do setting for S/N measurement according to steps 34) to 39), and store the setting in addresses D 1 to D 4.
  - 46) Press the RCL key to recall the contents stored at address A 1 in step 43). The displays on the front panel indicate the contents at address A-1.
  - 47) Recall all addresses A 2 to D 4 in sequence. Ensure that all settings stored in steps 43) to 45) are recalled.
  - 48) Data stored in the 16 memory registers (addresses A-1 to D-4) are saved, even after power to the analyzer is turned off. Confirm this by turning the POWER switch (1) off and on.
  - 49) The analyzer was designed so that the state set immediately before power is turned off is restored when the analyzer is powered up again. Confirm this also.

#### 4.4 Cautions to be observed during Actual Measurement

##### (1) dB/dBm selection—AMPTD switch

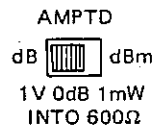


Fig. 4-4

The switch selects whether the oscillator output amplitude is represented in dB or dBm (see 4.3 14)).

Set the switch to the desired position prior to the use and be careful not to touch the switch during measurement.

The dBm unit is naturally used in a 600-ohm terminated line since the unit is clearly defined in terms of power dissipated in a 600-ohm load.

The dB unit is only conditionally definite because it is a relative voltage ratio as 1 V rms being 0 dB; a 6-dB difference depends on whether the output has a matched load or not. Remember that the output of the VP-7721A has been calibrated with a 600-ohm load. This is noted by INTO 600Ω marked beneath the switch on the front panel as shown in Fig. 4-4.

Measuring the voltage at the OSC OUTPUT connector directly with a high-impedance voltmeter (e.g. the level meter section of the VP-7721A) reveals that the output is 6 dB higher than the displayed value. To supply the exact level appearing in the digital display, the oscillator output should be terminated with a 600-ohm load.

##### (2) Oscillator output

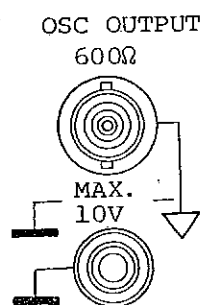


Fig. 4-5

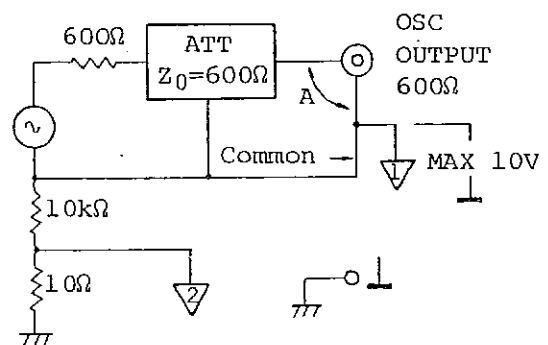


Fig. 4-6



Fig. 4-6 shows the oscillator output circuit. The common side (  ) of the OSC OUTPUT connector (outer metal shell of the BNC connector) is floated from the chassis (  ). This floating scheme is not primarily for floating voltage but for preventing a ground loop which may be formed by connecting this instrument to the device under measurement. The common side is usually connected to the chassis ground directly at an appropriate point in the measurement setup. For floating requirement, however, up to 5 volts can be applied without affecting the performance.

The maximum allowable floating voltage without damage is 10 volts (peak) as noted on the front panel (Fig. 4-5).

If a non-floating input equipment is connected to this connector, the common side (  ) is grounded directly. This is a normal state for audio frequency measurements.

The metal terminal marked with  (see Fig. 4-5) is used to connect a separate wire which links the chassis or to connect the braid of a shielded wire to provide common ground.

The output of the oscillator is an unbalanced type due to the circuit configuration shown in Fig. 4-6.

Be careful not to apply an external voltage to the OSC OUTPUT connector accidentally.

Applying 12 volts or more across "A" in Fig. 4-6 will deteriorate internal components.

The maximum permissible voltage between the center conductor of the OSC OUTPUT connector and the chassis is also 10 volts (peak).

(3) Common side of the measurement input

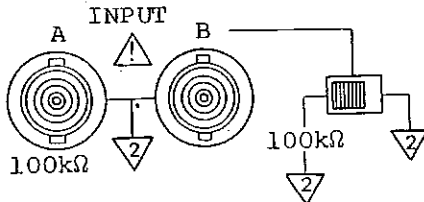


Fig. 4-7

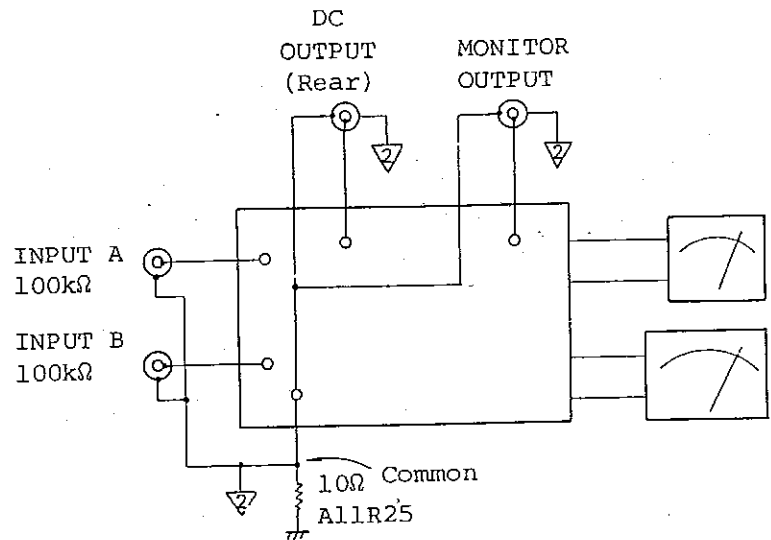


Fig. 4-8

When a very low level or distortion is measured, a problem caused by a ground loop can occur due to device interconnection. To avoid the problem, the common sides (  ) are connected together, and they are connected to the chassis (  ) through a 10-ohm resistor (see Fig. 4-8). So the common side (  ) cannot be voltage floated. If an output terminal of a device with floating voltage is connected to the INPUT A or B BNC connector directly, the floating side of the device will be short-circuited to the chassis through the 10-ohm resistor and may cause either damage to the device under measurement or burning out of the 10-ohm resistor, AllR25.

The floating connection is described in the following paragraph (4).

- (4) Connection between a device under test and the input connectors. The measurement section of the VP-7721A provides two input BNC connectors and a switch to select either floating or non-floating input connection (see Fig. 4-7). The input signal path is changed by the operation of the switch as illustrated in Fig. 4-9.

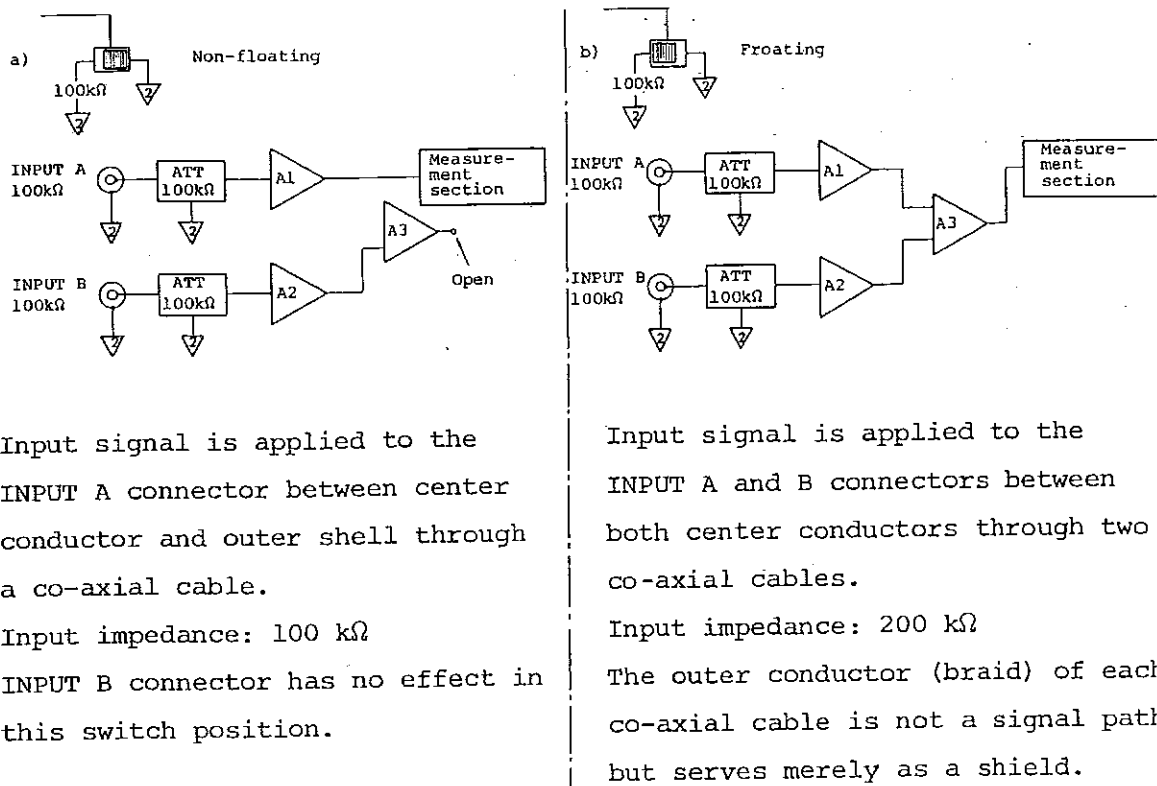


Fig. 4-9 Input circuit arrangement

The actual interconnection are made as shown in Fig. 4-10 (Floating) and Fig. 4-11 (Non-floating).

