FA-524/FA-724

ACTIVE CROSSOVERS

OWNERS MANUAL

ALTAiR

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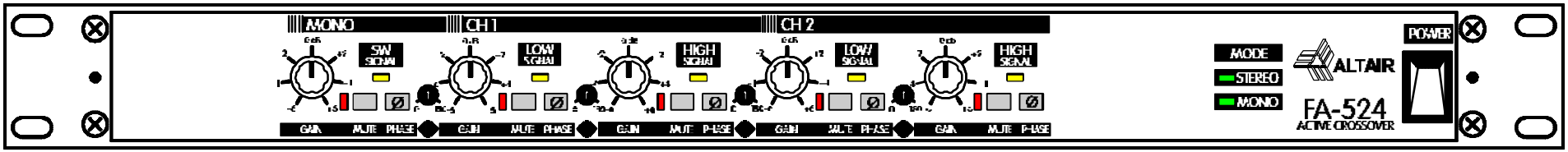
1. SWITCHES, CONTROLS, ADJUSTMENTS AND CONNECTORS

These are the switches, controls, adjustments and connectors that you could find in your crossover ALTAIR. The description and explanation of each one of them, you will find in the corresponding section.

FRONT PANEL



LEVEL CONTROL.

PHASE ADJUSTMENT BETWEEN WAYS.

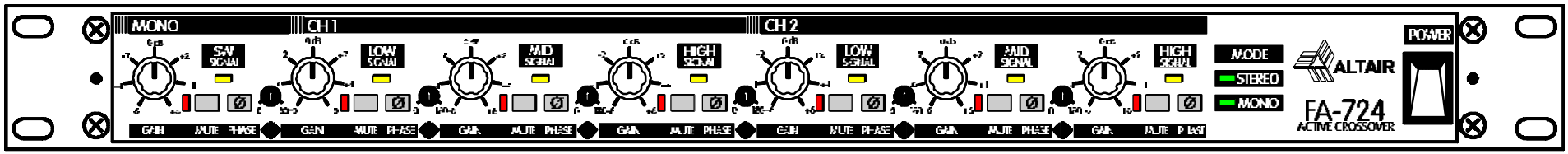
SIGNAL, THRESHOLD AND OVERLOAD INDICATOR.

TURN ON AND OPERATION MODE (STEREO/MONO) INDICATOR.

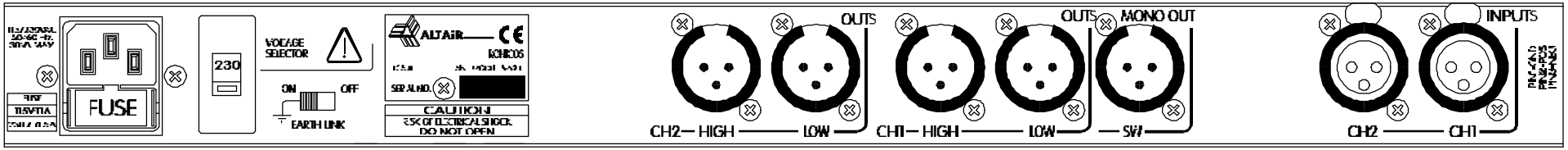
MUTE (WITH INDICATOR LED).

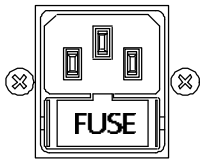
POWER SWITCH.

PHASE SWITCH.



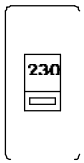
REAR PANEL



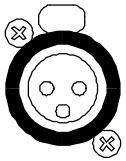


MAINS CONNECTOR AND FUSE HOLDER.

OUTPUT CONNECTOR.

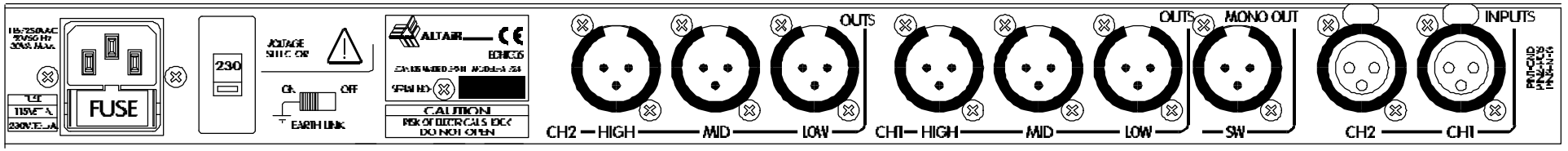


VOLTAGE SELECTOR.



INPUT CONNECTOR.

EARTH LINK SWITCH.



2. WORKING PRECAUTIONS

- The manufacturer is not made responsible of any damage occurred in the crossover unit outside the limits of the warranty or that had been produced by not keeping in mind the working precautions.

