ELECTRONIC CROSSOVER NETWORK

D-23

OPERATING INSTRUCTIONS

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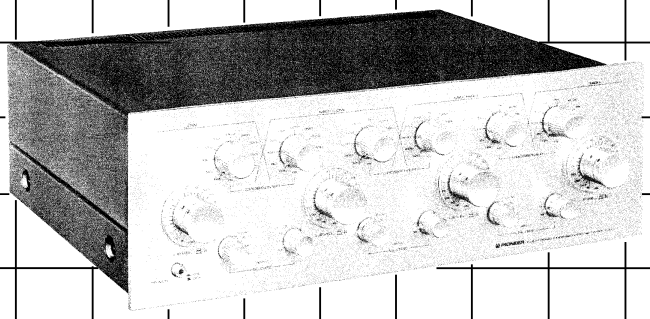


WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

PIONEER®

CONTENTS

FEATURES

Low Noise Filters with Low Insertion Loss

The D-23 employs only high performance filter circuits comprised of high quality capacitor, resistor, and pair transistor-equipped SEPP circuits. For the 6dB/oct and 12dB/oct slopes, 1-stage and 2-stage RC-type passive filters are employed. The 18dB/oct slope is obtained by means of a 12dB/oct active filter (with excellent cut-off characteristics) combined with a 1-stage 6dB/oct RC-type passive filter. In the selection of crossover frequencies, the use of specially designed high-precision variable resistors permit very accurate adjustments for every 1/3 of an octave. Furthermore, use of only high quality components throughout has resulted in improved stereo separation.

Low Distortion Buffer Amplifier

The D-23 has pair transistor-equipped SEPP circuits at both input and output stages. Signals from the preamplifier are thus sufficiently amplified before being applied to filters of each frequency range. Consequently, input impedance and dynamic range are increased, thus preventing any adverse effects on the low-impedance connected filter elements in the following stages. In addition, the SEPP circuits also eliminate distortion caused by the 2nd and other even harmonics. Resultant distortion is very low indeed.

Effective Selection of Crossover Frequency by 6 Independent Switches

The D-23 features 11 different selectable crossover frequencies between the low and low mid-range frequency regions, ranging from 63Hz to 630Hz, each increasing in steps of 1/3 of an octave. Similarly, the low mid-range to high mid-range, and the high mid-range to high frequency "joints" also have 11 different crossover frequencies between 320Hz and 3.2kHz, and 1.6kHz and 16kHz, respectively. Furthermore, since it is possible to select frequencies with the controls in each frequency range, it is also possible to set crossover frequencies apart from the 11 basic frequencies. This permits the user to select just the right crossover frequencies to get the best results from the speakers employed. Moreover in combination with the slope switches, the user is able to compensate for any dip or peak occurring at the crossover frequencies, these usually being due to the acoustical characteristics of the room and the characteristics of the speaker combination.

3-Way Slope Switches

The slopes at the cut-off frequencies in each frequency range may be set to 6, 12, or 18dB/oct. Besides selecting the most suitable crossover frequencies to match the acoustical characteristics of the room and speakers, the user can also adjust the slope to gain optimum continuity of sound from one frequency range to another.
Furthermore, the slope controls in the LOW, MID-LOW, and MID-HIGH ranges also include a FLAT position which permits the D-23 unit to be connected up in various combinations of 3-way and 2-way multi-amplifier systems, depending on the number and type of speakers available.

Independent Level Controls for Each Frequency Range

The D-23 is equipped with independent level controls for separate left (L) and right (R) channel level adjustments in all 4 frequency ranges (i.e., LOW, MID-LOW, MID-HIGH, and HIGH). Individual level adjustments can thus be made in order to match room characteristics, and the efficiencies of the power amplifiers and speakers. All level controls also have memory markers to assist in level comparison testing and fine adjustments.

Functional Beauty Plus Impressive Design

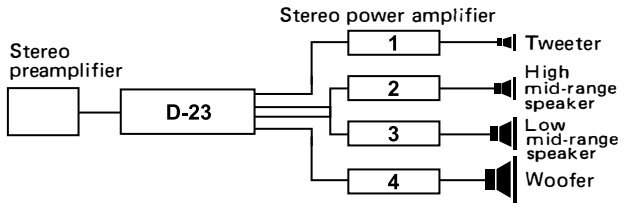
The D-23 also features a very impressive front panel design with easy-to-operate controls laid out in a very functional fashion. Combination with other Pionner components means uniformity among all components, giving audio enthusiasts an outstanding multi-amplifier system.

MULTI-AMPLIFIER SYSTEMS

In order to faithfully reproduce any program source with true high fidelity, the audio reproduction equipment must have negligible distortion, a large dynamic range, and a wide frequency response. Rather than depending on one amplifier to reproduce the whole frequency spectrum, dividing the frequencies up into distinct ranges, and using independent, well balanced, speakers for each frequency range, makes it possible to reproduce a much more stable sound.

4-WAY MULTI-AMPLIFIER SYSTEMS (Fig. 1)

A 4-way system consists of 4 independent stereo power amplifiers, and 4 pairs of speakers (2 woofers, 2 low mid-range speakers, 2 high mid-range speakers, and 2 tweeters).

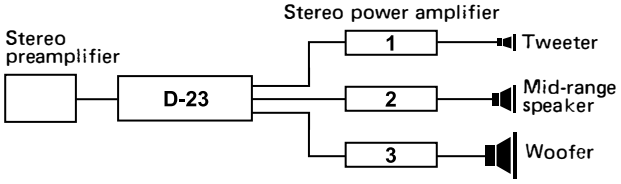


1. For high range frequency
2. For high to mid-range frequency
3. For mid- to low range frequency
4. For low range frequency

Fig. 1

3-WAY MULTI-AMPLIFIER SYSTEMS (Fig. 2)

A 3-way system requires 3 independent stereo power amplifiers and 3 pairs of speakers (2 woofers, 2 mid-range speakers, and 2 tweeters).

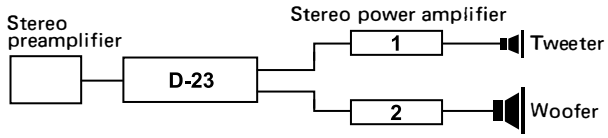


1. For high range frequency
2. For mid-range frequency
3. For low range frequency

Fig. 2

2-WAY MULTI-AMPLIFIER SYSTEMS (Fig. 3)

A 2-way system employs 2 stereo power amplifiers, a pair of woofers (for low to mid-range frequency), and a pair of tweeters (for mid-to high range frequency).

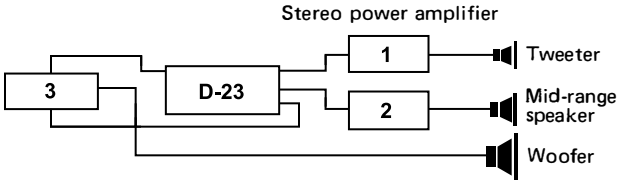


1. For high range frequency
2. For low range frequency

Fig. 3

Systems Employing Pre-main, or Integrated Amplifiers (Fig. 4)

It is also possible to build a multi-amplifiers system employing a pre-main or integrated amplifier if it has provision for independent use of its preamplifier and power amplifier functions.