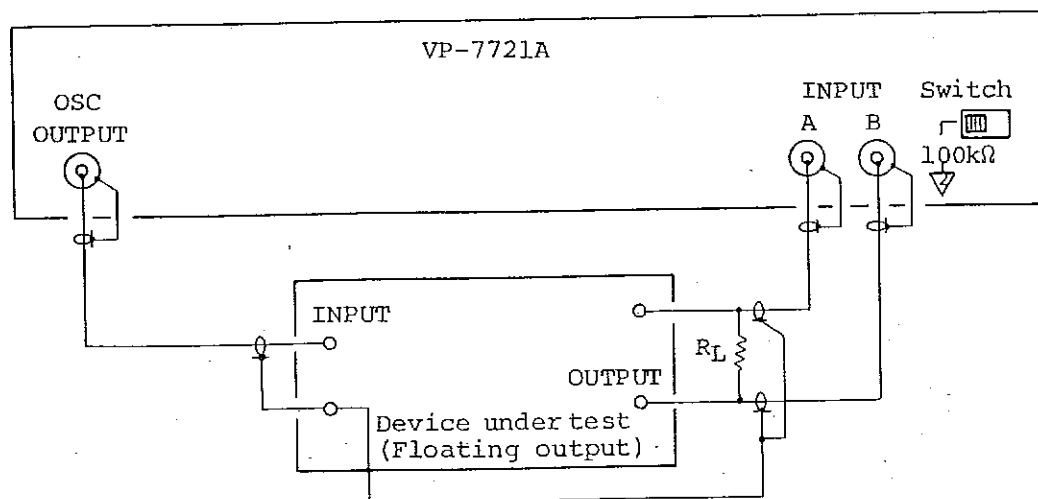


Fig. 4-10 Floating connection

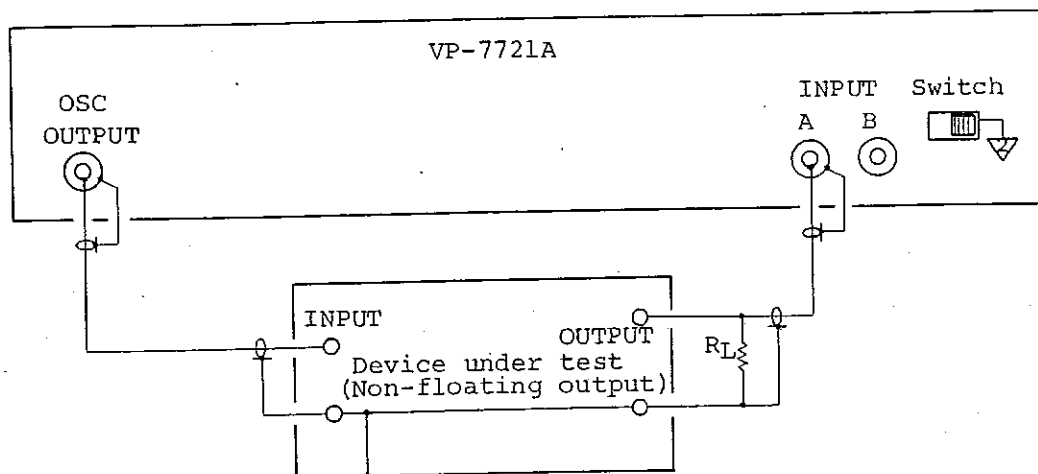


Fig. 4-11 Non-floating connection

**CAUTION**

The maximum floating voltage is 150 volts. It is specified as the peak value of the voltage that appears between center conductor of the INPUT A or B connector and the common (  ). Accordingly it is equivalent to the maximum allowable input voltage described in the succeeding paragraph (5). Note that excessive floating voltage may cause damage to the instrument.

**WARNING**

If the input signal level or the floating voltage exceeds 50V, particular attention should be paid not to touch an exposed point on the line to be connected to the center conductor of the INPUT A or B connector.

Note 1) Non-floating connection can only be made to the INPUT A connector (Fig. 4-11).

For floating connection, both A and B connectors are used (Fig. 4-10).

The connectors A and B are interchangeable.

Note 2) Be careful not to connect a device with floating output to the VP-7721A set to non-floating arrangement as shown in Fig. 4-11. It may cause either damage to the device or burning out of the 10-ohm resistor, AllR25 within the instrument.

Note 3) A device with non-floating output can be connected to the VP-7721A set to either floating or non-floating arrangement. However, it basically should be set to non-floating arrangement as shown in Fig. 4-11 for more accurate measurement of very low level or distortion. This is because the noise and distortion contents inherent in the amplifiers, A2 and A3 shown in Fig. 4-9 are removed from the signal path in the non-floating arrangement. Tables 2-1 through 2-4 in the Specifications show the differences of the performance.

(5) Maximum allowable input voltage

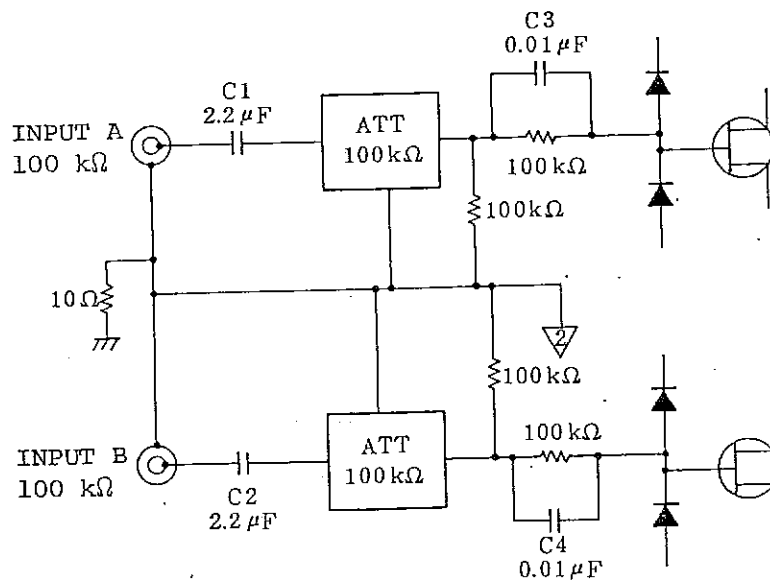


Fig. 4-12 Input circuit

Fig. 4-12 shows the input circuit of the analyzer. The DC component of input signals is blocked by capacitors C1 and C2. If the input signal frequency is high enough to pass C3 and C4, the level of applied signal must be limited to avoid deterioration of semiconductors in the ranges 3V full scale or less where the attenuators (ATT in Fig. 4-12) are "through" state.

The value given by the steeply falling curve in Fig. 2-1 (Specifications section) is the maximum allowable peak input AC component. Be careful to observe the limit in frequencies above 17 kHz with the measurement range of 3V full scale or less.

(6) Protective measures in the oscillator output circuit

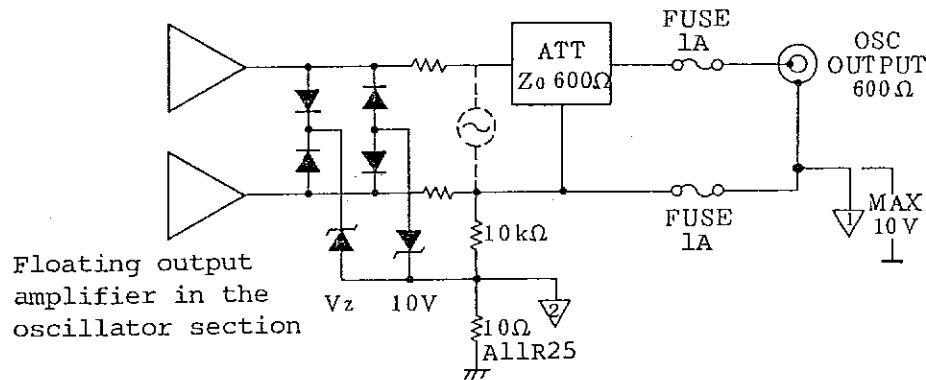


Fig. 4-13 Oscillator output circuit

The output circuit of the oscillator section of the VP-7721A includes the protective measures as illustrated in Fig. 4-13. The fuses and diodes protect the floating output amplifier and other component parts from damage caused by an incorrect connection with a device under measurement.

For fuse replacement, see the Maintenance section of this manual. The following CAUTION will give information to prevent the blow out of the fuse (s).

CAUTION

Non-floating connection as shown in Fig. 4-11 has a possibility of hazard. Fig. 4-14 illustrates the interconnection between an amplifier and the VP-7721A in non-floating arrangement.

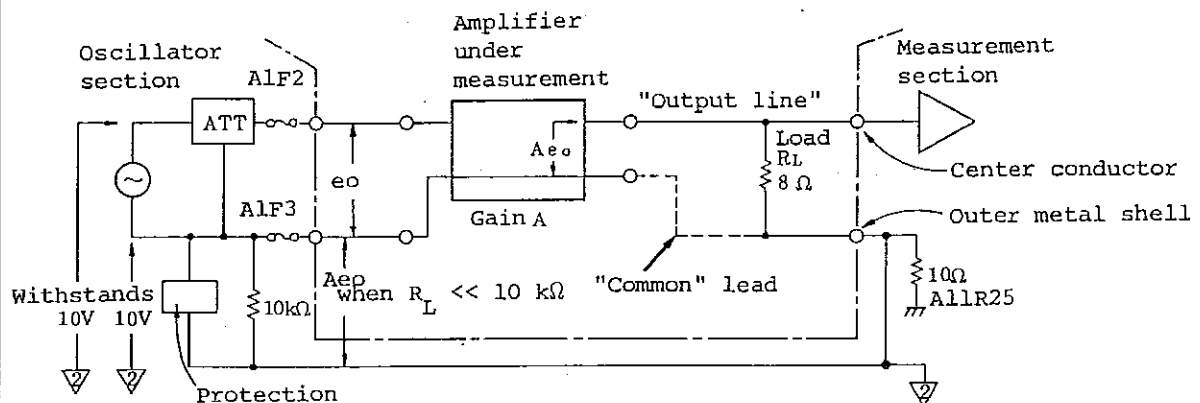


Fig. 4-14 Non-floating interconnection

If the "Common" lead shown by dotted line in Fig. 4-14 is disconnect under the condition that the amplifier gain  $A$  is large and the load  $R_L$  is small enough compared with 10 kilohms, the voltage appearing across 10 kΩ (i.e. the voltage between the common side of the oscillator and the chassis) will have the value of  $A_{eo}$ .