- First at all, make sure that the mains voltage to which the crossover is to be connected is the same that the voltage selector setup placed at the crossover rear panel

- **DANGER:** In the crossover unit there is high voltages, doesn't open it. The crossover unit doesn't contain elements which could be repaired by the user. Whenever crossover unit is connected to the mains, contains elements with high tensions. In order to disconnect the crossover unit completely, you must disconnect it of the mains.

- Protect the crossover unit of the rain and humidity. Make sure of that no liquid or object introduces in their interior. If a liquid is poured over the crossover unit, disconnect it of the mains and consult a qualified technical service.

- Don't place the crossover unit near heat sources.

3. INSTALLATION

CHANGING THE VOLTAGE

The crossover unit is set to operate at 230V, 50-60Hz and at 115V, 50-60Hz.

❶ Make sure that the crossover unit is disconnected of the mains.

❷ Set up the voltage selector, placed at the crossover rear panel, in the position that shows the voltage which you want to connect it.

Crossover set up 115 V.

Crossover set up 230 V.

❸ Make sure that the fuse is the right one for the selected voltage:

T1A ---------> 115V.
T0,5A ----------> 230V.

CHANGING THE FUSE

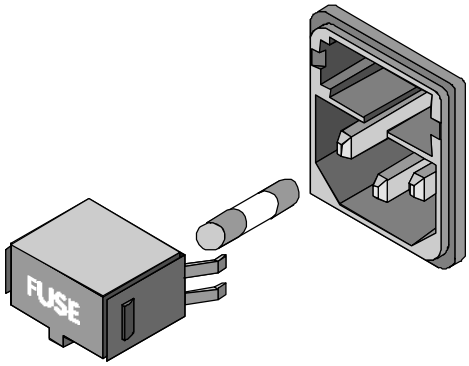
The crossover unit is factory set up with a T0,5A FUSE, adequate in order to work with a mains of 220-240V, 50-60Hz.

❶ Make sure that the crossover unit is disconnected of the mains.

❷ In the crossover rear panel, is placed the mains connector and the fuse holder. The box bellow this mains connector is called fuse holder. Take out the fuse holder.

❸ Upon extracting the fuse holder, the fuse will appear, take out it and change for the new one.

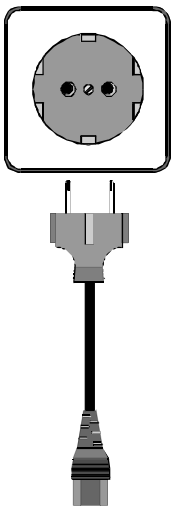
❹ Insert the fuse holder into the mains connector again.



CAUTION: Always make sure upon changing the fuse, of that is the adequate for the selected mains voltage (T1A for 115V and T0,5A for 230V).

CONNECTION TO THE MAINS

The connection of the crossover power supply to the mains takes place by a tripolar cord provide by the factory.



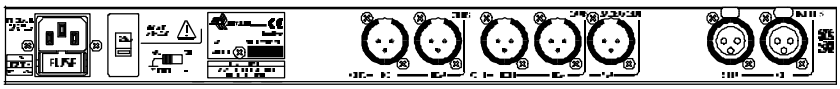
❶ Make sure that the crossover power switch, is at position 0 (turned off).

❷ Insert the female connector of the tripolar cable into the crossover power supply male connector, placed at the rear panel.

❸ Insert the male connector of the tripolar cable into the mains plug.

❹ Turn on the crossover power switch. In that moment the MODE LED indicator will light, indicating that the crossover is turned on.

CAUTION: Make sure that the mains tension to the one which is going to connect the crossover unit is correct, as well as their fuse is the adequate.



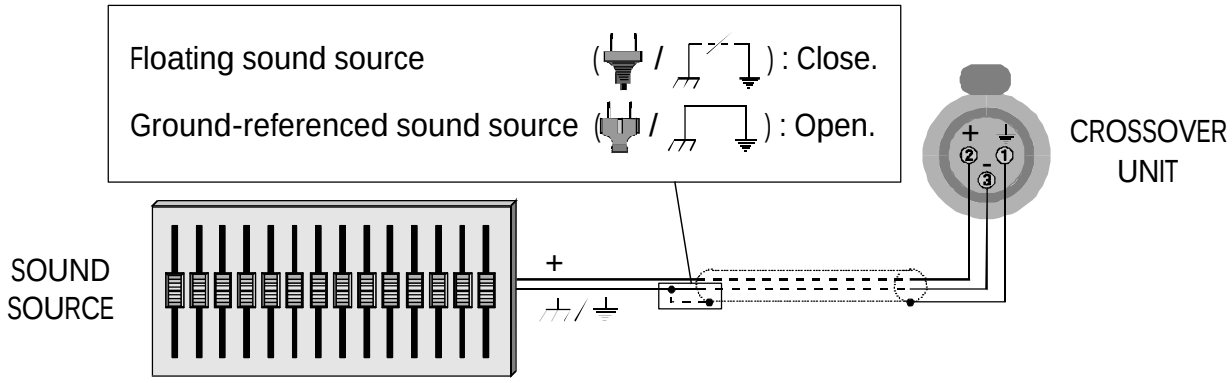
INPUT CONNECTION

The crossover signal input, is carried out through two XLR-3-31 females connectors, one per channel. The input connections are balanced, with a nominal impedance of 20 KΩ (10 KΩ unbalanced).