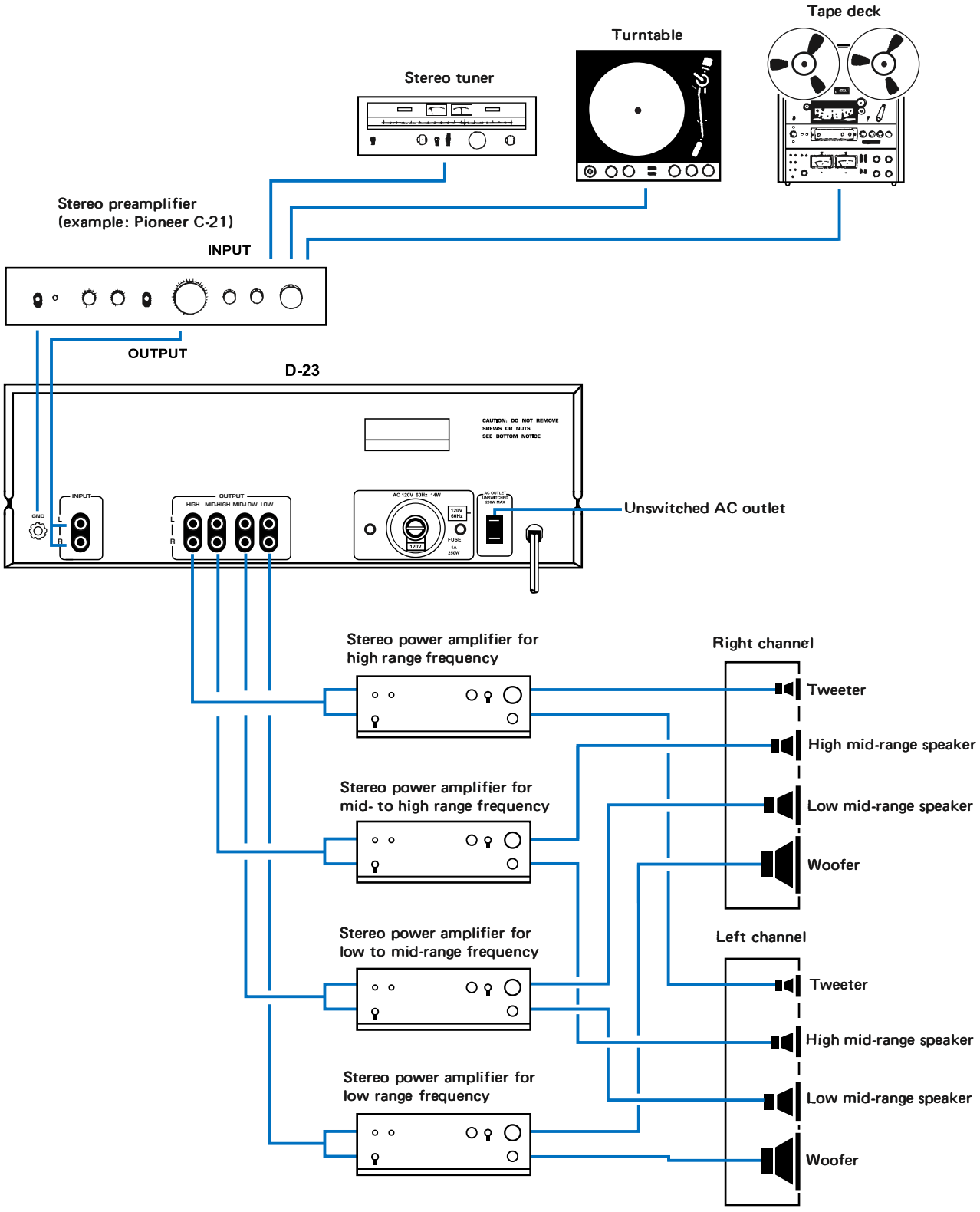
1. For high range frequency
2. For mid-range frequency
3. Premain amplifier (or integrated amplifier) for low range frequency

Fig. 4

Note: These diagrams show left channel (or right channel) only.

CONNECTION DIAGRAM

(FOR 4-WAY AMPLIFIER SYSTEM)



CONNECTIONS

CONNECTION TO THE PREAMPLIFIER UNIT

1. Connect the INPUT terminals of D-23 to the OUTPUT terminals of the preamplifier (see Fig. 5), making sure that left (L) and right (R) channels are connected correctly. In the D-23, all upper row terminals are for left channel, and all lower row terminals are for right.
2. Connect the D-23 power supply cord to the switched AC outlet on the rear panel of the preamplifier.
   Turn D-23's power switch ON. All consequent turning ON and OFF of the preamplifier power supply switch will thus automatically switch D-23 ON and OFF.

CONNECTIONS TO POWER AMPLIFIER UNITS

1. Connect each of the OUTPUT terminals (HIGH, MID-HIGH, MID-LOW, and LOW) on the rear panel of D-23 to the INPUT terminals of the respective stereo power amplifiers (see Fig. 5). Be sure that left and right channels are connected correctly.
2. Now connect the power supply cord of each power amplifier unit to any power socket (including the AC outlets on the rear panel of the preamplifier) whose power output capacity exceeds the maximum power consumption of the power amplifier.

PRECAUTIONS

- Check that all connections are firm and safe. Loose connections may result in loss of sound, generation of noise, or damage to the speakers.
- When connecting to the speakers, make doubly sure that the speaker's reproduction frequency range corresponds to the correct output terminal on the rear panel of the D-23. Incorrect connections could result in damaged speakers.
- Besides left and right channels, the power amplifiers and the speakers also require correct connection of the plus (+) and minus (—) polarities.

NOTE:
Depending upon SLOPE selection, connection of opposing polarities can sometimes improve results. For details, see page 8.

- Always wait until all connections have been properly checked before turning the power supply ON.
- In order to protect the speakers against possible rupture due to unexpected noise or extraneous frequencies beyond the speaker's range it is recommended that a capacitor be inserted between the power amplifier and speaker terminals. For further details, see the section on "Protective capacitors for speakers" on page 10.
- It is also recommended that phase differences between input and output terminals of the stereo power amplifiers be checked prior to connecting to the D-23.

