ELECTRONIC CROSSOVER NETWORK

SF-850

OPERATING INSTRUCTIONS

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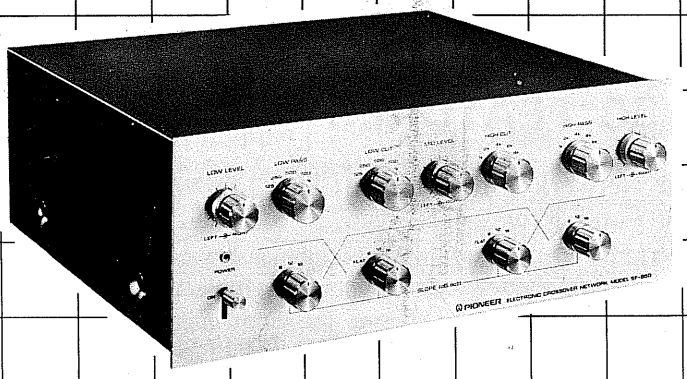


Leather-like vinyl metal is used in the construction of this cabinet.

PIONEER

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

We would like to thank you sincerely for having acquired the SF-850 Electronic Crossover Network.
The SF-850 is an electronic crossover network which was designed to provide component stereo at its best. With its help, a 2-way or 3-way multi-amplifier system of the highest grade can be built to satisfy even professional needs. To assure optimum performance, please study these instructions carefully.

CONTENTS

SF-850 FEATURES

Crossover Network with Excellent Signal-to-Noise Ratio and Distortion Factor

A high performance network which combines low-noise silicon transistors with selected circuit components. Designed to keep normal loss at a minimum by raising the input impedance and lowering the output impedance, it makes pre-amplifier and power amplifier selection easy.

Crossover Frequencies can be Selected

Five steps each can be selected in the Low-Mid range, from 125Hz to 1kHz and in the Mid-High range, from 1kHz to 8kHz, to set up the crossover frequencies which bring out the speaker characteristics best.
Moreover, since each channnel is equipped with an individual frequency selection switch, a well-balanced overall characteristic can be achieved by neutralizing the peaks or dips which differ with the type of speaker employed and the room acoustics.

The Cut-off Slope can be Changed in 3 Steps

Since the slope for each channel can be selected from 6dB/oct, 12dB/oct, or 18dB/oct, natural sound production which matches the speaker and room acoustics can be enjoyed. Selection of cut-off slope can be in conjunction with the crossover frequency. Furthermore, since the Mid Range slope switch provides a FLAT position, the crossover frequency in a 2-way multi-amplifier system can be set in the low (125Hz–1kHz) or high (1kHz–8kHz) range. It can be effectively used by lowering the crossover when employing large diameter woofers and horn type medium and high range speakers, and by raising it when employing small diameter low-range and horn type high-range speakers.

Exclusive Level Control for Each Range

Since low, mid, and high ranges, plus left and right channel levels can each be independently set, level adjustment can be made to suit taste and to match power amplifier and speaker efficiency and room composition.

Easy-to-Operate Design

The front panel, which is designed for easy operation, fits every room by nature of its simple design. Moreover, when assembling Pioneer components, a uniformly designed high-grade multi-amplifier system can be set up.

MULTI-AMPLIFIER HI-FI SYSTEMS

True high fidelity in music reproduction demands a very wide frequency response, wide dynamic range and minimization of distortion. One excellent way of achieving these goals is the so-called "multi-amplifier system." In this, the total audible sound spectrum is divided into two or three portions ("ranges") by an electronic crossover network such as the SF-850. Each range is then separately amplified in a power amplifier and reproduced via corresponding speakers. This elaborate configuration has several substantial benefits—considerably lower intermodulation distortion, phase accuracy (because no passive LC network is needed in the speakers), high damping factor, excellent transient response and dynamic range and full control over each (low, mid- and high) range. Fig. 1 shows a typical 3-way multi-amplifier system.

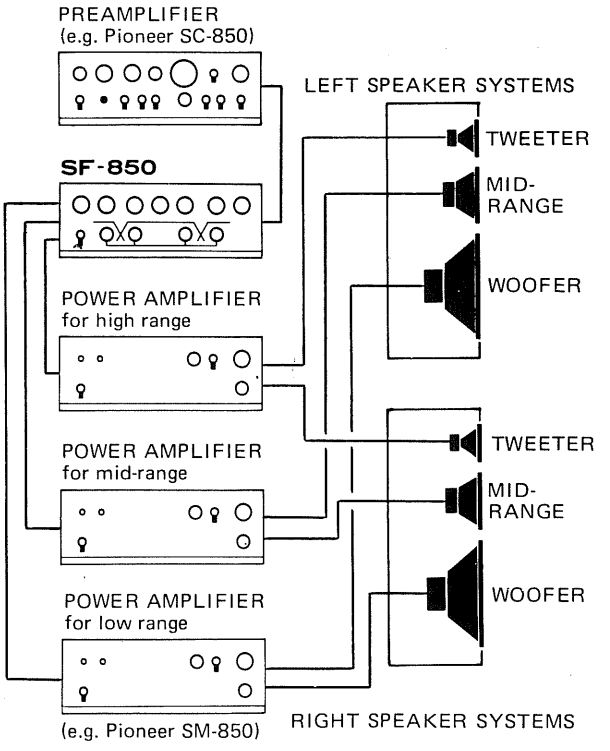


Fig. 1

A WORD ABOUT ROOM ACOUSTICS

The sound that you hear is greatly influenced by the acoustics of your listening room—by the placement of the loudspeakers, the proportions and materials of walls, floor and ceiling, the total space, the amount and arrangement of furniture, curtains, carpets, etc. Generally, the loudspeakers should be placed with their backs against a wall to obtain optimum bass response. A low ceiling, hard walls and floor and a blank wall facing the speakers make the sound very "live" and lacking in definition and clarity. This can usually be alleviated by putting up sound-absorbent draperies, curtains, etc. Conversely, a room overstuffed with upholstered furniture and carpets sounds "dead." In such a case, try rearranging the furniture.