$A_{eo}$  can reach up to approximately power supply voltage of the amplifier under measurement. If it exceeds 10 volts, the protective diodes are activated and the current begins to flow through the fuses  $AlF2$  and  $AlF3$ . The current exceeding 1 ampere will blow out the fuse (s).

If the "Common" lead is connected correctly but the input common side is connected to the chassis ( $\text{---}\text{---}\text{---}$ ) instead of BNC metal shell ( $\text{---}\text{---}\text{---}$ ),  $A_{eo}$  is applied across  $R_L$  and 10Ω in series. When  $A_{eo} \cdot 10 / (R_L + 10)$  exceeds 1.2 volts, the 10Ω resistor,  $AllR25$  will burn out.

Accordingly the following precautions should be observed for non-floating input arrangement.

- (1) Minimize the output power of the amplifier under measurement when interconnection lead wires are connected or disconnected.
- (2) Do not disconnect the "Common" lead in Fig. 4-14 during measurement. If it is required, disconnect "Output line" or connection between the load RL and the VP-7721A prior to the "Common" lead.
- (3) When it is required to provide a measurement fixture, such as signal selector switch, insert it between the load RL and the VP-7721A. If it is essential to insert such a fixture between the amplifier and the load RL, the switching timing should be so arranged that the common side is switched during the disconnected period of the "Output line".
- (4) Never connect a BTL type (balanced, transformer-less type) power amplifier to the input connector in non-floating arrangement. Use the floating connection for this type of amplifier.

#### 4.5 Distortion Measurement using Internal Oscillator

- a) Basic operation is the same as that described in Section 4.3. Connect the device to be tested to the analyzer as shown in Fig. 4-15. In this connection, the analyzer acts as an automatic tuning distortion measurement set.

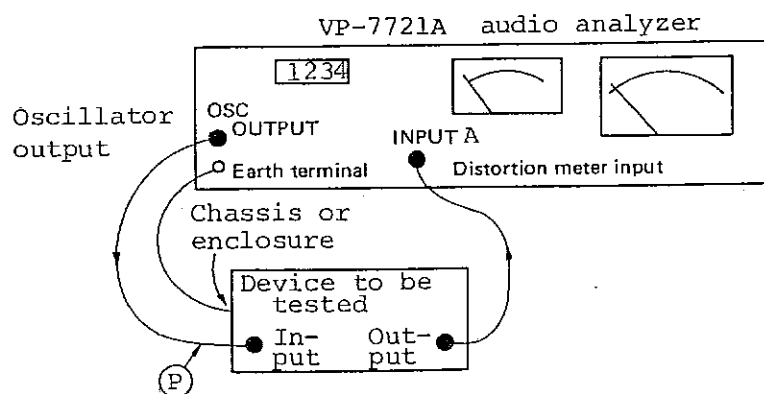


Fig. 4-15 Distortion measurement connection using internal oscillator



- b) When the input and output of the device to be tested fits BNC connectors, the connection shown in Fig. 4-15 is possible. Coaxial cables are recommended. To prevent induction interference, connect a metal part of the device to be tested (such as chassis or enclosure) to the earth terminal of the analyzer as shown in Fig. 4-15
- c) When the input impedance of the device under test is 600-ohm, signals of the level displayed in the digital display are applied under the connection shown in Fig. 4-15. However, if the device under test has a high impedance, insert a 600  $\Omega$  termination pad at point (P). When the signal level is read in dBm, the signal should be terminated with 600  $\Omega$ . When the signal level is read in dB, the analyzer can be connected directly to a high-impedance input terminal only if you remember that the signal level is 6 dB higher than indicated.
- d) The operation of the oscillator and distortion meter is the same as that for the normal operation in Section 4.3. Turning off the RANGING key (AUTO mode) causes the input level meter and distortion meter deflects appropriately.
- e) The input signal level below 1 V requires the input level meter range setting of 1 V or 0.3 V full scale. For these low input level measurement, the usable distortion indicator range will be limited as shown in Table 4-3. The limitation also depends on the use of either LPF, 30 kHz or 80 kHz.

Table 4-3 Limitation of distortion range

| INPUT LEVEL<br>METER range | LPF | Distortion indicator range                                                          |
|----------------------------|-----|-------------------------------------------------------------------------------------|
| 3V - 100V<br>full scale    | any | All ranges can be selected.                                                         |
| 1 V full<br>scale          | ON  | All ranges can be selected.                                                         |
|                            | OFF | -90 dB (0.003% full scale) range cannot be selected.                                |
| 0.3 V<br>full scale        | ON  | All ranges can be selected.                                                         |
|                            | OFF | -80 dB (0.01% full scale) and -90 dB (0.003% full scale) ranges cannot be selected. |

- b) Connect the external source to the analyzer through a coaxial cable (see Fig. 4-16). When the measured signal must be terminated with 600  $\Omega$ , insert a 600-ohm termination pad at point (P).
- c) Determine the frequency and output level of the external source, and place the meters of the analyzer in the automatic ranging mode, which will allow the input level meter deflect appropriately. As described in e) and f) of the preceding section, there are restrictions on the input signal level according to the distortion to be measured. Special care need not be taken when signals of 1 V or more are applied.
- d) Press the FREQ  $\blacktriangle$  key of the MODE select keys (22) with the LED in the key on. The digital display indicates a frequency, which can be changed to the desired value with the eight setting keys: (23) (24) (25) (26) and the MODIFY control (28). In this case, the frequency displayed is the fundamental tuning frequency. Find a frequency at which the deflection of the indicator (9) begins to decrease. Then, change the frequency in small steps until obtaining the minimum deflection of the meter (9). The meter reading is the distortion factor, while the digital display is the frequency of the external source.

NOTE

The digital display does not display the value counted by a frequency counter. Rather, the frequency of the distortion measurement fundamental rejection filter is set to the displayed frequency. Therefore, the displayed frequency is not affected by an external signal, and matches the external signal frequency when the distortion is measured by step d). The accuracy of the displayed value is around  $\pm 5\%$ .

#### 4.7 Level Measurement

The analyzer can also be used as an independent AC level meter indicating the true rms value. See Section 4.3 for the operation. Since the INPUT connectors are commonly used for distortion meter and the level meter, connect it according to Fig. 4-15 or 4-16.

#### 4.8 S/N Measurement

- a) The S/N ratio can be measured by connecting the device to be tested as shown in Fig. 4-15.
- b) The input level of S (signal) component below 1 V requires the input level meter range setting of 1 V or 0.3 V full scale. For these low input S level measurement, the usable S/N indicator range will be limited as shown in Table 4-6. The limitation also depends on the use of either LPF, 30 kHz or 80 kHz.

Table 4-6 Limitation of S/N range

| INPUT LEVEL<br>METER range | LPF | S/N indicator range                        |
|----------------------------|-----|--------------------------------------------|
| 3V - 100V<br>full scale    | any | All ranges can be selected.                |
| 1 V full scale             | ON  | All ranges can be selected.                |
|                            | OFF | 90 dB range cannot be selected.            |
| 0.3 V<br>full scale        | ON  | All ranges can be selected.                |
|                            | OFF | 80 dB and 90 dB ranges cannot be selected. |

- c) Additional limitations should be considered for accurate S/N measurement even in the selectable ranges due to the residual noise within the analyzer.

Tables 4-7 and 4-8 (indentical to Tables 2-3 and 2-4, respectively in the Specifications) describes the conditions.

Table 4-7 S/N measurement limit for unfloated input  
(V in rms, values with dB are S/N)

| Input range          | $\geq 3V$  | 1V                   | 0.3V                   | Detection<br>bandwidth BW |
|----------------------|------------|----------------------|------------------------|---------------------------|
| S component<br>level | $E_s > 1V$ | $1V \geq E_s > 0.3V$ | $0.3V \geq E_s > 0.1V$ |                           |
| 5Hz-15.99kHz         | 100dB      | 90dB                 | 85dB                   | 80kHz BW                  |
|                      | 90dB       | 85dB                 | 75dB                   | 500kHz BW                 |
| 16kHz-159.9kHz       | 80dB       | 75dB                 | 60dB                   | 500kHz BW                 |

Table 4-8 S/N measurement limit for floated input  
(V in rms, values with dB are S/N)

| Input             | $\geq 3V$  | 1V                   | 0.3V                   | Detection bandwidth BW |
|-------------------|------------|----------------------|------------------------|------------------------|
| S component level | $E_s > 1V$ | $1V \geq E_s > 0.3V$ | $0.3V \geq E_s > 0.1V$ |                        |
| 5Hz-15.99kHz      | 95dB       | 85dB                 | 80dB                   | 80kHz BW               |
|                   | 85dB       | 80dB                 | 70dB                   | 500kHz BW              |
| 16kHz-159.9kHz    | 80dB       | 75dB                 | 60dB                   | 500kHz BW              |

The detection bandwidth is set to 500 kHz by turning off the HPF and both LPFs, and the detection bandwidth LPF is set to 80 kHz by turning on only the 80 kHz BPF.