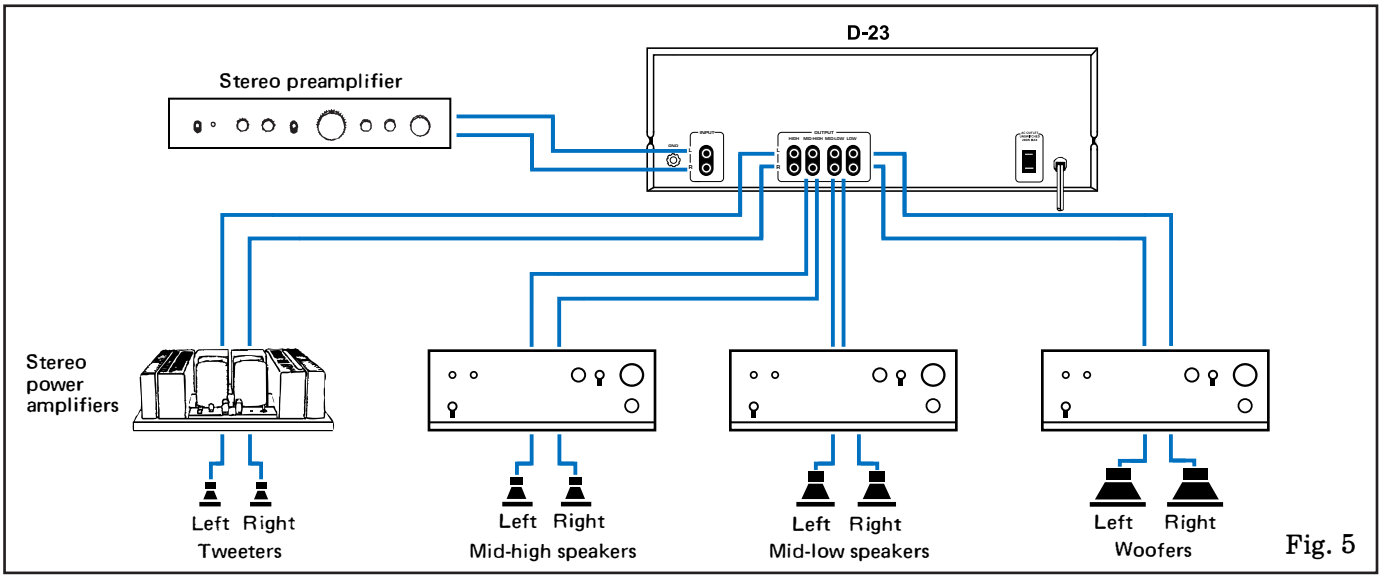


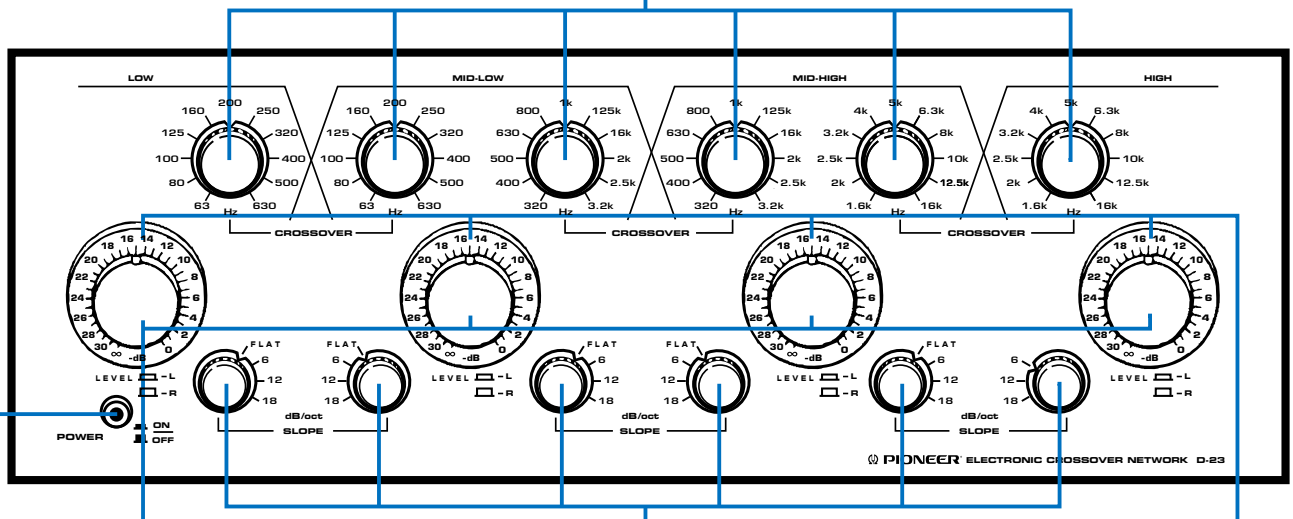
Fig. 5

FRONT PANEL FACILITIES

POWER SWITCH (WITH PILOT LAMP)

The push ON power switch incorporates a built-in muting circuit to suppress the generation of any noise during the switching action. Consequently, no sound will be heard during the first few seconds after turning the power ON.

FREQUENCY SELECTOR CONTROLS (See below)



LEVEL CONTROLS

(LOW, MID-LOW, MID-HIGH, HIGH)

These controls are for adjusting output levels of each frequency range. Left and right channels are adjusted independently.

MEMORY MARKERS

These markers will prove very useful in marking pre-selected levels for comparison purposes and other fine adjustments.

SLOPE SELECTOR CONTROLS (See below)

FREQUENCY SELECTOR AND SLOPE SELECTOR CONTROLS

Crossover frequencies between each frequency range are determined by the cut-off frequencies in each range and the selected slope for each of these frequencies. Cut-off frequencies are selected by the frequency selector controls along the top row, while slope characteristics are selected by the slope selector controls along the bottom row. But if any slope selector control is set to FLAT, the cut-off frequency selected by the corresponding frequency selector control will become irrelevant, resulting in a flat frequency response across all frequency ranges.

LOW LP*: Control for selection of slope and cut-off frequency at upper limit of low range frequency (LOW). (See Fig. A).

MID-LOW HP*: Control for selection of slope and cut-off frequency at lower limit of low to mid-range frequency (MID-LOW). (See Fig. B).

MID-LOW LP: Control for selection of slope and cut-off frequency at upper limit of low to mid-range frequency (MID-LOW). (See Fig. C).

MID-HIGH HP: Control for selection of slope and cut-off frequency at lower limit of mid-to high range frequency (MID-HIGH). (See Fig. D).

MID-HIGH LP: Control for selection of slope and cut-off frequency at upper limit of mid-to high range frequency (MID-HIGH). (See Fig. E).

HIGH HP: Control for selection of slope and cut-off frequency at lower limit of high range frequency (HIGH). (See Fig. F). Note that this slope selector control has no FLAT position.

*LP: Low-pass filter
HP: High-pass filter

NOTE:
If the tweeter and mid-range speakers receive signals whose frequencies are below their respective lower limits, rupture of those speakers may result. Therefore, be especially careful when switching the slope selector controls, particularly when selecting the FLAT position.

Fig. A

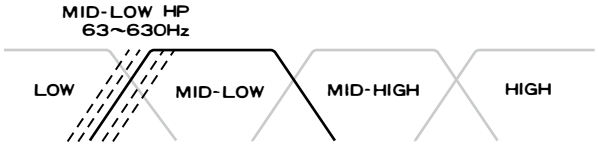


Fig. B

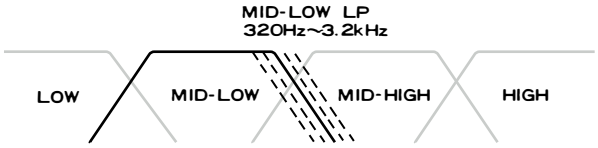


Fig. C

Fig. D

Fig. E

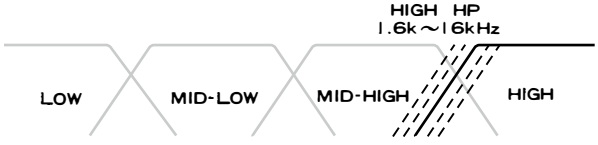


Fig. F

CUT-OFF FREQUENCY

Theoretically, the cut-off frequency is the point at the start of the two finely drawn lines in Fig. G.
In the D-23, the actual characteristics are shown by the dotted line (Fig. H) and the broken line (Fig. G). So the cut-off frequency corresponds to –3dB when the slope selector is set to –6, or –18dB/oct, and –6dB when it is set to –12dB/oct.

SLOPE

Slope refers to the amount of attenuation in the frequency response curve per octave (1 octave corresponds to a doubling, or halving of the frequency).