COMPOSITION OF A MULTI-AMPLIFIER SYSTEM

By combining the SF-850 with a stereo pre-amplifier, two or three stereo power amplifiers, program source units (such as turntable, tape deck or tuner) and speaker units (or speaker systems), the following kinds of multi-amplifier systems can be obtained.

3-WAY SYSTEM

As illustrated in Figs. 1 and 2, a 3-way multi-amplifier system requires three stereo power amplifiers and speaker units (or speaker systems) with individually accessible speakers for the high, medium and bass ranges. System response and crossover frequencies will be somewhat as shown in Fig. 3.

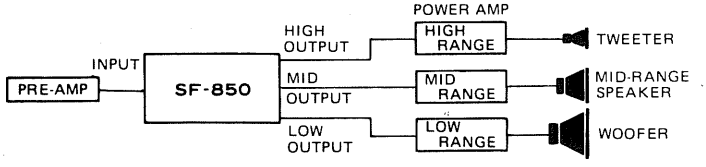


Fig. 2

Figs. 2, 4 and 6 show only one channel; connections for the other stereo channel are identical.

fc: Crossover frequencies

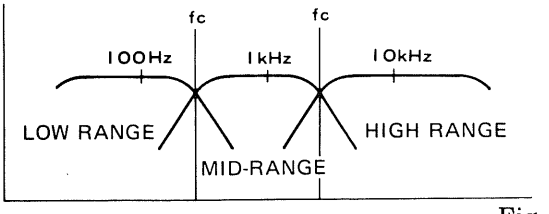


Fig. 3

2-WAY SYSTEMS

A 2-way multi-amplifier system can be built in either of two kinds: frequency division between low and mid-high range, or between low-mid and high ranges.

Low/Mid-High Division (Used to connect OUTPUT Jacks 2-way B)

Fig. 4 shows such a system. Two stereo power amplifiers are needed, the speaker units (or speaker systems) must have 2-way inputs for low and mid/high ranges. The crossover frequency should be set at below 1kHz, taking into consideration the characteristics of the speakers. Refer to Fig. 5.

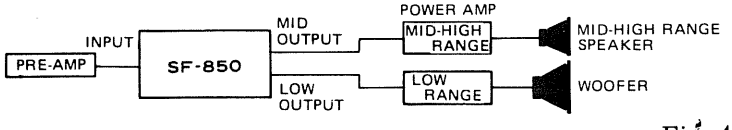


Fig. 4

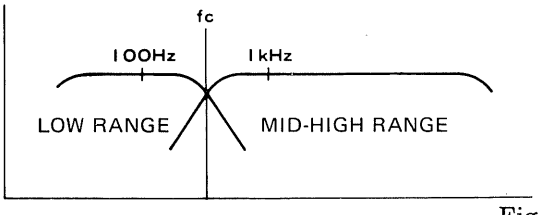


Fig. 5

Low-Mid/High Division (Used to connect OUTPUT Jacks 2-way A)

As shown in Fig. 6, this system is very much like the one described above. The low and mid ranges are lumped together, and the crossover frequency is set somewhere above 1kHz. Its selection again depends on the characteristics of the speakers. See Fig. 7.

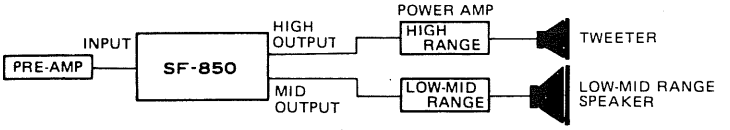


Fig. 6

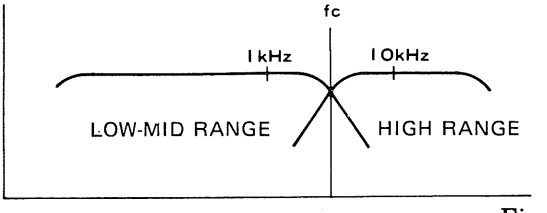


Fig. 7

HOW TO CONNECT THE SF-850

CONNECTIONS TO PRE-AMPLIFIER

1 Connect the pre-amplifier's output jacks to the jacks marked INPUT on the SF-850. See Fig. 8. Observe correct channel connections—the upper jack on the SF-850 is for the left channel, the lower jack, for the right channel.

2 Plug the SF-850's AC cord into a SWITCHED auxiliary AC outlet on the pre-amplifier. This way, the SF-850 can be switched on and off by the pre-amplifier's power switch.

CONNECTIONS TO POWER AMPLIFIERS

1 Fig. 8 shows the connection to one power amplifier—connection to the other amplifier(s) is made in the same way. Be sure to make correct channel connections; of the three pairs of OUTPUT on the SF-850, the upper jacks are for the left channels, the lower jacks, for the right channels.
Composition of a 3-way or 2-way multi-amplifier system is explained on page 4. Refer to these paragraphs when making power amplifier connections.