#### 4.9 Preset Application

The application of the preset operation described in steps 40) to 48) in Section 4.3 to the measurement in Sections 4.5 to 4.8 will result in highly efficient measurement using the preset function. Up to 16 setups, which can be changed easily, can be recalled instantly. The following remote control expands the number of sets from 16 to 32.

#### 4.10 Remote Control

a) The following operations can be controlled remotely.

- (1) Preset recall operation (when the LED in the RCL key of the MODE select key (22) is on)
  - . Recall operation of 16 preset setups by eight keys (equivalent to keys A to D, 1 to 4 on the instrument).
  - . Recall operation of additional 16 setups by four keys above (equivalent to keys A to D) and four additional keys.
- (2) Selection of digital display (frequency or output amplitude). Equivalent to the DISPLAY key (5) on the instrument.
- (3) Modify operation (frequency or output amplitude)
  - Equivalent to the operation of the MODIFY control (28). The display selected by item (2) above can be incremented. The digit specified by the MODIFY digit select switch (27) is controlled.
- (4) Filter selection
  - Equivalent to the HPF 400 Hz (21), LPF 30 kHz (20), 80 kHz (19), and WEIGHTING (18) keys.

- (5) Up/down operation (when the FREQ  $\blacktriangle$  or AMPTD  $\blacktriangledown$  key of the MODE select keys (22) is on)

Up/down change of the frequency range or frequency or output amplitude.

Equivalent to the operation of keys (23) to (26).

b) Remote and local control

Both local and remote control is possible with a remote control fixture of the type shown in f) connected to the 24-pin connector on the rear panel of the analyzer.

c) Remote control connector

See Fig. 4-17.

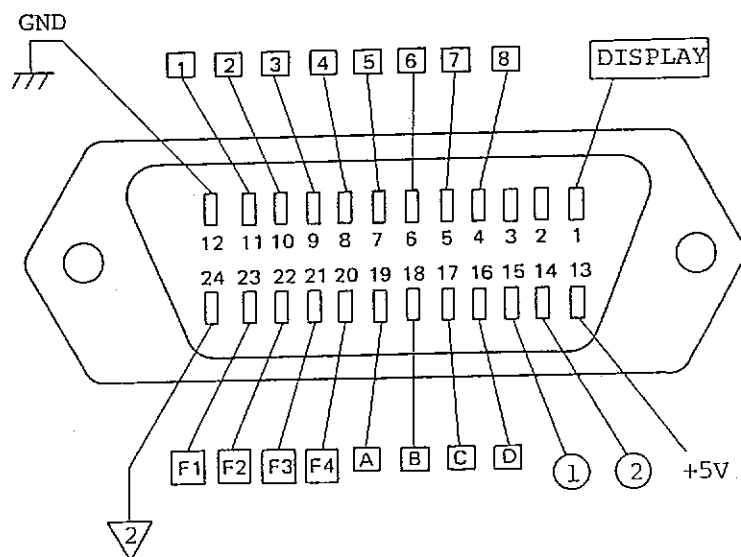


Fig. 4-17 Remote control connector pin arrangement

d) Mating plug

Micro-ribbon connector AMPHENOL

Plug 57-30240

e) Display of setups

All setups in the remote control mode are displayed on the front panel as in local control mode.

f) Remote controller

Figure 4-18 shows an example of basic connection of a remote controller which can control operations (1) to (5) in a).

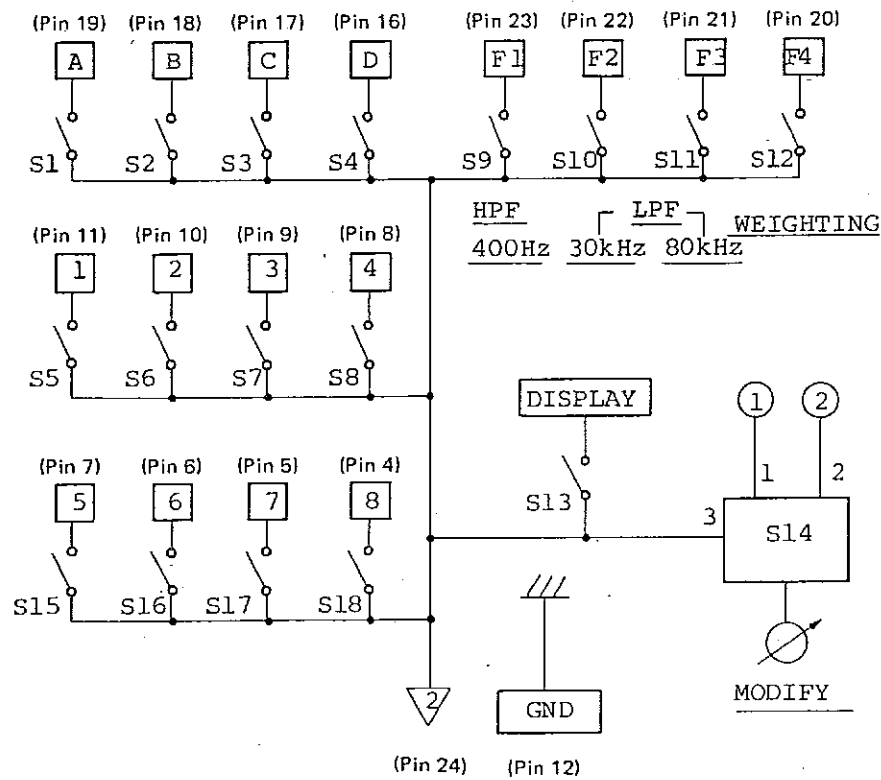


Fig. 4-18 Example of a remote control fixture

- Notes 1. Pin numbers in parentheses are those of the remote control connector.
2. S1 to S13 and S15 to S18 are momentary-on switches.
3. S14 is a rotary encoder.

It can be ordered with the following part number:

EWT-XDFS2550B

4. The remote control fixture in this example does not need to be connected to pin 13 (+5V output). Do not allow 50 mA or more to be drawn from this pin for other purposes.
5. Connect pin 12 (GND) to the enclosure of the remote controller.

6. S15 to S18 (keys 5 to 8) are switches not provided with VP-7721A. By addition of these switches, the number of preset addresses can be expanded from 16 (A-1 to D-4) to 32 (A-1 to D-8).

g) Switching condition

Switching conditions applied to S1 to S12 in Fig. 4-18 are shown in Fig. 4-19.

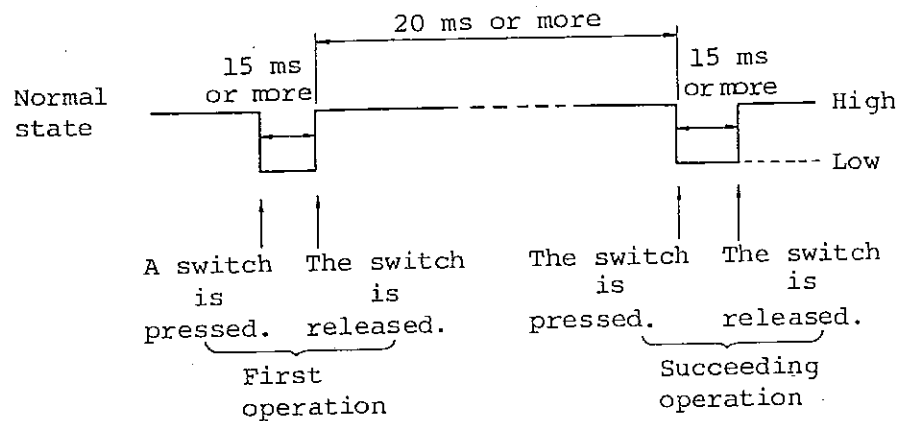


Fig. 4-19 Switching conditions

Note: "LOW" is the state that the point is connected to the common point ( ) through a resistor of 500 ohms or less, or the voltage of the point against the common point is 0.5 volts or less.

## 5. MAINTENANCE AND STORAGE

### 5.1 CLEANING

Clean the panels with a dry, soft cloth. Never use a volatile solvent such as benzene or lacquer thinner. For coated metallic part, use a cloth moistured with a very small quantity of neutral detergent.

### 5.2 REPLACEMENT OF PROTECTIVE FUSE(S)

The protective fuse replacement requires removal of bottom cover of the instrument.

#### WARNING

Disconnect the power cable from mains supply before removing the bottom cover.

- (1) Verify that the power cable is disconnected from the instrument.
- (2) Place the instrument upside-down.
- (3) Remove six screws from the bottom cover and pull up the cover off the instrument.
- (4) The protective fuses are located as shown in Fig. 5-1.