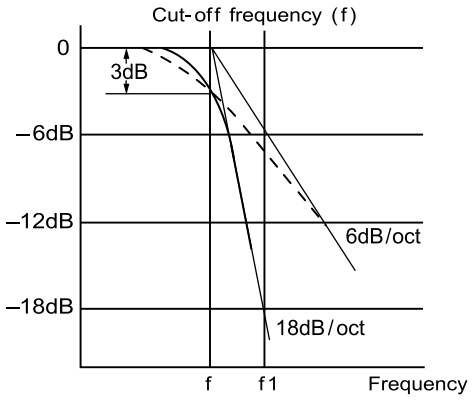


Fig. G

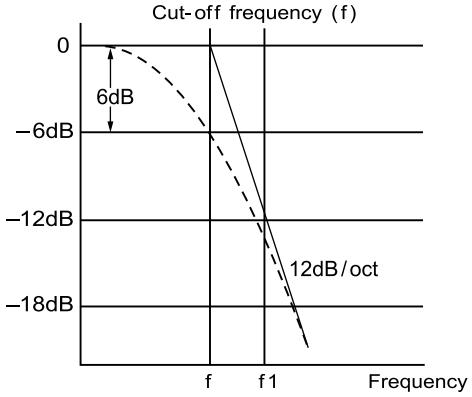


Fig. H

BEFORE OPERATING THE D-23

CROSSOVER FREQUENCIES

Crossover frequency is the frequency where the frequency responses of each speaker cross each other, as shown in Fig. 6.

The D-23 Electronic Crossover unit employs a large number of low-pass and high-pass filters to cut-off certain frequencies. If the same cut-off frequencies for the low and high frequency sides are selected by the frequency selector controls, the crossover frequency will be at a point —3dB below the flat portion of the frequency response curve (or —6dB below when the slope selector is set to 12dB/oct). (See Fig. 7).

It is possible, however, to select the wrong crossover frequency (see Fig. 8), due to the acoustical peculiarities of the listening room, and the type of speakers used. In selecting proper crossover frequencies, the following points should be kept in mind.

- All speakers have a reproduction frequency range (see Fig. 9) which is described in the speaker's technical specifications. This will include crossover or cut-off frequencies. These specifications, however, usually quote the upper or lower limits. So when considering slope selections, it is advisable to select cut-off frequencies somewhat higher than the rated frequency for tweeters (see Fig. 10), and frequencies somewhat lower for woofers (see Fig. 11).
- The selected crossover frequency should avoid any peaks or dips in the frequency response curves of either speaker. Fig. 12 shows a poorly chosen crossover frequency which will have an adverse effect on the quality of sound.

SLOPES

As can be seen in Fig. 6, when the frequencies of two speakers are added together, there is a tendency for a dip, or a peak to appear on the overall frequency response curve in the vicinity of the crossover frequency. Fig. 8 shows, however, that changing of both cut-off frequencies and slope characteristics can improve the bridging of the sounds from the two speakers. After first taking note of the frequency characteristics of the speakers employed, testing with different slopes will enable the selection of the most appropriate slope position.

Precautions in Selecting Slopes

If 2kHz is chosen as the crossover frequency for a tweeter whose cut-off frequency is also around 2kHz (see Fig. 10), selection of the 6dB/oct slope will mean that the tweeter will be liable to receive signals of frequencies which it is not able to handle properly (indicated by shaded area). This will result in loss of tonal quality, or in extreme cases, damage to the tweeter itself.

In general, when the crossover frequency is close to the speaker's upper (or lower) limit of the reproduction frequency range (Fig. 9), the selected slopes should be either 18dB, or 12dB.

Fig. 11 is an example of suitable woofer cut-off frequencies for different slopes.

PHASE

When changes in phase occur in the vicinity of the crossover frequency, as shown in Fig. 12, the "joining" of the sound between adjacent frequency ranges deteriorates, resulting in an unnatural sound reproduction.

In such a case, reverse the polarities of the connections between the power amplifier and the speakers in either of the frequency ranges, and then listen again. In many cases, a definite improvement will be heard.

- "Reverse the polarities" means connecting the negative speaker terminal to the positive output terminal of the power amplifier, and positive speaker terminal to the negative output terminal, or vice versa.

Phase can also be altered by the acoustical characteristics of the room, and the type of speakers used in the combination. Therefore, it is strongly suggested that speaker polarities be changed over in order to find the most natural tonal quality. Phase matching can also be improved by changing slopes, so it is also advisable to try out different slope settings as well.

NOTE:
Again, phase may be inverted by the stereo power amplifiers used in the multi-amplifier system. If so, try changing speaker polarities in this case too.