2 Plug the AC cords of the power amplifiers into SWITCHED auxiliary AC outlets on the pre-amplifier or on the SF-850. In this way, the power amplifiers can be turned on and off by the pre-amplifier's power switch.

NOTE:
Instead of a pre-amplifier and power amplifier, an "integrated amplifier" or "receiver" can be used, provided that its pre- and power amplification stages can be used separately. (Such integrated amplifiers and receivers are equipped with PRE OUT and POWER IN jacks.)

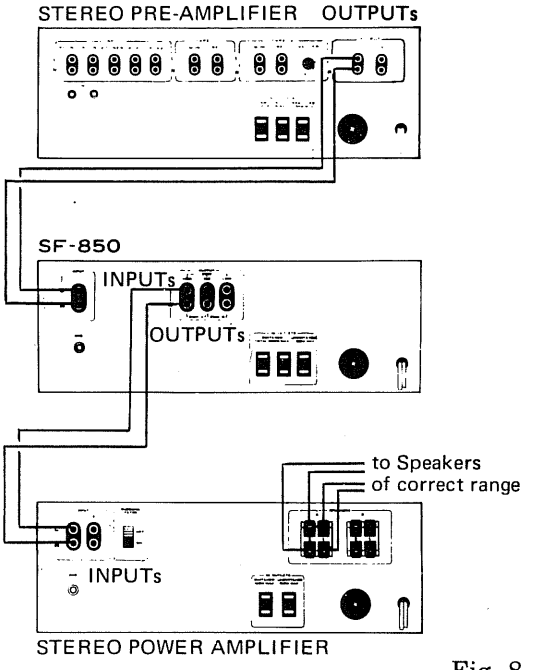
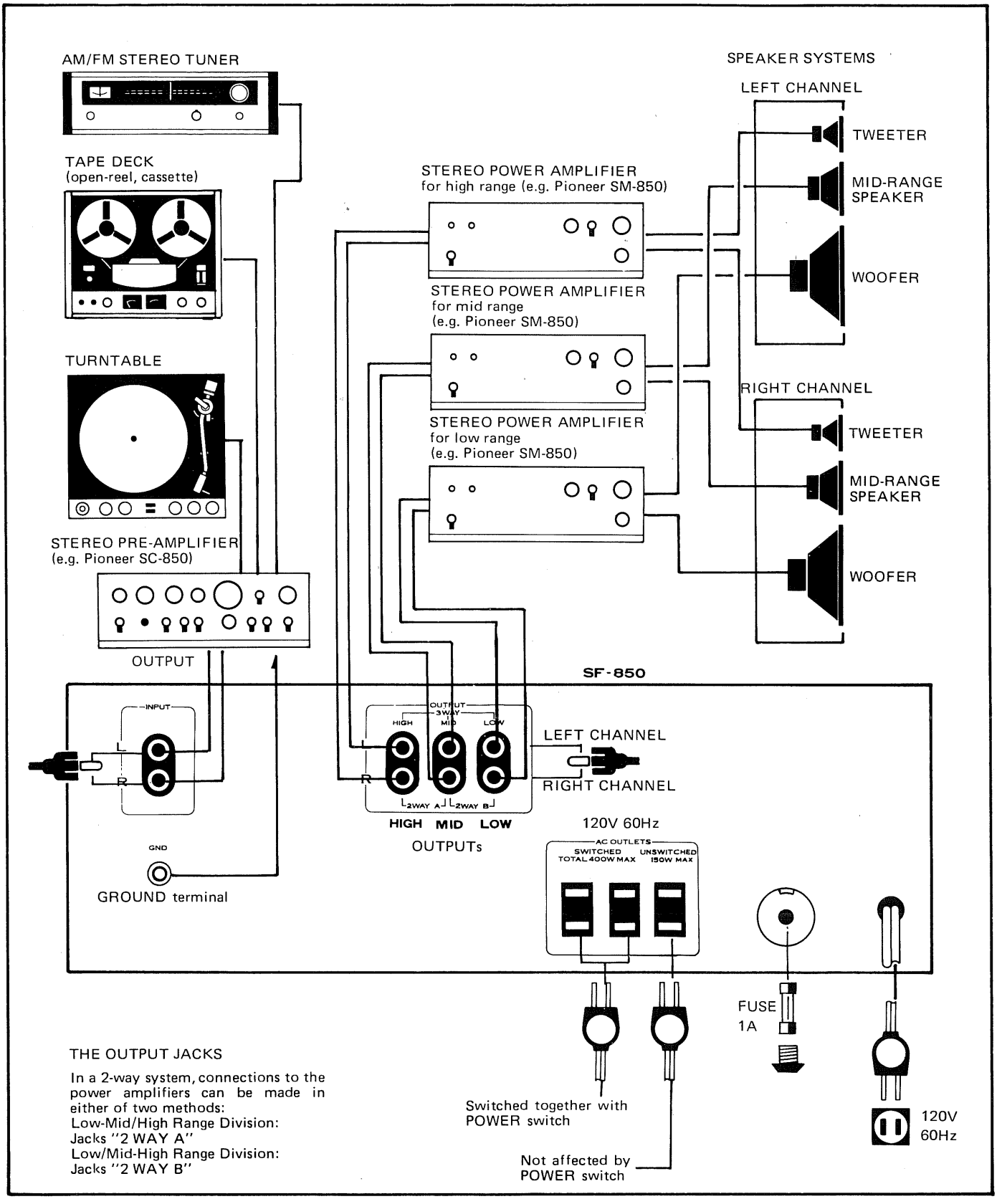