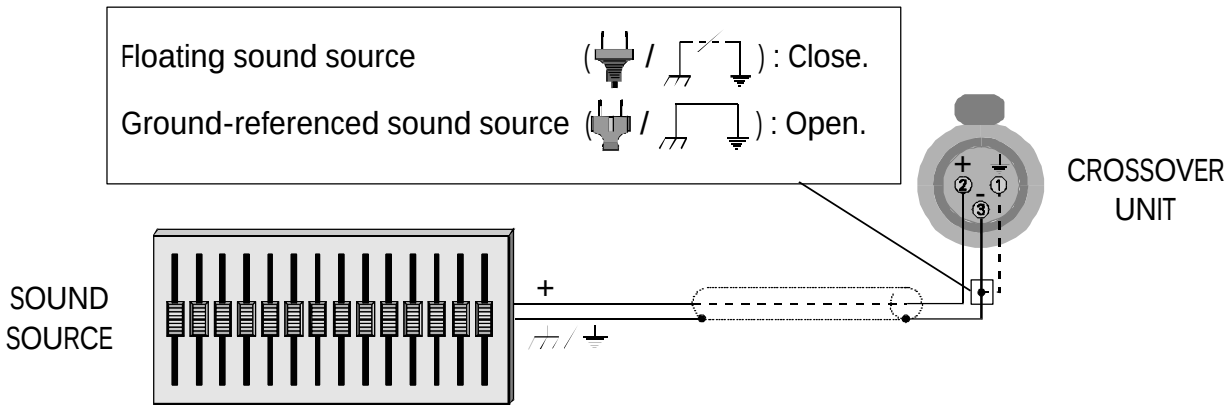
The following pictures shows some of the different possibilities of connection, relying on the type of input signal, balanced or unbalanced and according to the ground configuration of the equipment (floating or ground-referenced).

UNBALANCED INPUT: This type of connection will be used when the sound source doesn't provide of balanced output. If it is possible, will be employed the connection type 1.

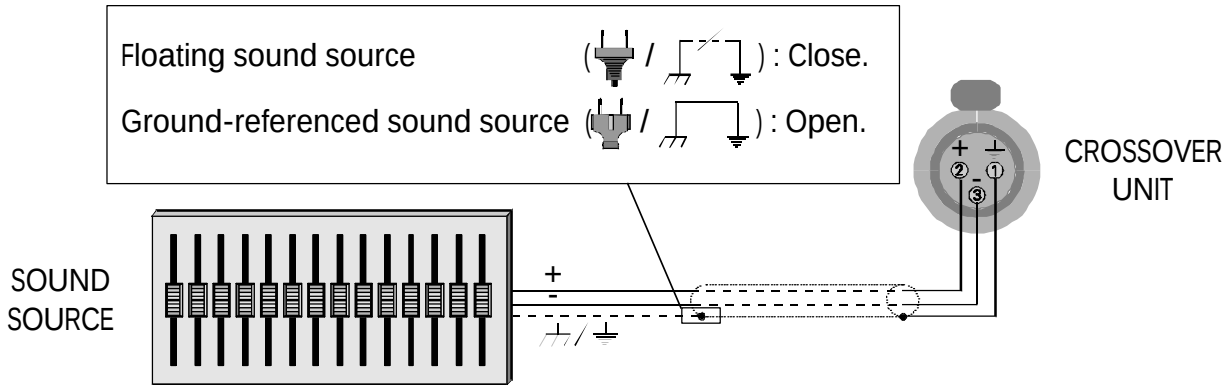
1) Using twin-lead shielded cable:



2) Using single conductor coax cable:



BALANCED INPUT:



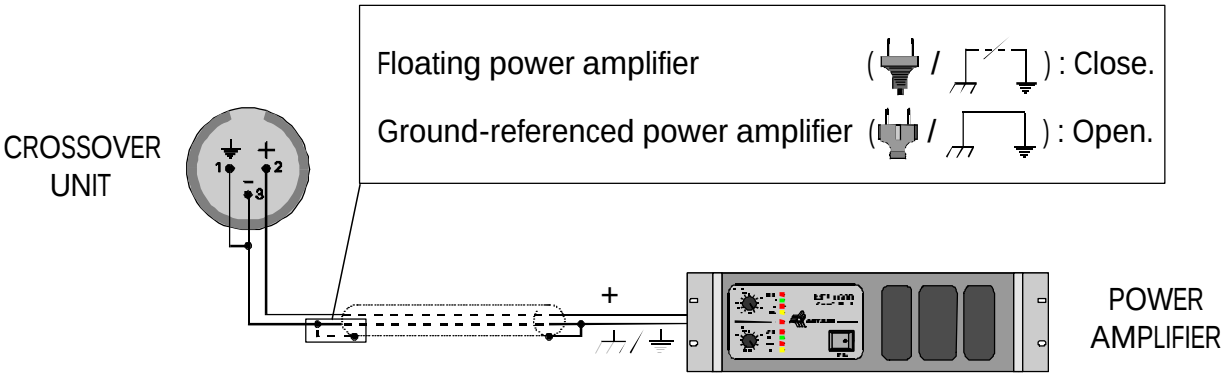
OUTPUT CONNECTION

The crossover output signal is carried out through XLR-3-32 males connectors, one per way (7 for the model FA-724 and 5 for the model FA-524). The outputs are balanced, with a nominal impedance of 100Ω.

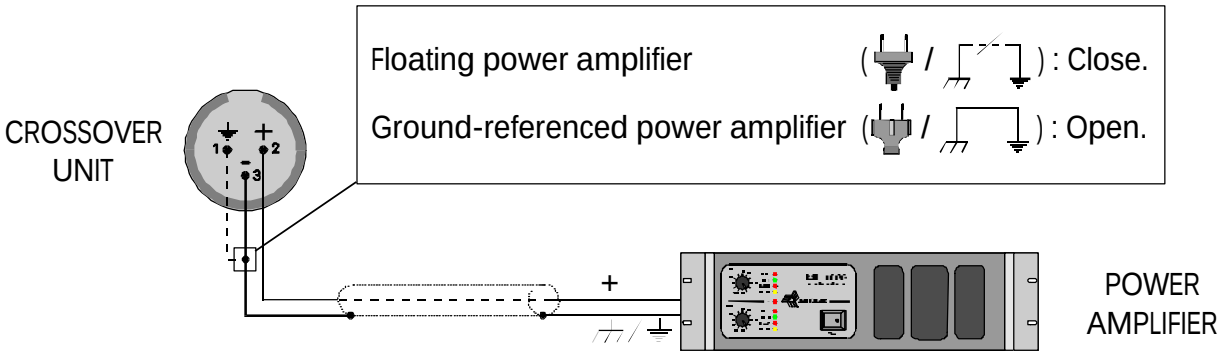
The following graphics shows some of the different possibilities of connection, relying on the type of the power amplifier input signal, balanced or unbalanced and according to the ground configuration of the equipment (floating or ground-referenced).

UNBALANCED OUTPUT: This type of connection will be used when the power amplifier doesn't provide of balanced input. If it is possible, will be used the connection type 1.

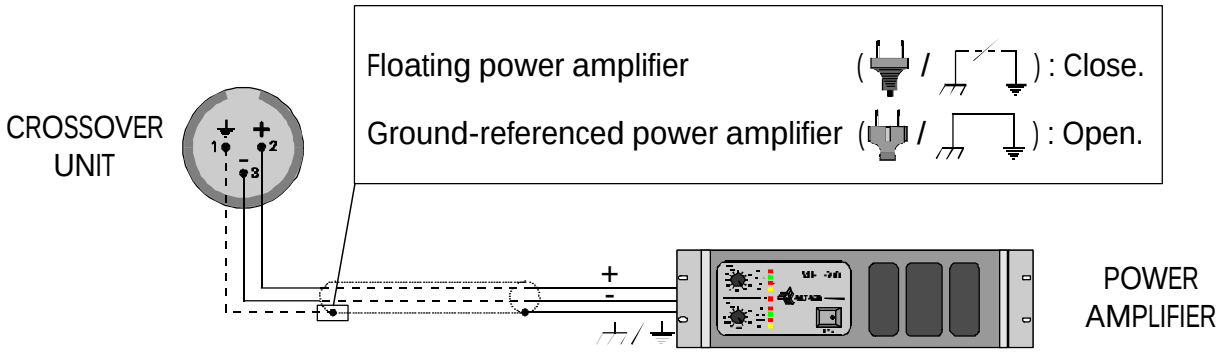
1) Using twin-lead shielded cable:



2) Using single conductor coax cable:

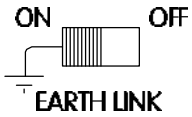


BALANCED OUTPUT:

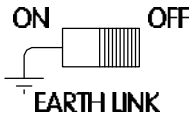


GROUND LINK

In some installations, it might be necessary to isolate the crossover electric ground, from the system mains earth, in order to avoid ground loops, that could generate unwanted noises, for this reason, the crossover provides an EARTH-LINK switch placed at the rear panel in order to lift the mains earth from the crossover electric ground.