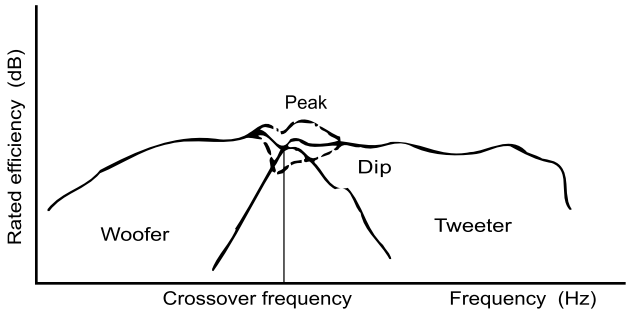


Fig. 6

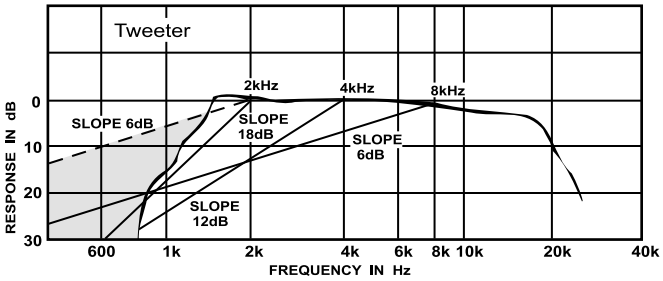


Fig. 10

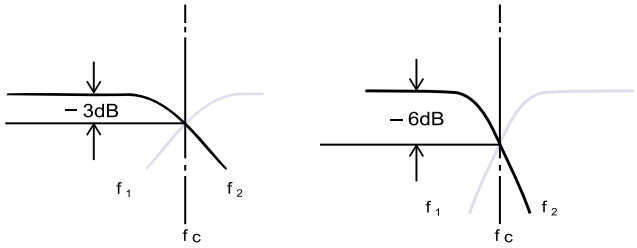


Fig. 7

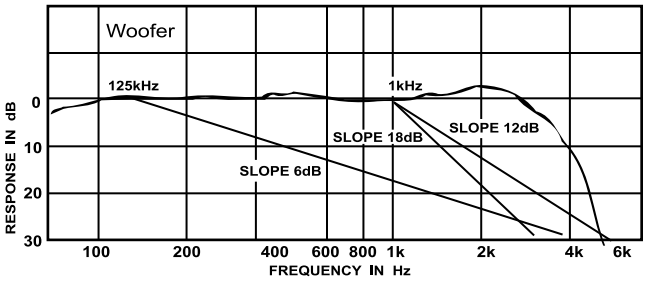


Fig. 11

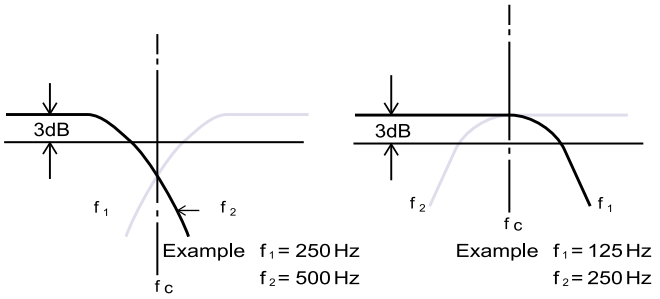


Fig. 8

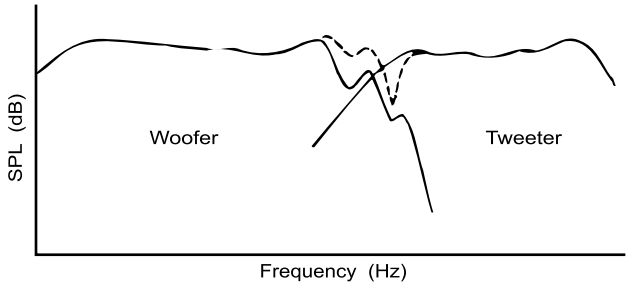


Fig. 12

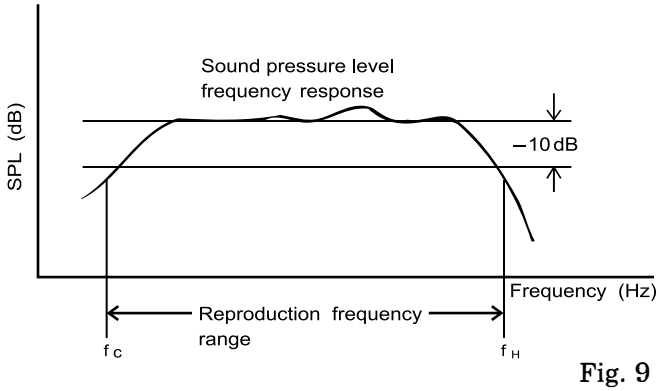


Fig. 9

PROTECTIVE CAPACITORS FOR SPEAKERS

If the tweeter, or mid-range speaker, is mistakenly connected to the power amplifier for low frequency range, or if noise is suddenly generated by a faulty connection, any large low frequency signal reaching the tweeter or mid-range speaker may cause irrepairable damage. To avoid this danger, it is recommended that protective capacitors be inserted as shown in Fig. 13. The capacitance of the capacitor can be determined from Chart 1 once the speaker's impedance and the crossover frequency (set by D-23) are known. For example, if the speaker's nominal impedance is 8 ohms, and the selected crossover frequency is 5kHz, the required capacitance will be 8μF.

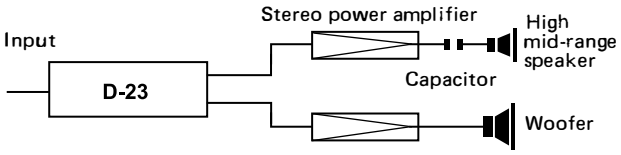
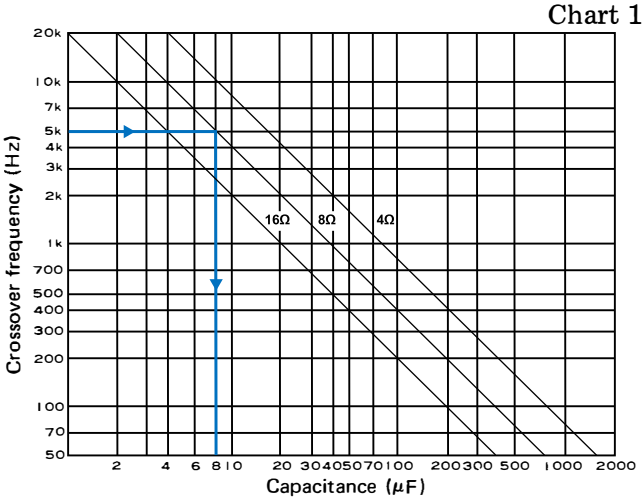


Fig. 13

Chart 1



Suitable capacitors include MP (metallized paper), MM (metallized mylar), and Oil capacitors. Do not use electrolytic capacitors (non-polar capacitors) since they have adverse effects on the quality of sound.

STEREO POWER AMPLIFIERS

Although the use of identical stereo power amplifiers would be ideal, it is also possible to use amplifiers of different power ratings, depending on the rated sensitivity of each pair of speakers.

For example, if a 60watt output power amplifier is used with woofers of 90dB/W sensitivity in the low frequency region, and the rated sensitivity of the tweeters being used is 96dB/W, a power amplifier of 15watts rated output power will be sufficient. Difference in rated sensitivity is 6dB (power 1/4; 60W × 1/4 = 15watts).

LEVEL ADJUSTMENTS

Since the output sound pressure levels in most ordinary speaker combinations are not the same, it will be necessary to adjust levels prior to playing. This entails adjusting the D-23 LEVEL controls while listening to the sound from the speakers. The procedure is as follows:

1. Check that all power switches are OFF.
2. Select the most suitable crossover frequencies and slope characteristics for each frequency range.
3. Set the preamplifier controls as follows:
   a Turn the TONE control OFF, or the BASS and TREBLE controls to FLAT.
   b Set the MODE selector to L+R (mono outputs).
   c Turn the BALANCE control fully counterclockwise so that sound is heard from the left channel speakers only.
   d Set the VOLUME control to normal listening level.
4. Check the rated output sound pressure levels of each speaker from the specifications in the respective instruction manuals. Commence with the speaker whose sound pressure level is lowest, setting the corresponding LEVEL control on the front panel of the D-23 to the "0" position, and all other LEVEL controls to" ∞ ".
5. Turn the power ON.
6. Now gradually turn the LEVEL control in the adjacent frequency range clockwise until there is a smooth consistency of sound between the two speakers. Use the level marker to mark this position.

NOTE:
Use the rated sound pressure levels of each speaker as a guide when adjusting levels in this manner.

7. After adjusting levels for all frequency ranges, re-check the consistency of sound across all ranges, and mark the positions with the level markers.
8. Turn the preamplifier BALANCE control clockwise so that now the sound is heard in the right channel speakers only, and repeat the above procedure.
9. Switch the MODE selector to STEREO, and check for overall stereo balance.

NOTES:
- *Change the program source, and repeat the level adjustments as a means of checking.*
- *Beginners are advised to compare the same program source with another (or already familiar) stereo system.*

OPERATIONAL PROCEDURE

1. Make the connections according to the multi-amplifier system being employed.

NOTE:
Check that the power supply of the D-23, and all the amplifiers is OFF.

2. Select suitable crossover frequencies by means of the frequency selector controls.
   Crossover frequencies are determined according to the characteristics of each of the speakers. See under "Crossover Frequencies" on page 8 for details.
3. Select suitable slopes for each of the crossover frequencies by means of the slope selector controls. See under "Slopes" on page 8 for details.
4. Turn the power ON, and adjust each of the LEVEL controls on the front panel of the D-23. See under "Phase" on page 8, and "Level Adjustments" on page 10 for details.
5. Commence playing the program source, setting the volume control on the preamplifier to the normal listening level. Further adjustments to account for the room's acoustical characteristics and any peculiarities in the program source itself, will improve the overall quality.

NOTE:
The SLOPE selector controls must NEVER be switched over to the FLAT position during the playing of a program.

4-WAY AMPLIFIER SYSTEMS

4-way systems, shown in Fig. 14, consist of 4 separate power amplifiers connected to the output terminals (LOW, MID-LOW, MID-HIGH, and HIGH) of D-23, plus independent pairs of speakers connected to each power amplifier.
The crossover frequencies and slopes for each frequency range are selected by the frequency selector and slope selector controls for each frequency range, after due consideration of the characteristics of each combination of speakers (see Fig. 16). This operation is described previously under "Operational Procedure".