Fig. 8

CONNECTION DIAGRAM



THE OUTPUT JACKS

In a 2-way system, connections to the power amplifiers can be made in either of two methods:
Low-Mid/High Range Division:
Jacks "2 WAY A"
Low/Mid-High Range Division:
Jacks "2 WAY B"

FRONT PANEL FACILITIES

LOW LEVEL CONTROL

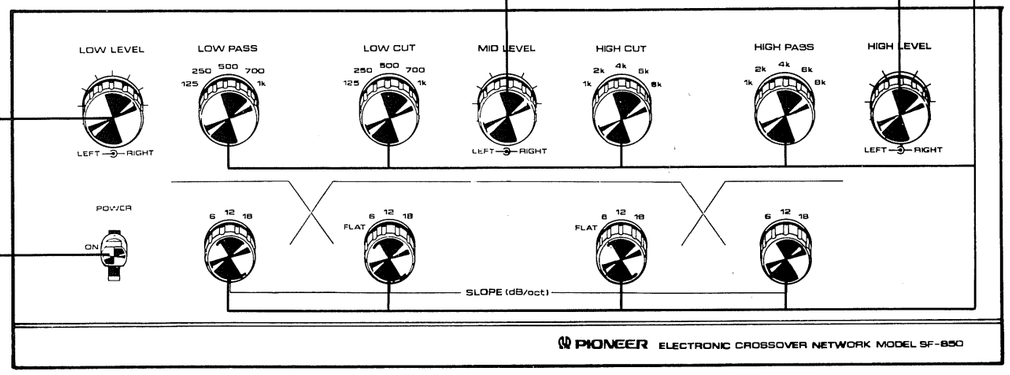
Controls the output level of the LOW range outputs. Clockwise rotation increases output level, counterclockwise rotation reduces it. The outer knob controls the right channel, the inner knob, the left channel.

MID LEVEL CONTROL

Controls the output level of the MID range outputs. Functions like the LOW LEVEL control.

HIGH LEVEL CONTROL

Controls the output level of the HIGH RANGE outputs. Functions like the LOW LEVEL control.



POWER SWITCH

Turns the power supply to the unit "on" and "off." Also controls the auxiliary AC outlet marked SWITCHED on the rear panel.

CROSSOVER FREQUENCY & SLOPE SELECTOR SWITCHES

In each case, the upper switch selects the cut-off frequency, and the lower switch selects the steepness of the slope, with which frequencies above or below that frequency are attenuated.

This cut-off slope becomes increasingly steep as the knob is set to 6, 12 and 18. See Fig. 9.

With the lower switch in position FLAT, the upper (frequency select) switch becomes inoperative.

LOW PASS

Selects cut-off frequency and cut-off slope at upper end of low range. See Fig. 10-a.

LOW CUT

Selects cut-off frequency and cut-off slope at lower end of MID range. See Fig. 10-b.

HIGH CUT

Selects cut-off frequency and cut-off slope at upper end of MID range. See Fig. 10-c.

HIGH PASS

Selects cut-off frequency and cut-off slope at lower end of HIGH range. See Fig. 10-d.

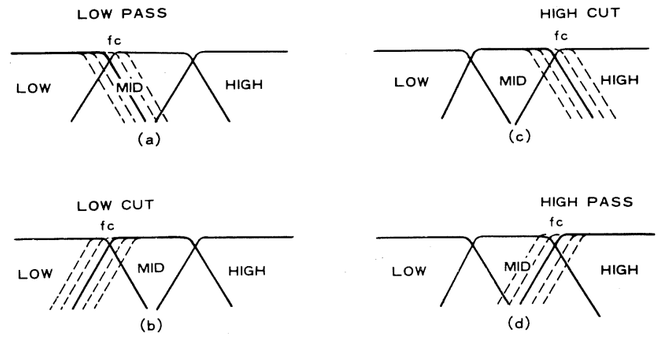


Fig. 10

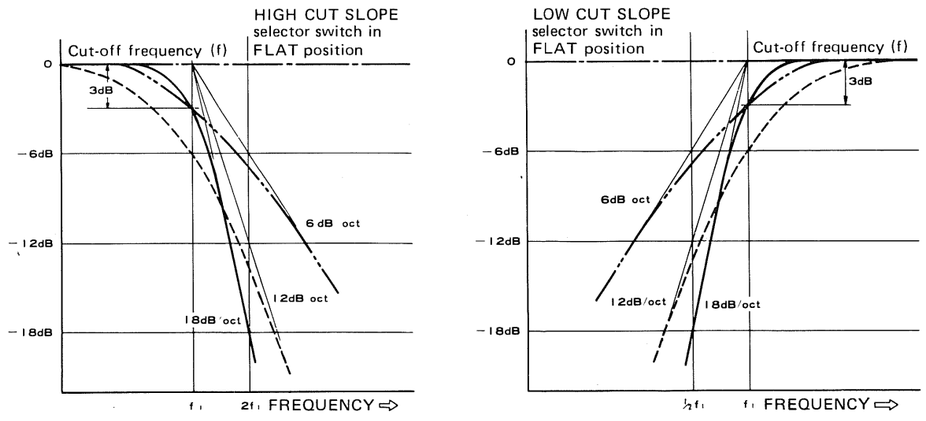


Fig. 9

TYPICAL 3-WAY SYSTEMS

CONNECTIONS

SF-850, three power amplifiers and speaker units (or 3-way speaker systems) must be connected as shown in Fig. 11. (The figure shows only one channel; connections for the other stereo channel are identical.)