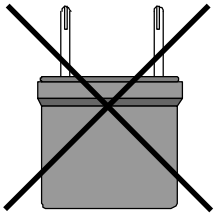


MAINS EARTH LINKED WITH THE CROSSOVER ELECTRIC GROUND



MAINS EARTH LIFTED FROM THE CROSSOVER ELECTRIC GROUND

CAUTION: Sometimes, lifts the mains earth, using a ground-lift connector, the one which undoes the ground loop also, but this is very dangerous, since if for any circumstance part of the mains signal is derived to the chassis, could cause a short-circuit through our body, upon having eliminated one of the working precautions of the unit. For this circumstance, NEVER lift the mains earth (lift the crossover EARTH-LINK switch) in order to avoid possible accidents.



4. OPERATION

The crossover utility, is divide the audible band (20Hz to 20KHz) in smaller bands, whose sum restores the audible band again. Once separate and tried meetly, the different bands are amplified and reproduce for separating giving a multiamp system like result. This division is carried out so that the different cabinet ways only receives the part of the band that they are capable of reproducing, avoiding possible breaks, and an unnecessary warming up, and so that the power amplifiers only amplify the signal that is going to reproduce the cabinet way that are feeding, avoiding that unnecessarily warms, amplifying signals that are not been going to reproduce.

MODES OF OPERATION

The crossover can be configured as either a stereo mode or mono mode. The crossover configuration is shown in the front panel of the unit by the MODE LED indicator (STEREO / MONO).

In STEREO mode operation, will provide of two totally independent crossover channel inputs, with 2 or 3 ways for the FA-724 and 2 ways for the FA-524.

In MONO mode operation, will only have one input channel: CH1 (the channel CH2 will be disabled, for the one which any signal that inserts in it, will be lost, since it won't appear in the output), and of 4, 5 or 6 ways for the FA-724 and 3 or 4 ways for the FA-524.

Besides these mentioned ways, exists an additional subwoofer mono way (SW), whose signal will be the sum of the input channels CH1 and CH2 in stereo mode, and the input channel CH1 in mono mode. It is important emphasize that in stereo mode, this output upon adding the signals of the input channels CH1 and CH2, if only inserts signal for one of the input channels, will only have the half of the signal in the output.

The following table list the possible configuration of the crossovers FA-724 and FA-524:

MODEL	STEREO MODE		MONO MODE				SUBWOOFER OUTPUT
	THREE WAYS	TWO WAYS	SIX WAYS	FIVE WAYS	FOUR WAYS	THREE WAYS	
FA-524	YES	YES	YES	YES	YES	YES	YES
FA-724	NO	YES	NO	NO	YES	YES	YES

On the other hand, the following table show the output configurations in the different modes of operation and their correspondence with the crossover printed rear panel:

MODE	FA-524				FA-724					
COMPONEN OVERLAY	CH1 LOW	CH1 HIGH	CH2 LOW	CH2 HIGH	CHI LOW	CH1 MID	CH1 HIGH	CH2 LOW	CH2 MID	CH2 HIGH
STEREO THREE WAYS	--	--	--	--	CH1 LOW	CH1 MID	CH1 HIGH	CH2 LOW	CH2 MID	CH2 HIGH
STEREO TWO WAYS	CH1 LOW	CH1 HIGH	CH2 LOW	CH2 HIGH	CH1 LOW	CH1 HIGH	F.R.	CH2 LOW	CH2 HIGH	F.R.
MONO SIX WAYS	--	--	--	--	LOW	MID1	MID2	MID3	MID4	HIGH
MONO FIVE WAYS	--	--	--	--	LOW	MID1	MID2	MID3	HIGH	F.R.
MONO FOUR WAYS	LOW	MID1	MID2	HIGH	LOW	MID1	MID2	HIGH	F.R.	F.R.
MONO THREE WAYS	LOW	MID	HIGH	F.R.	LOW	MID	HIGH	F.R.	F.R.	F.R.
NOTE: F.R. is the abbreviation of FULL RANGE.										

LEVEL CONTROL

Each one of the crossover ways provides a gauged level control between ±6 dB, placed at the front panel. Notice that when this level control is placed in - 6 dB position doesn't disappear the output signal.

These controls are designed in order to allow the level calibration of each way with the others.

Due to that the control of level is placed before the limiter (as seen in the block diagram), the output level depend on the calibration of the limiter.

SIGNAL, THRESHOLD AND OVERLOAD INDICATOR

The crossover has an indicator of signal, threshold and overload for way. This indicator is a tricolor LED placed at the crossover front panel.

When the indicator is green, the output signal has overcome -20 dBv. Upon lighting the indicator in color amber will have overcome the limiter threshold defined, and therefore is beginning to limit, whenever is active. Upon passing the indicator to red color will know that there is overload, that is to say, in any point of signal path the limit of security of 15 dBv has been surpassed. In order to correct this problem, should lower the level of that way or decrease the input signal.