(Seen from the bottom)

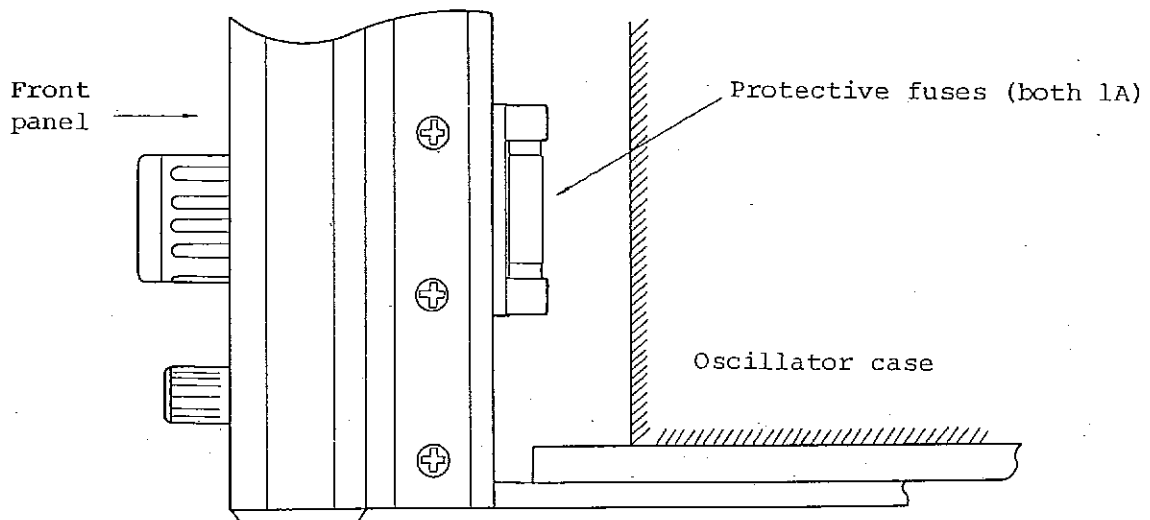


Fig. 5-1 Protective fuses



- (5) Replace blown fuse (s) with new one (s). Use only fuses supplied with the instrument. For further replacement, please order the fuses quoting Matsushita part number "TSC1A", and address the order to your nearest Matsushita's representative.
- (6) Reinstall the bottom cover and secure it with the screws removed in step (3).

### 5.3 CALIBRATION AND SERVICE

When inspection or maintenance calibration is necessary, or when an operational problem arises, call the nearest Matsushita's representative.

### 5.4 STORAGE

When the instrument is not used for a long time, cover it with a plastic wrapper for dust protection and store it in a clean dry environment.

## 5.5 REMOVAL OF MEMORY BACKUP BATTERY

### WARNING

Removal of the battery should be performed only by a qualified person. Contact the dealer or representative from which you purchased the product to request for servicing.

### Removal procedure

### WARNING

Be sure to disconnect the power cable before starting the procedure shown below.

- ① Remove six(6) screws and the top cover from the instrument.
- ② Remove four(4) screws from the pc board shown as ① in figure 5-2, then remove the pc board ①.
- ③ Remove the battery from the pc board shown as ② in figure 5-2. (The battery is soldered on the pc board.)

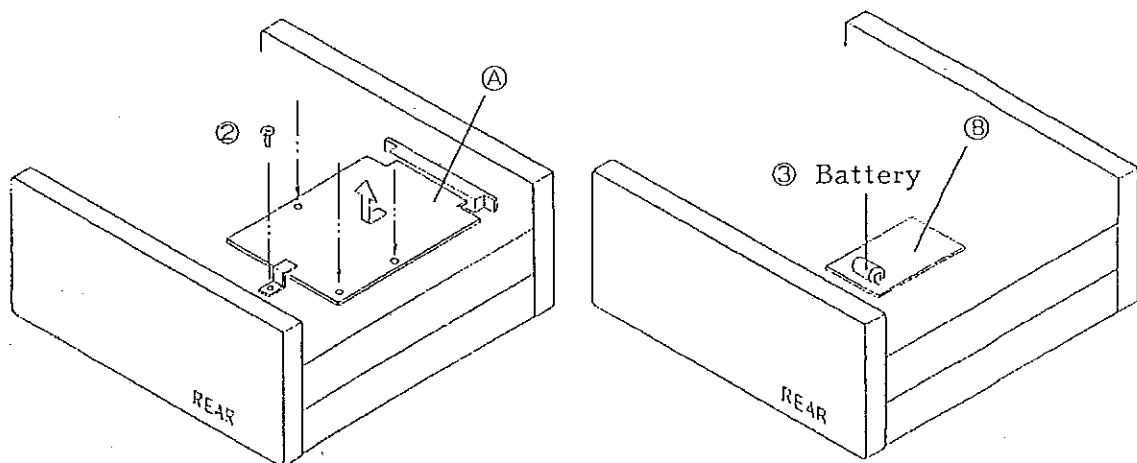
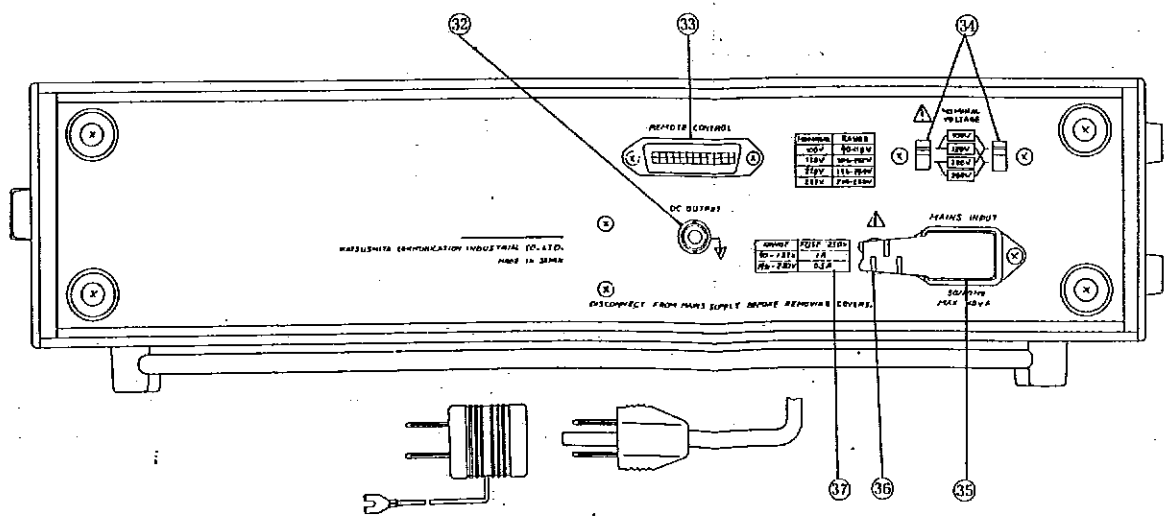
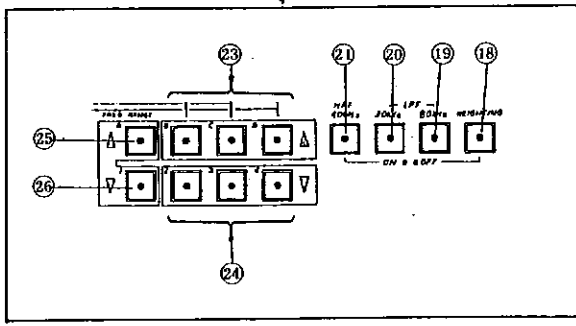
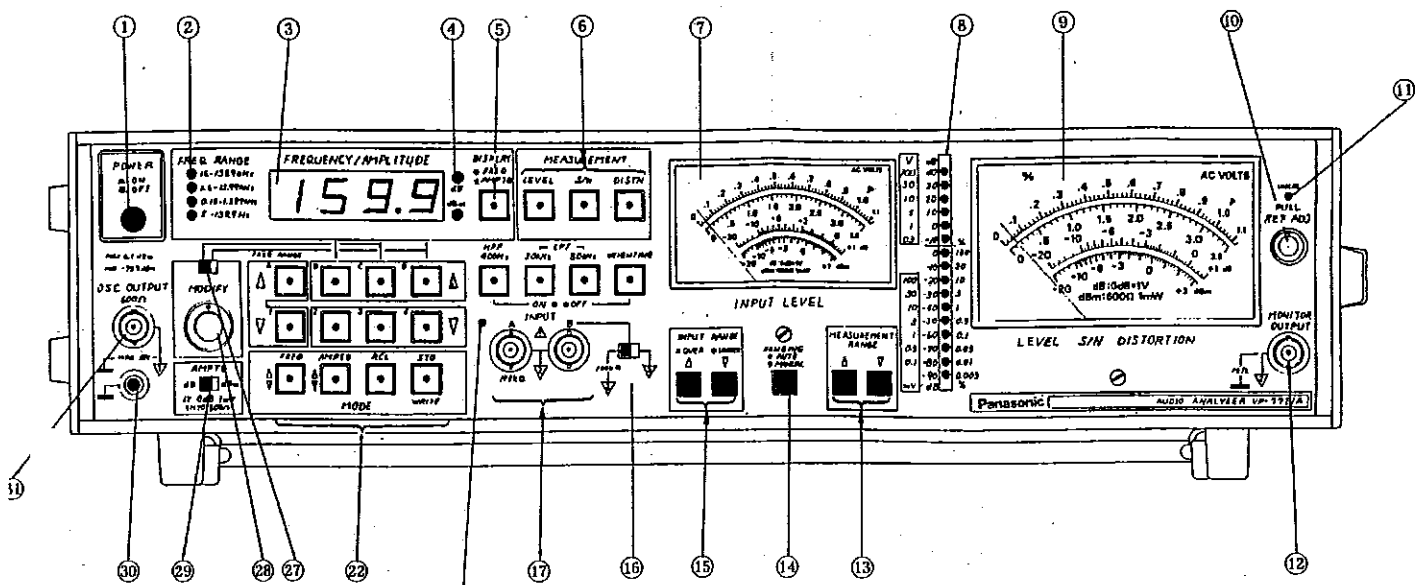