1 Connect the HIGH OUTPUTs of the SF-850 to the inputs of the high range power amplifier.
2 Connect the speaker outputs of the high range power amplifier to the TWEETER (or HIGH) inputs of your speaker units.
3 Connect the MID OUTPUTs of the SF-850 to the inputs of the mid range power amplifier.
4 Connect the mid range power amplifier to the SQUAWKER (or MID-RANGE) inputs of your speaker units.
5 Connect the LOW OUTPUTs of the SF-850 to the inputs of the low range power amplifier.
6 Connect the low range power amplifier to the WOOFER or BASS (or LOW) inputs of your speaker units.

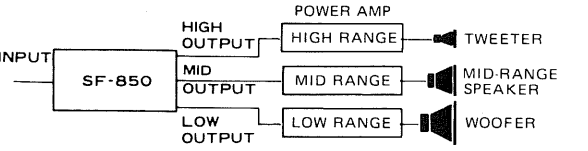


Fig. 11

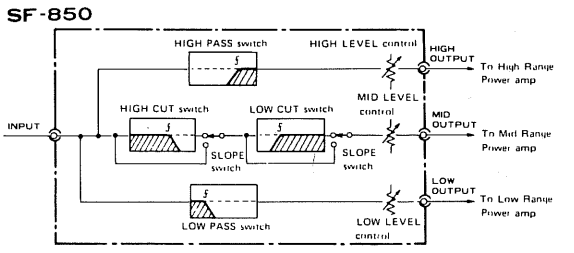


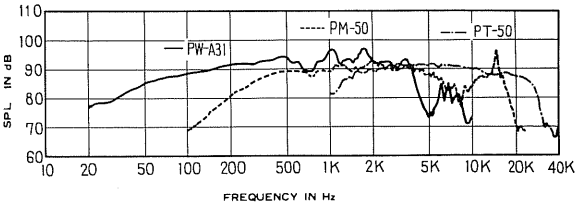
Fig. 12

OPERATION

1 Turn all level controls (LOW, MID and HIGH) of the SF-850 fully clockwise, to maximum.
2 Select the correct crossover frequencies with the help of the LOW PASS, LOW CUT, HIGH CUT and HIGH PASS switches. Selection of these frequencies must depend upon speaker characteristics.
3 With the SLOPE selector switches, select the appropriate cut-off slopes at the crossover points. For details, refer to page 12, "SELECTION OF CUT-OFF SLOPES."
The Table 1 gives an example of frequency and slope settings when using Pioneer speakers PW-A31, PM-50 and PT-50 (or PT-150) for the low, mid and high ranges, respectively.
4 Turn volume control of pre-amplifier back to minimum, then switch all amplifiers on.
5 Set program source (turntable, etc.) in operation.
6 Turn volume control of pre-amplifier up gradually to obtain desired listening level.
7 Due to different efficiency in the low, mid-range and high speakers, and in order to compensate for the acoustics of the room, the level controls of the SF-850 will have to be adjusted individually. This can be done by ear or, better yet, with appropriate test records or tapes. Very advanced hi-fi amateurs and professionals use special calibration microphones and VU meters for this purpose.

	Woofer (PW-A31)	Mid-Range Speaker (PM-50)		Tweeter (PT-50 or PT-150)
Freq'cy Select Sw	LOW PASS 700Hz	LOW CUT 700Hz	HIGH CUT 6kHz or 8kHz	HIGH PASS 6kHz or 8kHz
SLOPE Select	12dB/oct	12dB/oct	12dB/oct	12dB/oct

Table 1



Sound Pressure Level vs. Frequency (in speaker units)

Fig. 13

NOTES:

1 The SLOPE selectors provide another means of control over the system's frequency response, especially in ironing out dips and peaks in the speakers and room acoustics.
2. In 3-way operation, never set the SLOPE selectors at FLAT position, as this may damage the speakers.

TYPICAL 2-WAY SYSTEMS

LOW/MID-HIGH RANGE DIVISION

Connections (Jacks 2-WAY B)

Connect the SF-850 to two power amplifiers and speaker units (or 2-way speaker systems) as shown in Fig. 14.

1 Connect the LOW OUTPUTs of the SF-850 to the inputs of the low range power amplifier.
2 Connect the low range power amplifier to the WOOFER inputs of your speaker units.
3 Connect the MID OUTPUTs of the SF-850 to the inputs of the mid-high range power amplifier.
4 Connect the mid-high range power amplifier to the mid-high inputs of your speaker units.
The speakers should have a crossover frequency of 1kHz or lower.