LEVEL INDICATOR					
LIMITER ON			LIMITER OFF		
GREEN	ORANGE	RED	GREEN	ORANGE	RED
Signal is present at a level of -20 dBv.	The signal has reached the limiter threshold setting.	The signal stars to saturate (intenal clip) (+15 dBv).	Signal is present at a level of -20 dBv.	--	The signal starts to saturate (internal clip) (+15 dBv).

MUTE

Each crossover way provides of a mute switch in order to could cancel this way. When this switch is pulsed, the corresponding way remains canceled, and lights a red indicator associate to this switch. This switch is very useful to verify each one of the ways for separating, cancelling all the ways less the one which is wanted to test.

The crossover muted all the ways when power is turned on, during a few seconds, in order to protect the loudspeakers of turn on transitory and avoid unwanted noises. This one could verify turning on the unit, and seeing that the mute indicators remains lit during a few seconds.

PHASE SWITCH

This switch placed in the front panel of the crossover, allows to change the phase of the way associated to it in 180º concerning their high way. The two more important utilities of this phase switch are for the compensation of the phase change upon using two different equipment, due to the wiring or the design of their different components, and in second place in order to balance the phase change between two adjacent ways, improving it of this manner the acoustical summation of the two ways. This last utility takes place in conjunction with the phase adjustment, of the that will talk later on.

PHASE ADJUSTMENT BETWEEN WAYS

The phase adjustment between ways takes place through a rotatory potentiometer placed at the front panel of the crossover. The configuration of this phase adjustment is placed at the frequency card to obtain a precise control of 0 to 180º on the relevant frequency. If used it in conjunction with the phase switch, will provide of a phase adjustment of 0 to 360º.

The filters used in crossover unit (LINWITZ-RILEY), secures that in the relevant frequency the two adjacent ways are in phase, however the differences between the loudspeakers in the adjacent ways, makes that is very useful provide of a phase adjustment between ways.

The process recommended in order to carry out the adjustment phase in all the bands, is leave the HIGH way of the crossover as reference, and go adjusting the phase successively, until reach at the LOW way.

Three simple methods in order to carry out the adjustment phase are:

1º) Using a spectrum analyzer and pink noise, until obtain the flattest frequency response of the equipment.

2º) Applying a sinewave signal at the relevant frequency, and adjusting the phase potentiometer of the way with lower frequency until the output signal achieves to the minimum (cancellation) and then press the phase switch of the way with lower frequency.

3º) Listening the speaker system.

It is important point out that this adjustment is thought in order to regulate the phase between the ways, and not as delay (except for the subwoofer output), in order to it is available an optional delay card, of the one which will talk later on.

In the subwoofer way the phase adjustment produces a adjustable delay until 6 ms (200 cm) valid from 20 to 100 Hz (to high frequencies the delay begins to diminish). In order to obtain the better phase alignment between the low and subwoofer ways is recommended place the subwoofer cabinets in a more advanced position that the low one for so have a margin of possible delay in the subwoofer way.

5. OPTIONS

In this section will explain the different available options for the crossovers FA-524 and FA-724.

Each crossover way provides of two insertion points, in those that could insert equalizer cards or delay cards. Upon providing of two insertion points, each way could provide of two equalization points, or a equalization point and a delay (The delay card only could insert in one of them, for the one which could not provide of two delay points).

FREQUENCY CARDS (TC-66)

Each frequency card provides of two filters, one high pass and another low pass, that defines the relevant frequency between two ways, with a slope of 24 dB/ octave LINKWITZ-RILEY type. The relevant frequency attenuation is 6 dB. The crossovers are given with the standard relevant frequencies that are shown in the following table:

STANDARD RELEVANT FREQUENCIES PROVIDE BY FACTORY	
WAY	**FREQUENCIES**
SUBWOOFER (SW)	82Hz,100Hz,120Hz,150Hz.
OTHER WAYS	100Hz, 120Hz, 150Hz, 180Hz, 220Hz, 270Hz, 330Hz, 390Hz, 470Hz, 560Hz, 680Hz, 820Hz, 1KHz, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2.

The supply of any other relevant frequency that the specified will be an option previous consults to the commercial department.

EQUALIZER CARD (TE-67)

In certain installations it is advisable insert equalization points in order to improve the system frequency response, for which the crossover provide an optional equalizer card. Inserting an equalization directly in the crossover is cheaper than utilize an graphic equalizer, and also avoids unwanted manipulations .

The optional equalizer card provides a full parametric equalization point, for the one which could define the three variables that setup a equalization point: gain, bandwidth and center frequency.

Could provide of two equalization points for way how maximum, installing two equalizer cards.

DELAY CARD (TD-69)

Sometimes are necessary establish a delay between ways, in order to balance the delays produced in them due to the design of the cabinets, and so improve their phase coherence. For it the divisors provide of an optional delay card.

The optional delay card configuration could request of 2 ms (70 cm), valid until 2 KHz and of 500 µs (17 cm), valid until 8 KHz. At high frequencies, the card is still working, but the time delay decreases progressively.