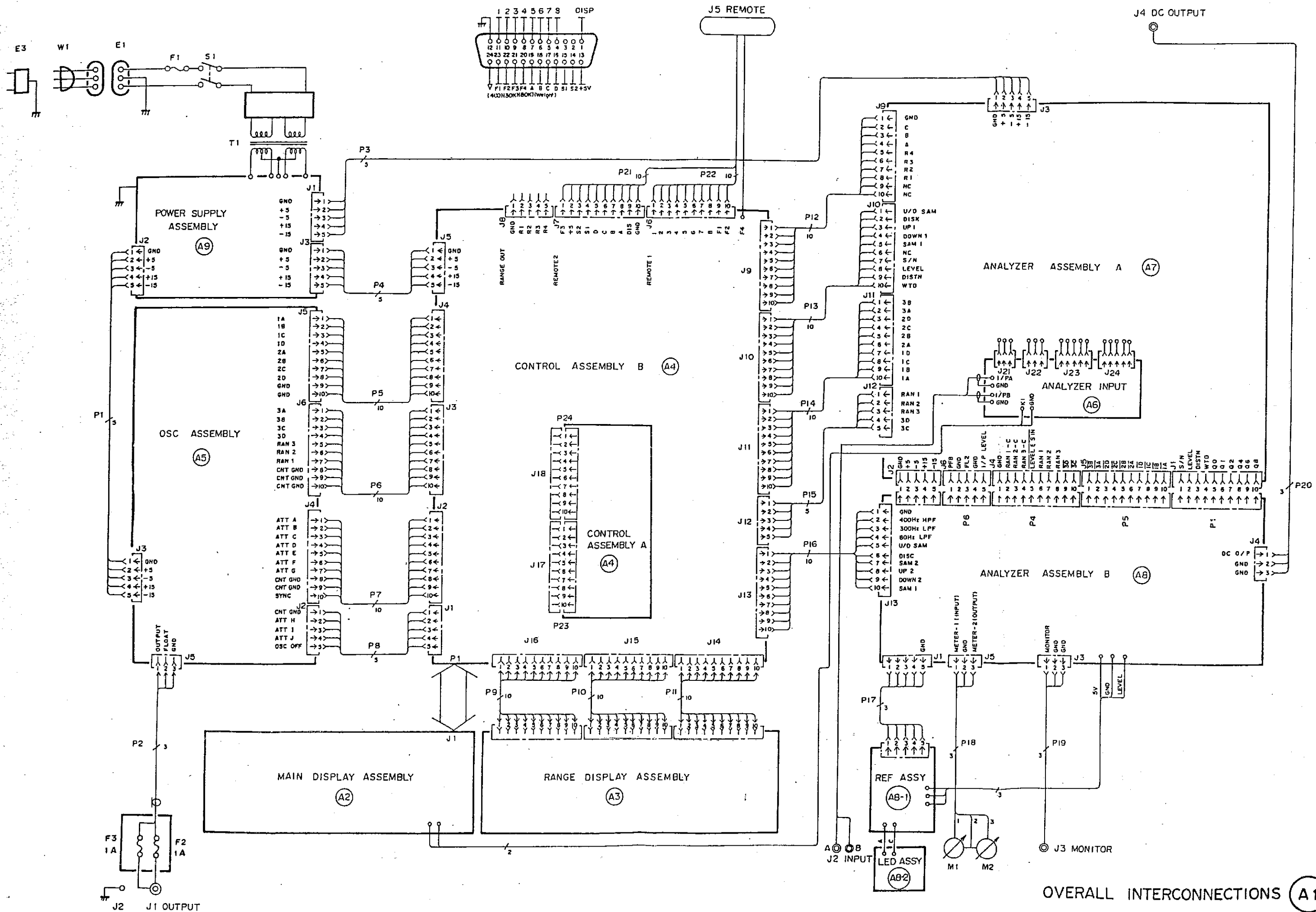
Figure 5-2 Removal of memory backup battery



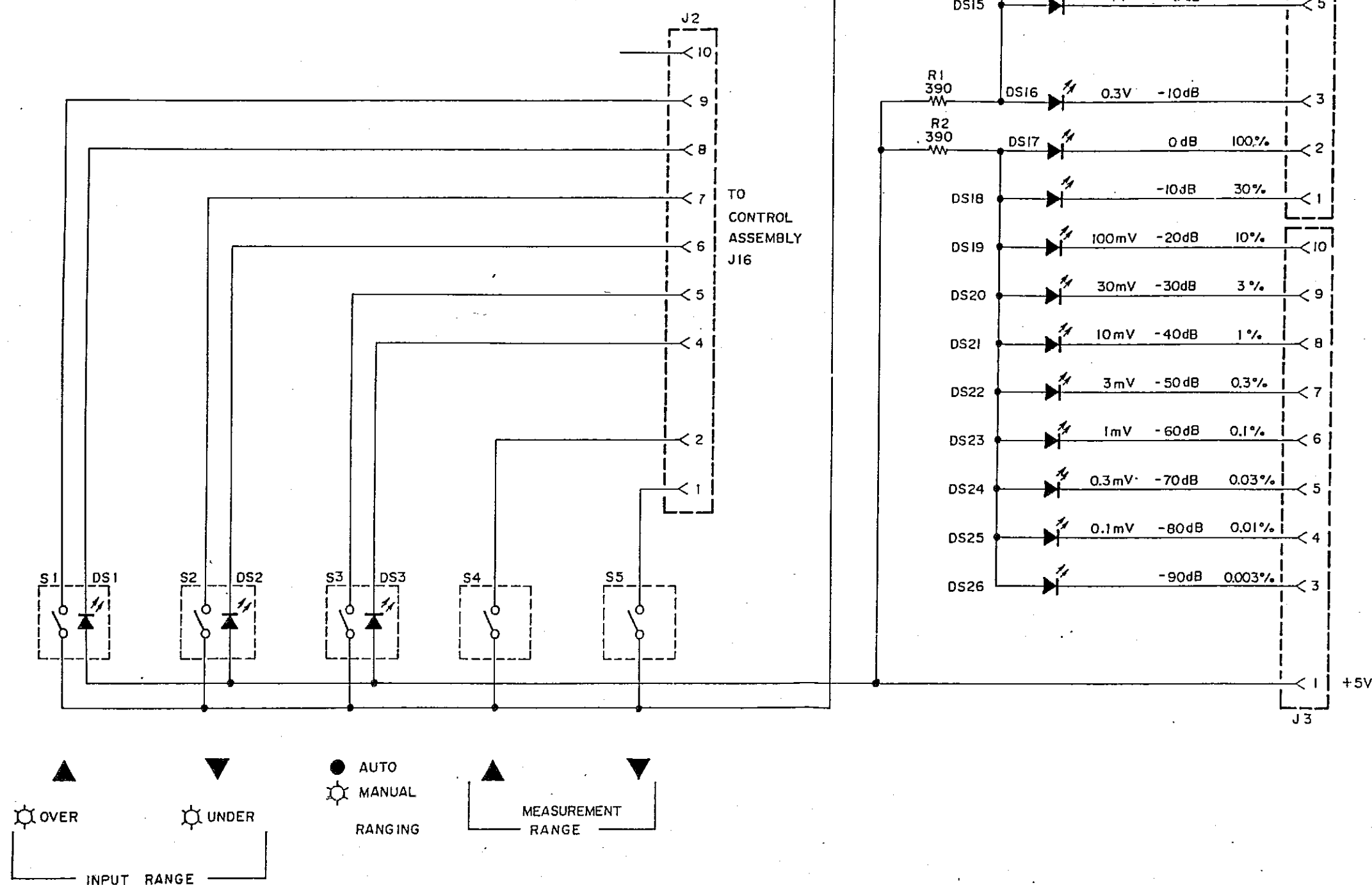
|                           |            |    |
|---------------------------|------------|----|
| · OVERALL INTERCONNECTION | (A1) ----- | 1  |
| · MAIN DISPLAY ASSEMBLY   | (A2) ----- | 2  |
| · RANGE DISPLAY ASSEMBLY  | (A3) ----- | 3  |
| · CONTROL ASSEMBLY        | (A4) ----- | 4  |
| · OSCILLATOR ASSEMBLY     | (A5) ----- | 5  |
| · ANALYZER ASSEMBLY INPUT | (A6) ----- | 6  |
| · ANALYZER ASSEMBLY A-(1) | (A7) ----- | 7  |
| · ANALYZER ASSEMBLY A-(2) | (A7) ----- | 8  |
| · ANALYZER ASSEMBLY B-(1) | (A8) ----- | 9  |
| · ANALYZER ASSEMBLY B-(2) | (A8) ----- | 10 |
| · POWER SUPPLY            | (A9) ----- | 11 |