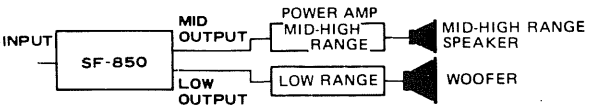


Fig. 14

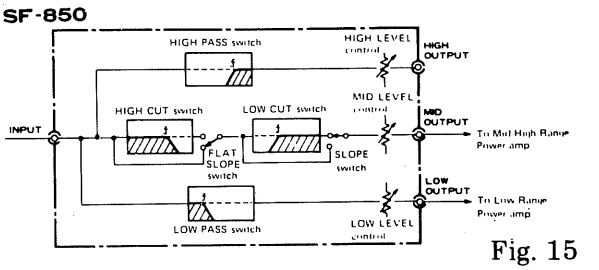


Fig. 15

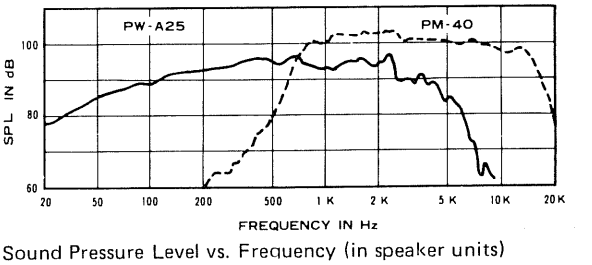
Operation

1 Turn the LOW and MID LEVEL controls of the SF-850 all the way clockwise, to maximum. Turn the HIGH LEVEL control all the way counterclockwise, to minimum.
2 Select the proper crossover frequency with the LOW PASS and LOW CUT selector switches. Selection must be done in accordance with speaker characteristics.
3 Set the HIGH CUT SLOPE selector switch to position FLAT. The medium range is thereby extended all the way into the high range—the two are lumped together to obtain a 2-way system.
4 Set the LOW CUT SLOPE and LOW PASS SLOPE selector switches in accordance with the desired cut-off steepness at the crossover point. These settings must be made with regard to the speaker characteristics. For details, refer to page 12, "SELECTION OF CUT-OFF SLOPES." The Table 2 gives an example of frequency and slope settings when using Pioneer PW-A25 and PM-40 speakers for the low and mid-high ranges, respectively.
5 For actual system operation, refer to items 4 thru 7 of "Operation, Typical 3-way System" on page 9.

Figs. 14, 15, 17 and 18 show only one channel, connections for the other stereo channel are identical.

	Woofer (PW-A25)	Mid-High Range Speaker (PM-40)
Freq'cy Select Sw	LOW PASS 1kHz	LOW CUT 1kHz
SLOPE Select	12dB/oct	12dB/oct

Table 2



Sound Pressure Level vs. Frequency (in speaker units)

Fig. 16

LOW-MID/HIGH RANGE DIVISION

Connections (Jacks 2-WAY A)

Connect the SF-850 to two power amplifiers and speaker units (or 2-way speaker systems) as shown in Fig. 17.

1 Connect the HIGH OUTPUTs of the SF-850 to the inputs of the high range power amplifier.
2 Connect the high range power amplifier to the TWEETER (or HIGH) inputs of your speaker units.
3 Connect the MID OUTPUTs of the SF-850 to the inputs of the low-mid range power amplifier.
4 Connect the low-mid range power amplifier to the WOOFER or LOW RANGE (or LOW-MID) inputs of your speaker units.

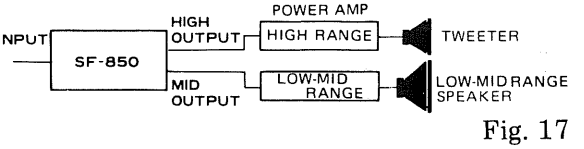


Fig. 17

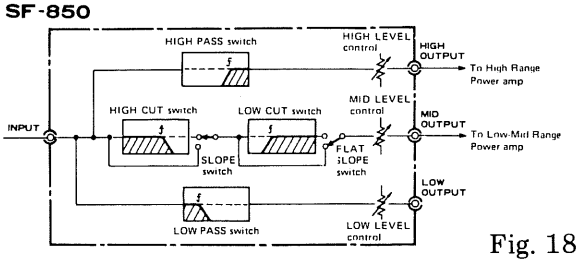


Fig. 18

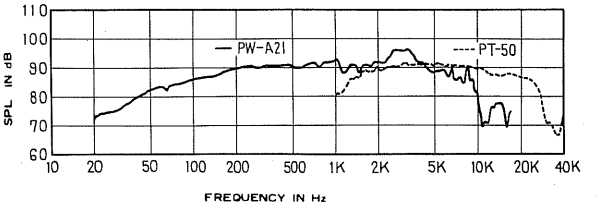
The speakers should have crossover frequency of 1kHz or above.

Operation

1 Turn the MID and HIGH LEVEL controls of the SF-850 fully clockwise, to maximum.
Turn the LOW LEVEL control all the way counter-clockwise, to minimum.
2 Select the proper crossover frequency with the HIGH PASS and HIGH CUT selector switches. Selection depends on speaker characteristics.
3 Set the LOW CUT SLOPE selector switch to position FLAT. The medium range is thereby extended downward, to include the bass range. See Fig. 18.
4 Set the HIGH CUT SLOPE and HIGH PASS SLOPE selector switches for the desired cut-off steepness at the crossover point. These settings must be made with regard to the speaker characteristics. For details, refer to page 12, "SELECTION OF CUT-OFF SLOPES."
The Table 3 gives an example of crossover frequency and slope settings when using Pioneer PT-50 (or PT-150) and PW-A21 speaker units for the high and mid-low ranges, respectively.
5 For actual system operation, refer to items 4 thru 7 of "Operation, Typical 3-way system" on page 9.

	Mid-Low Range Speaker (PW-A21)	Tweeter (PT-50 or PT-150)
Freq'cy Select Sw	HIGH CUT 4kHz	HIGH PASS 4kHz
SLOPE	12dB/oct	12dB/oct

Table 3



Sound Pressure Level vs. Frequency (in speaker units)

Fig. 19

ADJUSTMENTS FOR OPTIMUM PERFORMANCE

MEANING AND SELECTION OF CROSSOVER FREQUENCIES

In a multi-amplifier audio system with an electronic crossover network, those points in the frequency spectrum where one range ends and another begins, are called "crossover frequencies." This is illustrated in Fig. 20. The cut-off frequencies selectable with the SF-850 are those frequencies where response has dropped by 3 dB (response will drop by 6 dB at 12 dB/oct.) see Fig. 21. The most common method is to adjust the cut-off frequencies at the upper end of one range and at the lower end of the next higher range for the same value, making them a single "crossover" frequency. In the response diagram, the intersecting point will be 3 dB below flat response.