The delay card of 2 ms. provides seven steps of 250 µs (8,75 cm) and 62,5 µs (2,12 cm) for the 500 µs one and a adjustable linear step through a potentiometer of 0 to 250 µs for the 2 ms delay card and of 0 to 62,5 µs for the 500 µs one.

SECURITY COVER (TP-1)

In some installations it is necessary avoid unwanted manipulations of the crossovers controls, for which it is available a security cover that avoids the access to the crossovers controls.

The installation is very easy, by means of two screws provided with the security cover binds at the front panel, the which has been two threaded holes for this purpose.

LOCKABLE SECURITY COVER (TS-1)

In some installations it is necessary isolate the crossovers controls with high safety that the which offers the security cover, for the one which it is available a lockable security cover of easy installation. The lockable security cover is provided with two keys.

6. SPECIAL OPERATIONS

In order to setup some of the crossover possibilities it must be open, removing the eight screws of their top cover.

NOTE: This type of operations, takes place with the unit open, because of what should be carried out by qualified technical personal.

WARNING: Before opening the unit, disconnect it of the mains. It is important mark that although the unit is turned off (with the power switch at position 0), if it continues connected to the mains there is different parts of the unit that are subjected to high tension.

CAUTION: Don't subject the crossover unit to rain or humidity, above all if it is open. If it comes to produce, disconnect it of the mains and warns a qualified technical service.

How you could note, the different ways are equal, for the one which the localization of a certain component is easy, since although we locate the another way one, will give us a comparative position of the component in order to find it in the way that we are interested in.

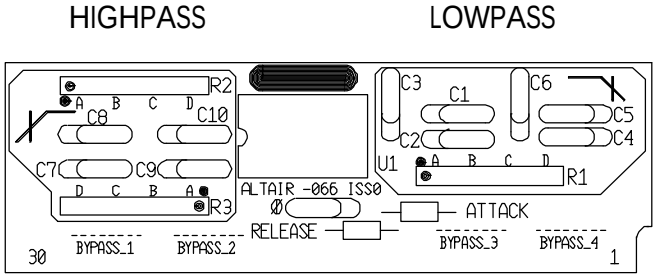
In each box we will be provided of a main board components amplification that corresponds to the operation that we are explaining, but sometimes for the general localization in the unit is important to provide the complete main board components picture.

The component are identified by a word and a number. The word indicates the kind of component to the that we referred (Ejm: R23 is a resistance), and the number their comparative position in the circuit, beginning for the upper left corner and toward down.

FREQUENCY CARDS

In the frecuency cards we can configured the cut frequency of the highpass and lowpass filters (normally equal, although they could be different if you want overlap ways), the attack time, the release time, and the phase adjustment.

The following picture shows the frequency card components, in which you could seen the different regions that we previously have been made reference:

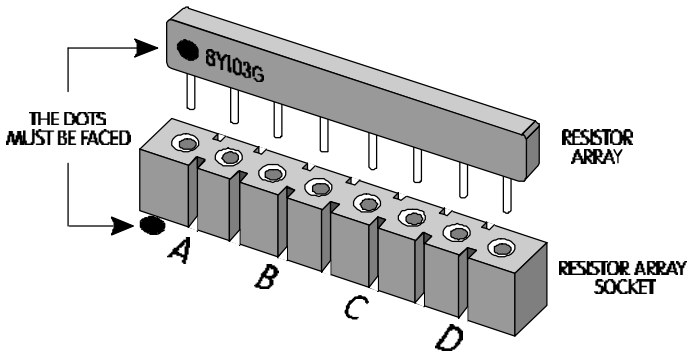


How you could observe in the frequency card components picture, it is divided fundamentally in two parts, a highpass filter ( ), and a lowpass one ( ). The resistor arrays R2 and R3 and the capacitors C7, C8, C9 and C10 belongs to the highpass filter and the resistor array R1 and the capacitors C1, C2, C3, C4, C5 and C6 belongs to the lowpass filter.

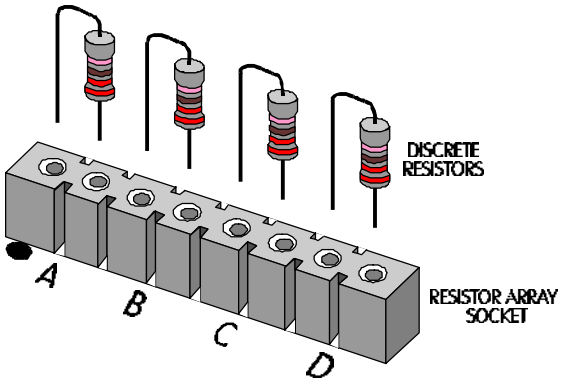
The high pass and loww pass filters are normally configured with the same cut frequency, however in the cases that require overlap bands they should be different. Remember always that the lowp ass filter belongs to the way located to the left, and the high pass filter to the way located to the right of the frequency card, looking at the crossover from the frontal.