**NOTES**

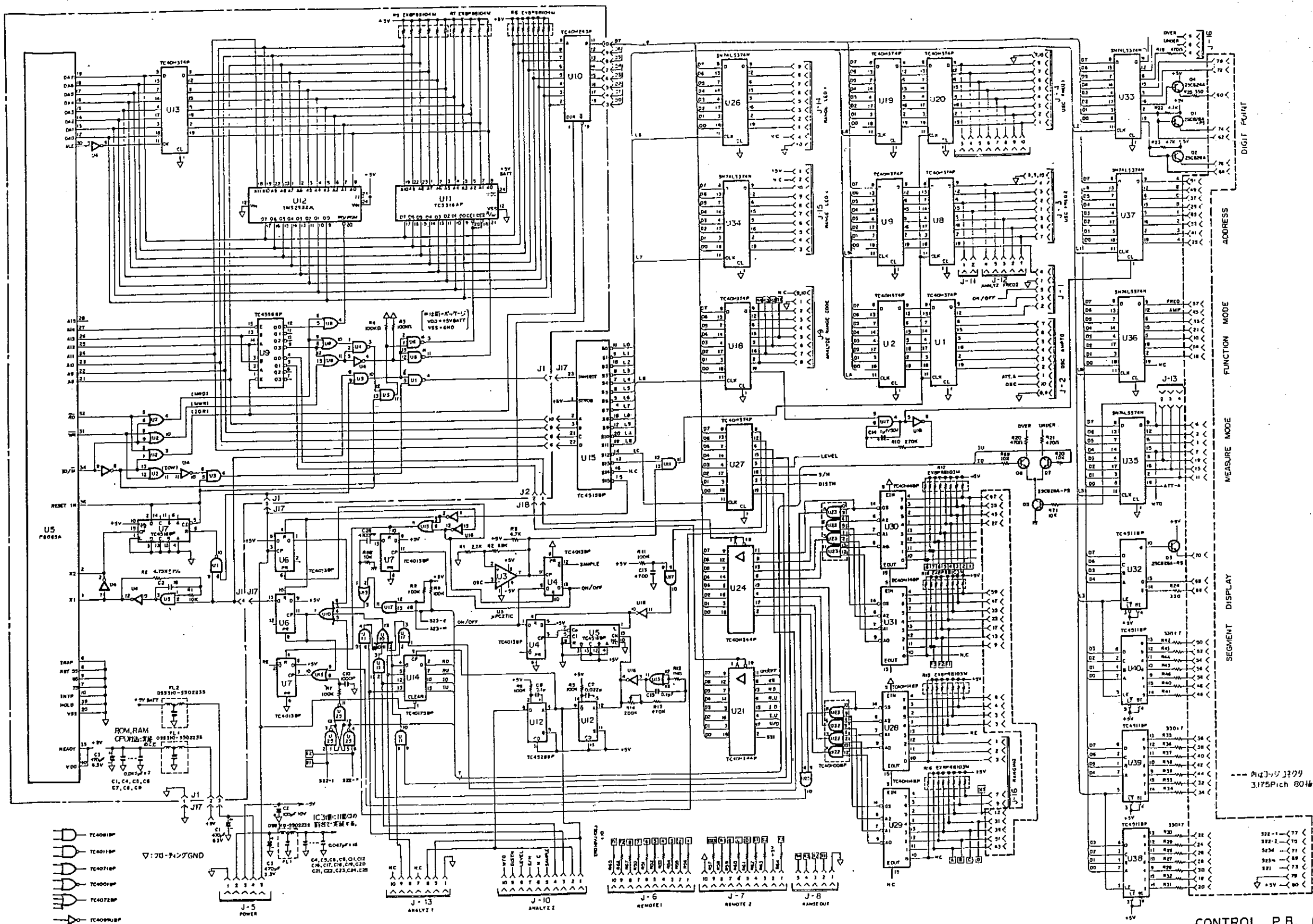
- ▷ WHEN THE CIRCUIT IS DIVIDED INTO SOME UNITS AND AN IDENTIFYING NUMBER IS ASSIGNED TO EACH UNIT, REFERENCE DESIGNATORS IN EACH CIRCUIT DIAGRAM ARE GIVEN IN ABBREVIATED FORM. PREFIX WITH EACH IDENTIFYING NUMBER FOR COMPLETE DESCRIPTION.  
EXAMPLES: A1C1, A6R3.
- ▷ RESISTANCE VALUES IN OHMS AND CAPACITANCE IN PICO FARADS (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  $\pm 5\%$  UNLESS OTHERWISE NOTED.
- ▷ \* FACTORY REWORKED OR CHECKED COMPONENTS.
- ▷ # VALUE SELECTED AT FACTORY, NOMINAL VALUE SHOWN.