NOTES:
- *In 4-way systems, the 18dB/oct slope is usually the best setting.*
- *If any of the slope selector controls are set to FLAT, the 4-way amplifier system will not operate properly, and there is a possibility of rupturing the speakers.*

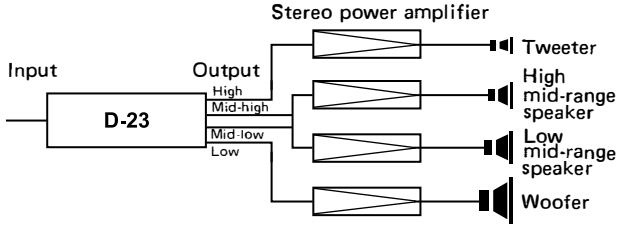


Fig. 14

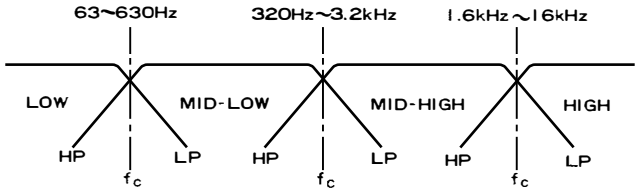


Fig. 15

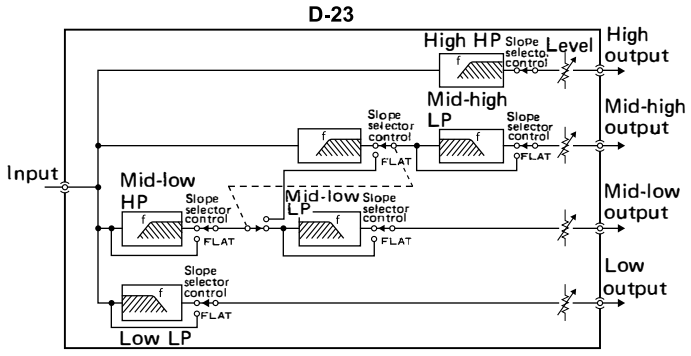


Fig. 16

3-WAY AMPLIFIER SYSTEMS

3-way amplifier systems can be formed in different ways, depending on how the slope selector controls are used. The most suitable composition will depend on the individual characteristics of the different speakers available. Operation of these 3-way systems is the same as described under "Operational Procedure".

NOTE:
Except where otherwise designated, the slope selector controls must NOT be set to the FLAT positions. Failure to comply with this stipulation may result in damage to the speakers.

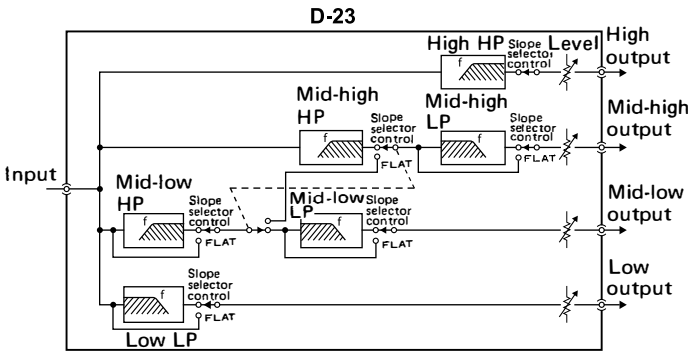


Fig. 17

SELECTION OF CROSSOVER FREQUENCIES BETWEEN LOW AND LOW MID-RANGE FREQUENCIES (63Hz–630Hz) AND BETWEEN HIGH MID-RANGE AND HIGH FREQUENCIES (1.6kHz–16kHz)

(Connections to LOW, MID-HIGH, and HIGH Output Terminals)

Connect the stereo power amplifiers to the LOW, MID-HIGH, and HIGH output terminals, as shown in Fig. 18, and then connect the appropriate speakers to each amplifier. After considering the combined characteristics of each speaker combination, select suitable crossover frequencies and slopes by means of the frequency selector and slope selector controls (LOW LP, MID-LOW HP, MID-HIGH LP, HIGH HP).

The MID-HIGH HP slope selector control must be set to the FLAT position in this case.

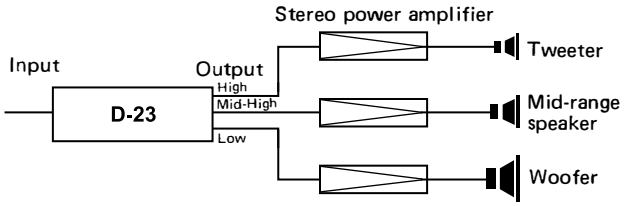
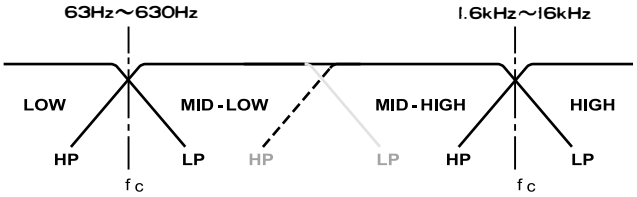


Fig. 18



MID-HIGH HP Slope Selector Control Set to FLAT position

Fig. 19

SELECTION OF CROSSOVER FREQUENCIES BETWEEN LOW AND LOW MID-RANGE FREQUENCIES (63Hz–630Hz) AND BETWEEN LOW MID-RANGE AND HIGH MID-RANGE FREQUENCIES (320Hz–3.2kHz)

(Connections to LOW, MID-LOW, and MID-HIGH Output Terminals)

Connect stereo power amplifiers to the LOW, MID-LOW, and MID-HIGH output terminals, as shown in Fig. 20, and then connect appropriate speakers to each of the amplifiers. After considering the characteristics of each speaker combination, select suitable crossover frequencies and slopes by means of the frequency selector and slope selector controls (LOW LP, MID-LOW HP, MID-LOW LP, MID-HIGH HP).

The MID-HIGH LP slope selector control must be set to the FLAT position in this case.

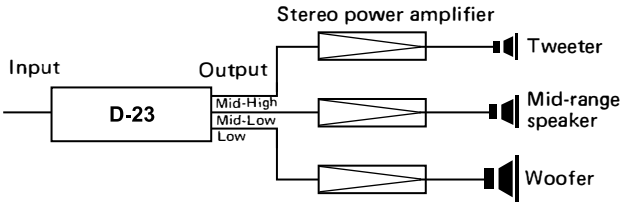
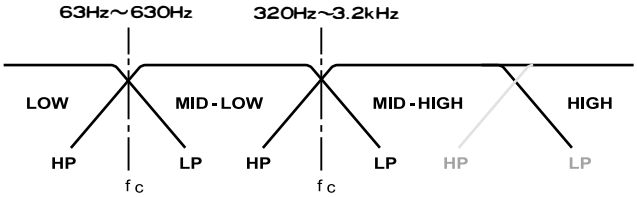


Fig. 20



MID-HIGH LP slope control set to FLAT position

Fig. 21

SELECTION OF CROSSOVER FREQUENCIES BETWEEN LOW MID-RANGE AND HIGH MID-RANGE FREQUENCIES (320Hz–3.2kHz) AND BETWEEN HIGH MID-RANGE AND HIGH FREQUENCIES (1.6kHz–16kHz)

(Connections to MID-LOW, MID-HIGH, and HIGH Output Terminals)

Connect stereo power amplifiers to the MID-LOW, MID-HIGH, and HIGH output terminals, as shown in Fig. 22, and then connect appropriate speakers to each of the amplifiers. After considering the characteristics of each speaker combination, select suitable crossover frequencies and slopes by means of the frequency selector and slope selector controls (MID-LOW LP, MID-HIGH HP, MID-HIGH LP, and HIGH HP).

The MID-LOW HP slope selector control must be set to the FLAT position in this case.