If, however, different types of speakers (such as horn and cone speakers) are used for adjoining ranges, it may be advantageous to separate the two cut-off frequencies by one octave (i.e. making the higher one double the value of the lower one), whereby response at the intersecting point drops lower than 3 dB.

Refer to Fig. 23. This shows a tweeter with a nominal

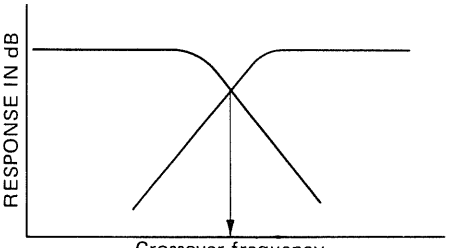


Fig. 20

cut-off of 2 kHz. If in this case the cut-off frequency is set at 2 kHz and the slope at 18 dB, the tweeter will still receive frequencies for whose reproduction it was in the interest of better sound quality it is advisable to choose a lower cut-off frequency in the case of woofers, a higher cut-off point in the case of tweeters.

SELECTION OF CUT-OFF SLOPES

At and near the crossover frequencies, both speakers for the adjoining ranges will reproduce the signal — in other words, they overlap. Depending on the amount and shape of this overlap, a peak or dip can be caused in the overall response curve. In such cases the cut-off frequencies can be moved further apart or closer together, and the steepness ("slope") of the cut-off can be changed in order to obtain smooth overall response. This is shown in Fig. 22.

The following general rules apply when selecting the cut-off slope.

Refer to Fig. 23. This shows a tweeter with a nominal cut-off of 2 kHz. If in this case the cut-off frequency is set at 2 kHz and the slope at 18 dB, the tweeter will still receive frequencies for whose reproduction it was not designed (the shaded area in the graph). This can cause distorted sound and, in extreme cases, can damage the tweeter. To prevent this, a higher cut-off frequency should be selected with the SF-850, as well as a steeper slope, to prevent undesirable frequencies from reaching the tweeter. The same principle applies, in reverse, to the woofer. In any event, the speaker units characteristics must be considered carefully when selecting cut-off frequencies and slopes.

A simple rule of thumb may serves as a guide:

Cut-off frequency close to speaker's nominal cut-off frequency ... Select steep cut-off slope (18 or at least 12 dB).

Cut-off frequency removed by 1-1/2 octaves or more from speaker's nominal cut-off frequency ... Select gradual cut-off slope (6 or 12 dB).

Fig. 24 illustrates this rule for a woofer with a nominal cut-off frequency of 2 kHz. Several applicable combinations of cut-off frequency and slope are shown. For example, with the cut-off at 1 kHz a slope of 12 dB should be used.

SPEAKER PHASING

The electronic crossover network divides the frequency band into several portions with the help of filters of 12dB/oct or 18dB/oct steepness. These filters cause phase inversions in the signals. This can lead to unnatural sound-lack of distinct source localization in the stereo image, for example.

In such cases, it often helps to reverse the speaker connections in one range (low, mid or high in a 3-way system, for example)—(+) on speaker to (—) on power

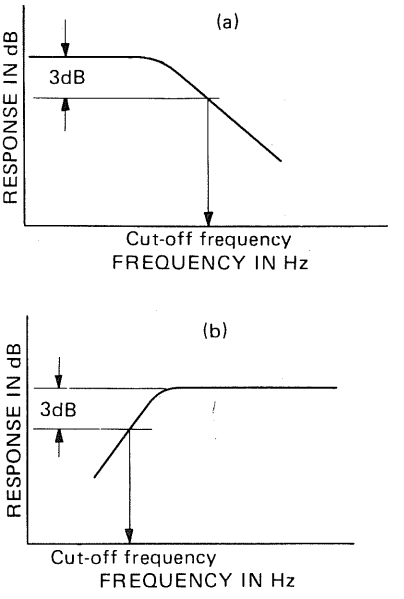


Fig. 21

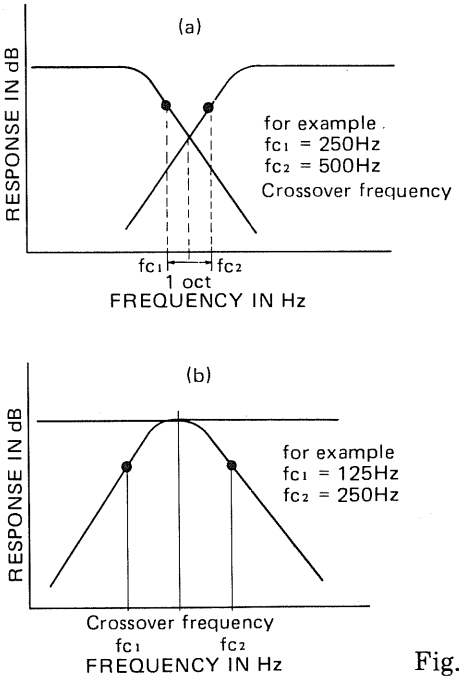


Fig. 22

amplifier. For example, if the acoustical image of the mid-range speaker seems indistinct when playing a monophonic source, try reversing the polarities of the mid-range speaker connections.