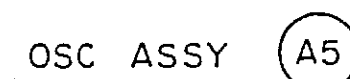


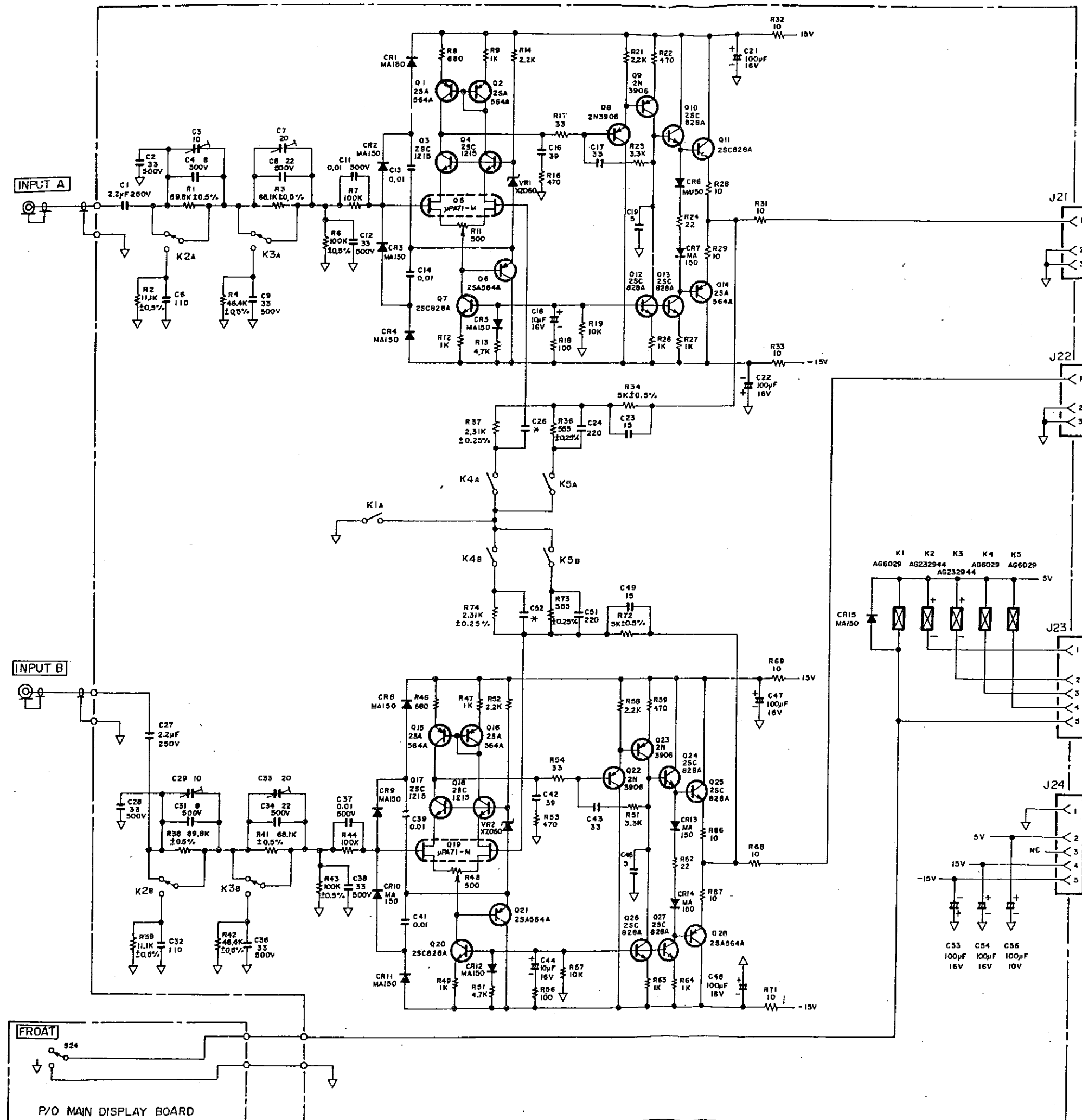


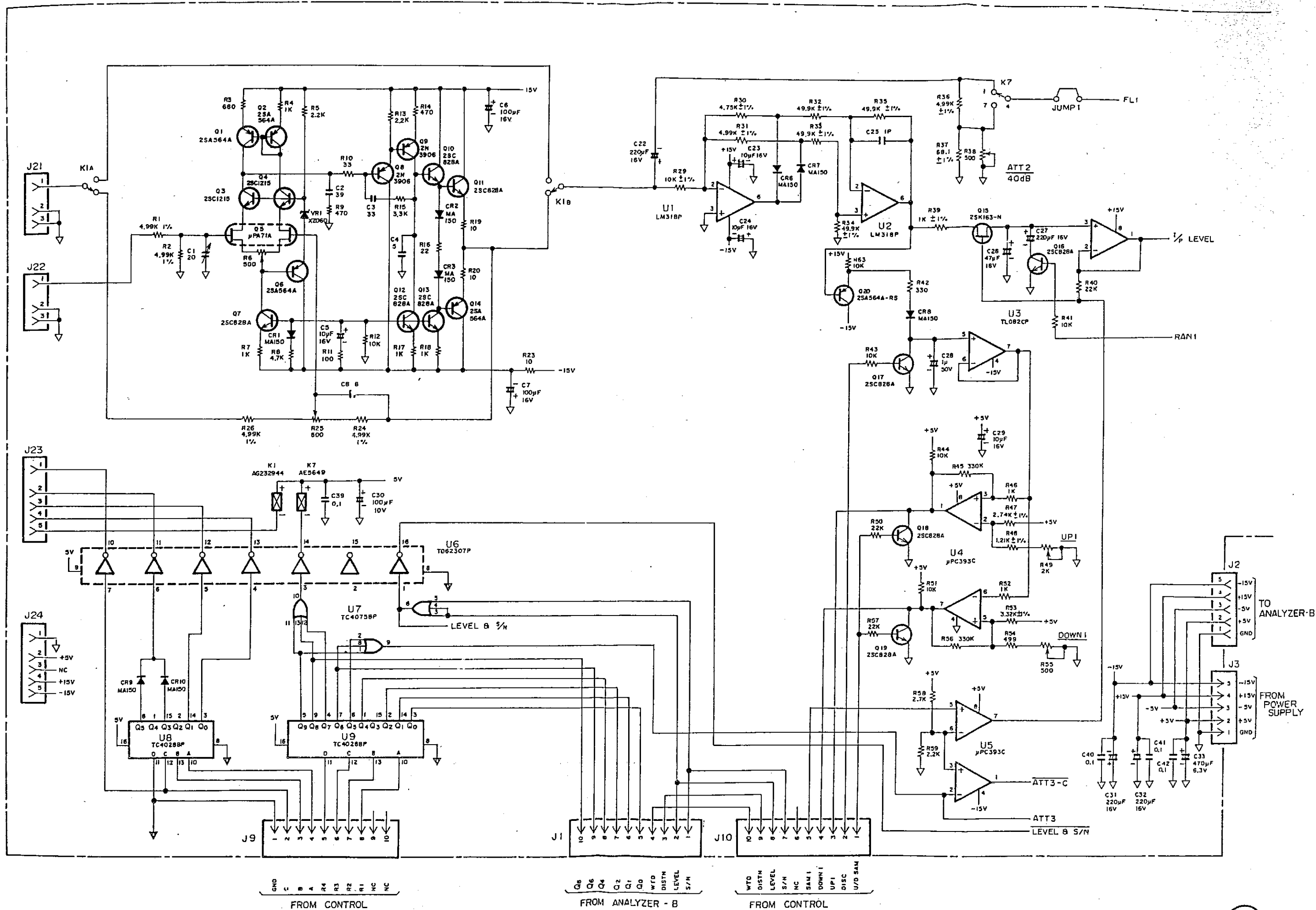
VP-7721 A

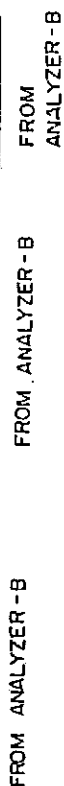


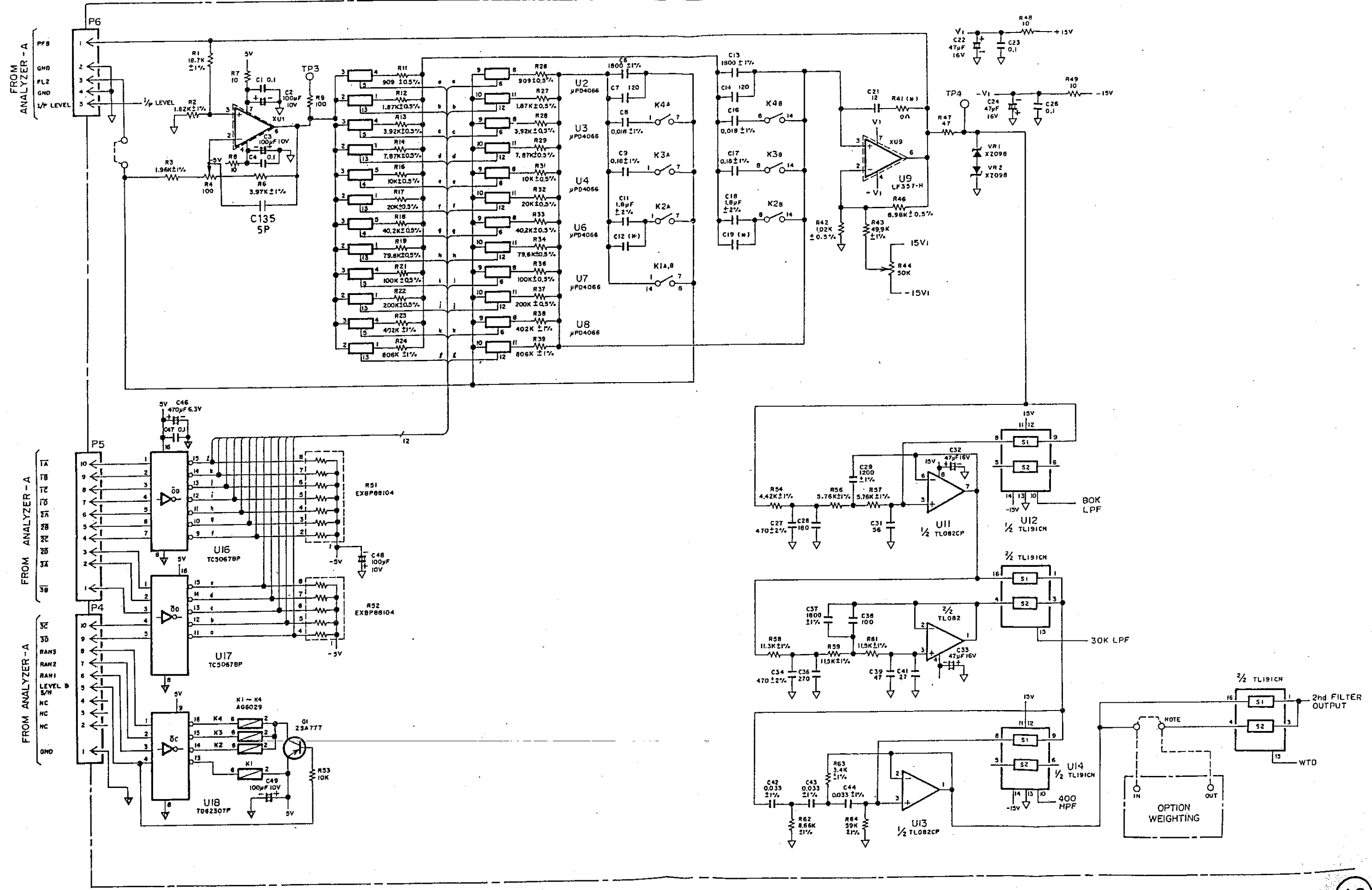




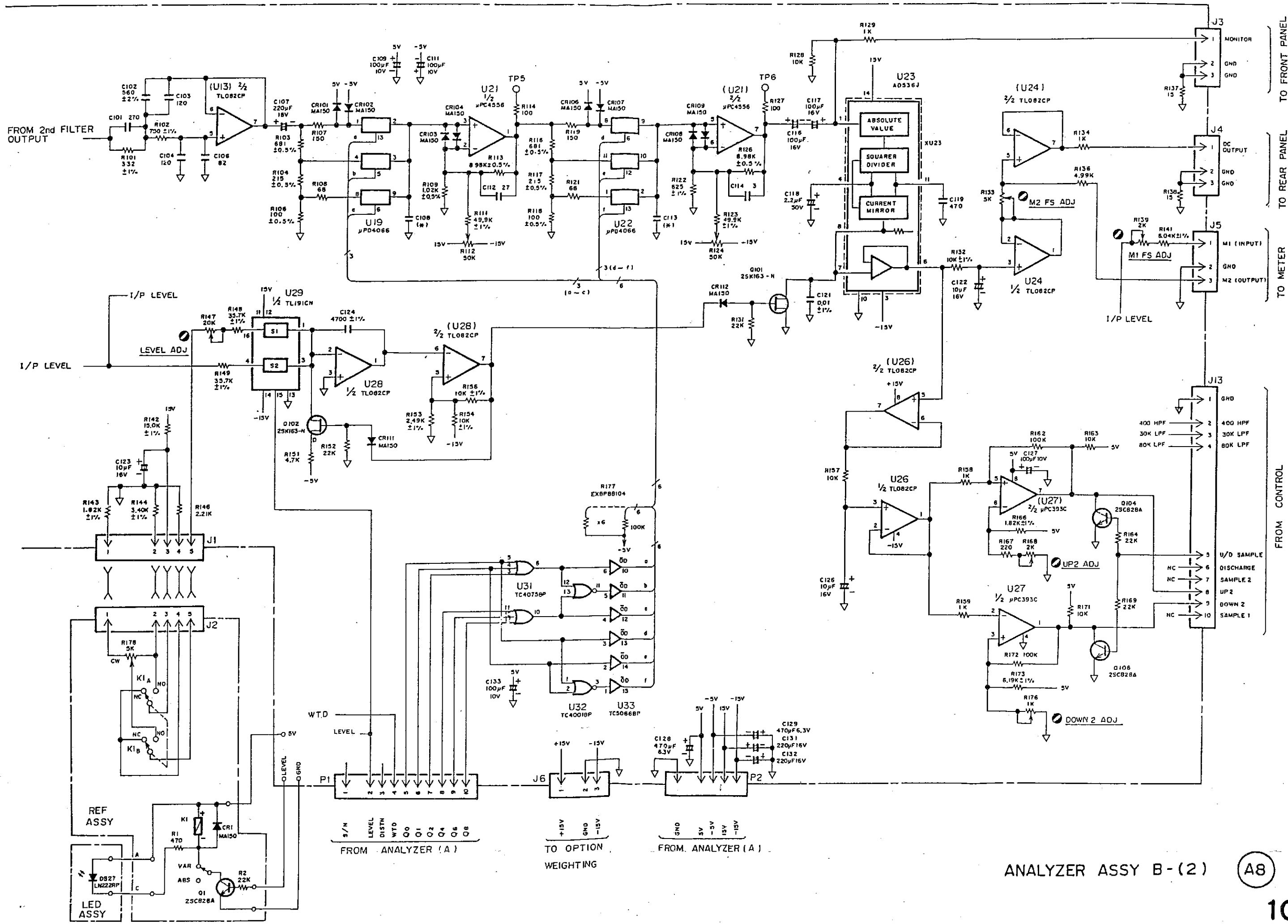








7721A



ANALYZER ASSY B-(2)

A8