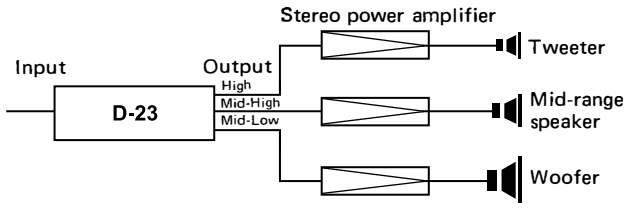
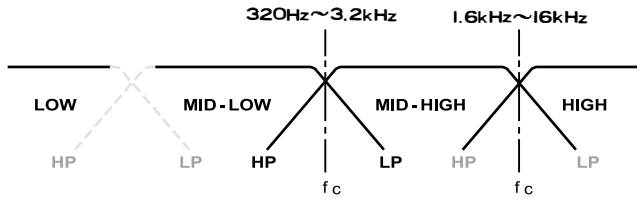


Fig. 22



MID-LOW HP slope selector control set to FLAT position

Fig. 23

2-WAY AMPLIFIER SYSTEMS

2-way amplifier systems can be formed in several different ways, depending on how the slope selector controls are used. The most suitable composition will depend on the individual characteristics of the different speakers employed. Operation of these 2-way systems is the same as described under "Operational Procedure".

NOTE:
Except where otherwise designated, the slope selector controls must NOT be set to the FLAT positions. Failure to comply with this stipulation may result in damage to the speakers.

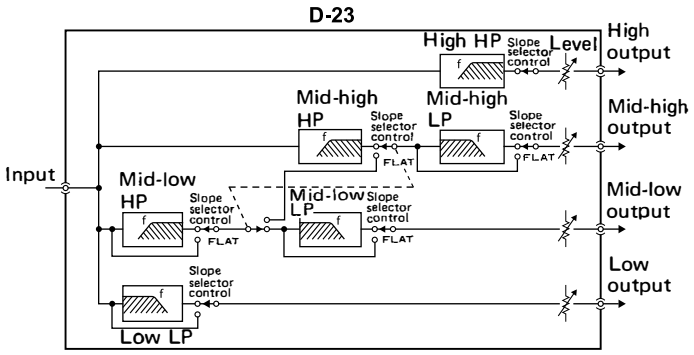


Fig. 24

SELECTION OF CROSSOVER FREQUENCY BETWEEN LOW MID-RANGE AND HIGH MID-RANGE FREQUENCIES (320Hz–3.2kHz)

(Connections to MID-LOW and MID-HIGH Output Terminals)

Connect stereo power amplifiers to the MID-LOW and MID-HIGH output terminals, as shown in Fig. 25, and then connect the appropriate speakers to the amplifiers. After considering the combined characteristics of the speaker combination, select a suitable crossover frequency and slopes by means of the frequency selector and slope selector controls (MID-LOW LP and MID-HIGH HP).

The MID-LOW HP and MID-HIGH LP slope selector controls must be set to FLAT positions in this case.

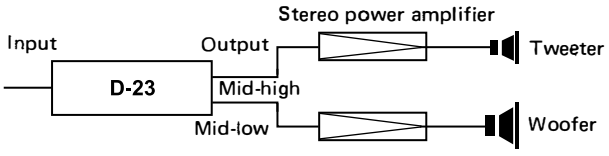
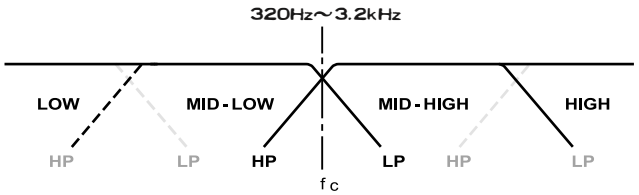


Fig. 25



MID-LOW HP and MID-HIGH LP slope selector controls set to FLAT positions

Fig. 26

SELECTION OF CROSSOVER FREQUENCY BETWEEN LOW AND LOW MID-RANGE FREQUENCIES (63Hz—630Hz)

(Connections to LOW and MID-LOW Output Frequencies)

Connect stereo power amplifiers to the LOW and MID-LOW output terminals, as shown in Fig. 27, then connect appropriate speakers to the amplifiers. After considering the combined characteristics of the speaker combination, select a suitable crossover frequency and slopes by means of the frequency selector and slope selector controls (LOW LP and MID-LOW HP).

The MID-LOW LP slope selector control must be set to the FLAT position in this case. The MID-HIGH HP slope selector control is not set to FLAT, since this would prevent any signal appearing at the MID-LOW output terminal.

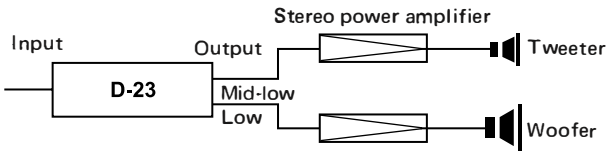
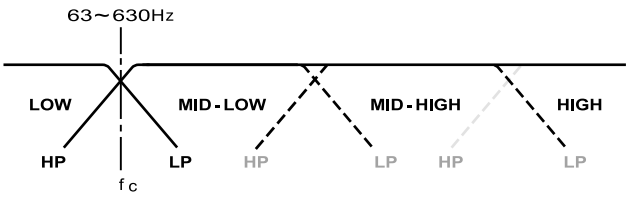


Fig. 27



MID-LOW LP slope selector control set to FLAT position

Fig. 28

SELECTION OF CROSSOVER FREQUENCY BETWEEN HIGH MID-RANGE AND HIGH FREQUENCIES (1.6kHz—16kHz)

(Connections to MID-HIGH and HIGH Output Terminals)

Connect stereo power amplifiers to the MID-HIGH and HIGH output terminals, as shown in Fig. 29, and then connect the appropriate speakers to the amplifiers. After considering the combined characteristics of the speaker combination, select a suitable crossover frequency and slopes by means of the frequency selector and slope selector controls (MID-HIGH LP and HIGH HP).

The MID-LOW HP and MID-HIGH HP slope selector controls must be set to the FLAT positions in this case.

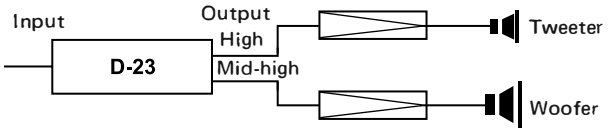
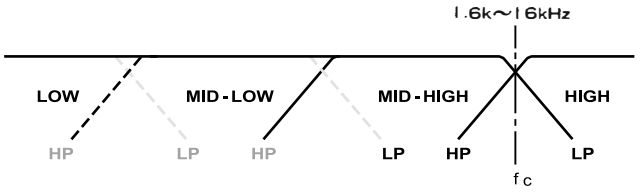
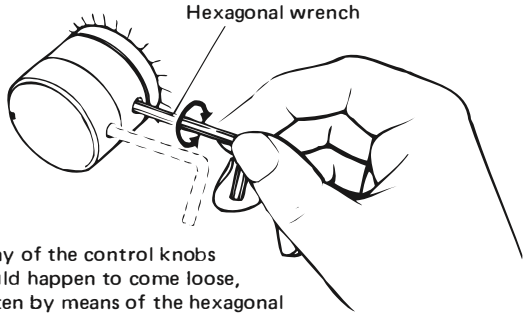