- Some power amplifiers have phase reverse switches. Play a monophonic program and set the switch for optimum "one-point" sound localization.
- Where no phase switches are provided, reverse the speaker polarities of the speakers of one range.

Optimum speaker phasing is possible with an appropriate test record (Shure TTR-101, for example). By alternately switching off the low, mid and high ranges of each channel, you will soon find the correct phase relationships.

SPEAKER PHASING IN A MULTI-AMPLIFIER SYSTEM

2-Way System

Speaker phasing may have to be changed, depending on the cut-off slope at the crossover point Fig. 25.
The Table 4 may serve as a guide.

3-Way System

- The same rules as in (1) apply—depending on the slope steepness, connect the woofer and mid-range speaker in phase or out of phase. Also connect the tweeter in phase with the mid-range, or out of phase, following the same rules:
- If the slopes at the crossover between LOW and MID ranges are as under A, B or C in the Table 4, connect woofer and mid-range speaker out of phase.
- If the slopes between MID and HIGH ranges are as under A, B or C, connect mid-range speaker and tweeter out of phase.
- If the slopes between low and mid-ranges and the slopes between mid and high ranges are as in A, B or C above (or any combination of those), connect woofer and tweeter in phase, but connect the mid-range speaker out of phase.
- If the slopes are as in D or E, connect all speakers in phase.

NOTE:
These rules generally apply even if different crossover frequencies are chosen for the LOW CUT and HIGH CUT sides at one crossover point. In some rooms and with some types of speakers, however, different phasing may lead to better results. As no general rules can be given, only experimentation and trial and error will let you obtain optimum, natural sound reproduction. The use of test records with "in-phase" and "out-of-phase" bands is also highly recommended.

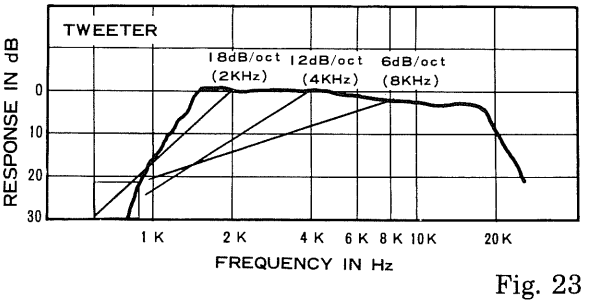


Fig. 23

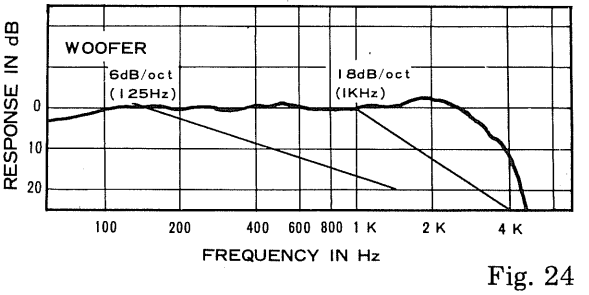


Fig. 24

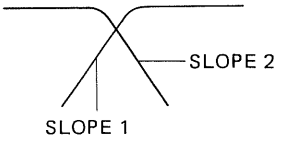
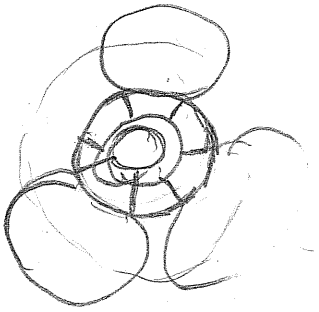


Fig. 25

Cut-off steepness of slopes 1 & 2	Phase
A: Both slopes 12dB/oct B: Combination of 12dB/oct slope and 18dB/oct slope C: Combination of 12dB/oct slope and 6dB/oct slope	Connect woofer and tweeter in opposite phase.
D: Both slopes 6dB/oct E: Both slopes 18dB/oct	Connect woofer and tweeter with same phase.

Table 4

〈76E00M54B〉



PIONEER ELECTRONIC CORPORATION
4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
U.S. PIONEER ELECTRONICS CORPORATION
75 Oxford Drive, Moonachie, New Jersey 07074, U.S.A.
PIONEER ELECTRONIC (EUROPE) N.V.
Luithagen-Haven 9, 2030 Antwerp, Belgium
PIONEER ELECTRONICS AUSTRALIA PTY. LTD.
178-184 Boundary Road, Braeside, Victoria 3195, Australia

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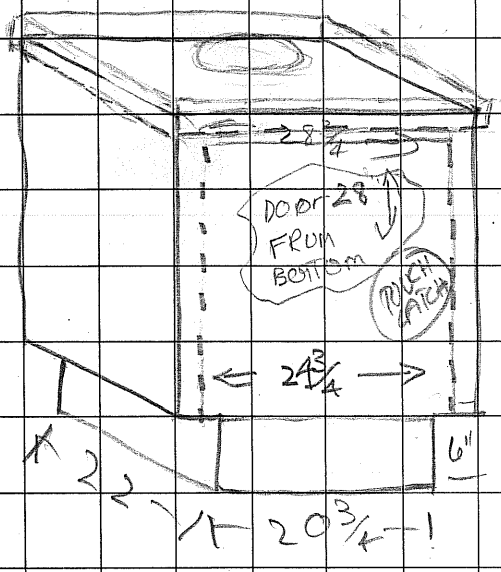

CABINET DIMENSIONS
30 HIGH
28 3/4 WIDE
26 DEEP

TOUCH LATCH
PIANO HINGE
6" KICK BASE 4" INSET