Fig. 29



MID-LOW HP and MID-HIGH HP slope selector control set to FLAT positions

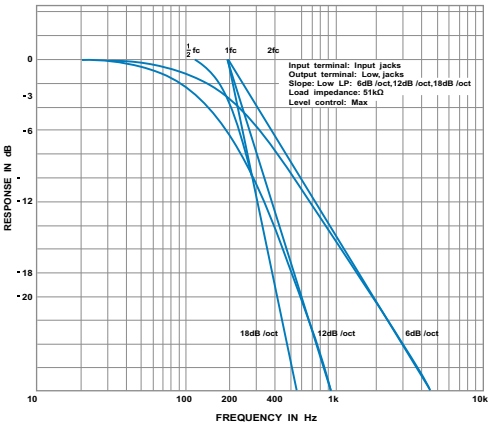
Fig. 30



CHARACTERISTICS CHARTS

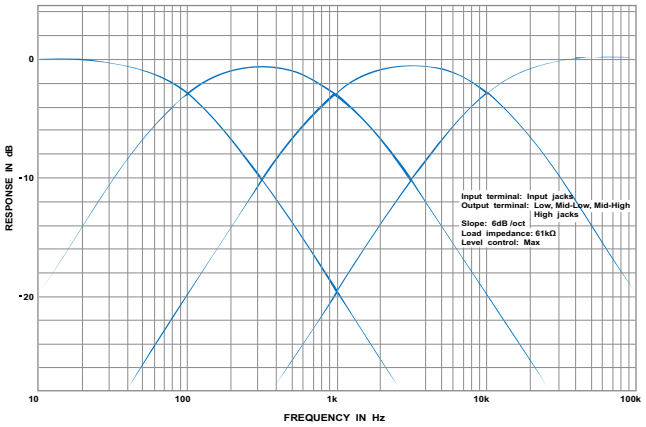
■ SLOPES CHARACTERISTICS

fc = 200Hz



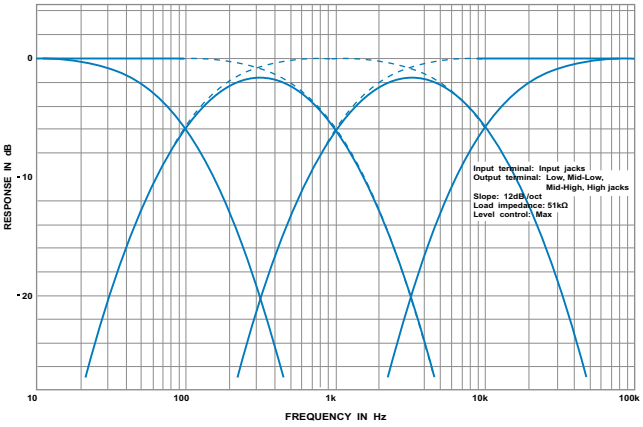
■ FREQUENCY RESPONSES

fc = 100, 1k, 10k(Hz) at 6 dB/oct



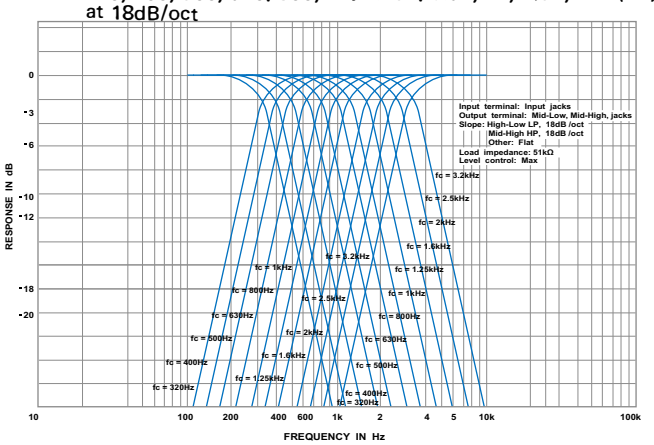
■ FREQUENCY RESPONSES

fc = 100, 1k, 10k(Hz) at 12dB/oct



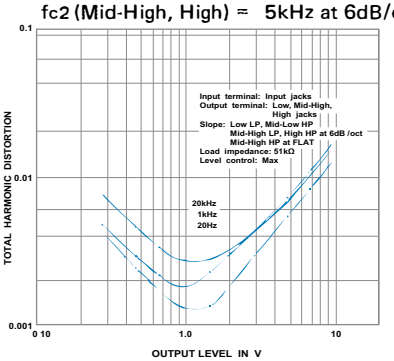
■ FREQUENCY RESPONSES

fc = 320, 400, 500, 630, 800, 1k, 1.25k, 1.6k, 2k, 2.5k, 3.2k(Hz) at 18dB/oct



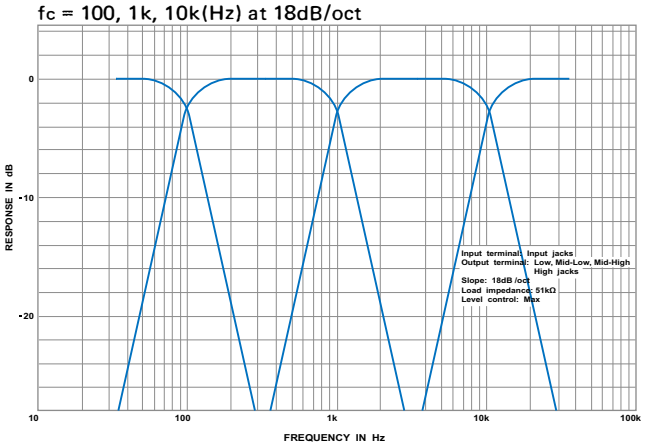
■ TOTAL HARMONIC DISTORTION vs. RATED OUTPUT LEVELS

fc1 (Low, Mid-High) = 200Hz at 6dB/oct
fc2 (Mid-High, High) = 5kHz at 6dB/oct



■ FREQUENCY RESPONSES

fc = 100, 1k, 10k(Hz) at 18dB/oct



SPECIFICATIONS

Semiconductors

Transistors 71
Diodes 18

Amplifier Section

Circuitry
- Buffer Amplifier . . . . . Pure complimentary SEPP.
- Filter . . . . . RC passive filter (6dB/oct., 12dB/oct.)
  RC activer filter + RC passive filter (18dB/oct.)
  2-way, 3-way, 4-way

Cut-off Frequency
- LOW (HIGH CUT)
- MID-LOW (LOW CUT) . . 63, 80, 100, 125, 160, 200, 250, 320, 400, 500, 630Hz
- MID-LOW (HIGH CUT)
- MID-HIGH (LOW CUT) . 320, 400, 500, 630, 800, 1k, 1.25k, 1.6k, 2k, 2.5k, 3.2kHz
- MID-HIGH (HIGH CUT)
- HIGH (LOW CUT). 1.6k, 2k, 2.5k, 3.2k, 4k, 5k, 6.3k, 8k, 10k, 12.5k, 16kHz

Slope . . . . . 6dB/oct, 12dB/oct, 18dB/oct.
LEVEL Control . . . . . 0 to −30dB (1dB step), ∞
left and right channel individual controls
Insertion Loss . . . . . 0 to −2dB
Input Impedance 50kΩ
Output Impedance . . . . . 4kΩ (Max.)
Output (R_L: 50k) . . . . . 1V, 10V (Max.)
Total Harmonic Distortion 20Hz to 20,000Hz
- 1V output 0.005%
- 10V output 0.1%

Frequency Response
- (LOW END, HIGH END) 10Hz, 100,000Hz $^{+0dB}_{-1dB}$

Hum and Noise (IHF, short-circuited, A network)
- 1V output 100dB

Miscellaneous

Power Requirements . . . . . 120V 60Hz only
Power Consumption . . . . . 14 watts (UL)
Dimensions . . . . . 420(W) x 150(H) x 352(D)mm
16-9/16 x 5-29/33 x 13-7/8 in.
Weight — Without package: 8.7kg (19lb 3oz)
With package: 9.7kg (21lb 6oz)

Furnished Parts

Connection Cord with Pin Plugs 4
Operating Instructions 1
Hex. Wrench (used for fastening knob) 1

NOTE:
Specifications and the design subject to possible modification without notice due to improvements.

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