FREQUENCY CARD CONFIGURATION

The filters configuration depend on the capacitors and resistor arrays value. The capacitors are soldered to the frecuency card, and the resistor arrays provide of a socket, in order to could change them easily. In order to insert a resistor array in the frequency card, you make coincide the dot that has the resistor array in a lateral, with the dot placed in the frecuency card components picture, and locating the pins of the resistor array over the socket, push down.



Sometimes it won't be possible to find a resistor array of a certain value. If this occurs, it is possible substitute the resistor array by discrete resistors, all of the same value locating them according to show the next picture:

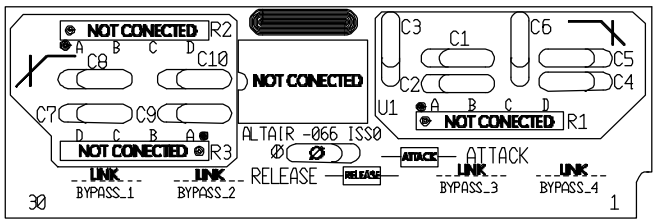


The ATTACK and RELEASE resistors are present in the frequency card, which define the limiter times of attack and release of the way placed at left of the frequency card, looking at the crossover from the frontal. The last way, upon not providing of these resistors in the frequency card, it has them in the main board:

MODEL	WAY —» HIGH R	
	ATTACK	RELEASE
FA-724	R379	R389
FA-524	R326	R336

Also one must highlight that the phase adjustment configuration corresponding to the way located at left of the frequency card, looking at the crossover from the frontal, is placed in the frequency card. This is a capacitor and comes numbered as:∅.

In order to setup the frequency card like bypass, will remove the integrated circuit U1, and the resistor arrays R1, R2 and R3 of the frequency card, and will place the links BYPASS_1, BYPASS_2, BYPASS_3 and BYPASS_4. Don't forget to leave the ATTACK and RELEASE resistors and the capacitor ∅ in the frequency card, since these define the attack and release times, as well as the phase adjustment of the way located at left of the frequency card looking at the crossover from the frontal:



The frequency cards are placed in the connectors J3, J6, J9, J12, J15 and J18, witch correspond with the numbers 1,2,3,4,5 and 6 of the main board.

In the next table could be found the most of the frequencies that one could define in the frequency card:

* FREQUENCY CARD GENERAL TABLE							
FREQUENCY	**LOW PASS FILTER**		**HIGH PASS FILTER**		**ATTAC**	**RELEAS**	**Ø**
	C1,C2,C3 C4,C5,C6	R1	C7,C8 C9,C10	R2,R3			
10 Hz	*330nF*	*33K*	*330nF*	*34K*	*220K*	*150K*	*220nF #*
11 Hz	330nF	30K9 (1%)	330nF	30K9 (1%)	220K	150K	220nF #
12 Hz	*330nF*	*27K*	*330nF*	*27K*	*220K*	*150K*	*220nF #*
13 Hz	330nF	26K1 (1%)	330nF	26K1 (1%)	220K	150K	220nF #
15 Hz	*330nF*	*22K*	*330nF*	*22K*	*220K*	*150K*	*220nF #*
16 Hz	330nF	21K5 (1%)	330nF	21K5 (1%)	220K	150K	220nF #
18 Hz	*330nF*	*18K*	*330nF*	*18K*	*220K*	*150K*	*220nF #*
20 Hz	330nF	16K9 (1%)	330nF	16K9 (1%)	220K	150K	220nF #
22 Hz	*330nF*	*15K*	*330nF*	*15K*	*220K*	*150K*	*220nF #*
24 Hz	330nF	14K3 (1%)	330nF	14K3 (1%)	220K	150K	220nF #
27 Hz	*330nF*	*12K*	*330nF*	*12K*	*220K*	*150K*	*220nF #*
30 Hz	330nF	11K3 (1%)	330nF	11K3 (1%)	220K	150K	220nF #
33 Hz	*330nF*	*10K*	*330nF*	*10K*	*220K*	*150K*	*220nF #*
36 Hz	330nF	9K53 (1%)	330nF	9K53 (1%)	220K	150K	220nF #
39 Hz	*330nF*	*8K2*	*330nF*	*8K2*	*220K*	*150K*	*220nF #*
43 Hz	330nF	7K87 (1%)	330nF	7K87 (1%)	220K	150K	220nF #
47 Hz	*330nF*	*6K8*	*330nF*	*6K8*	*220K*	*150K*	*150nF #*
51 Hz	330nF	6K65 (1%)	330nF	6K65 (1%)	220K	150K	150nF #
56 Hz	*330nF*	*5K6*	*330nF*	*5K6*	*220K*	*150K*	*150nF #*
62 Hz	330nF	5K49 (1%)	330nF	5K49 (1%)	220K	150K	150nF #
68 Hz	*330nF*	*4K7*	*330nF*	*4K7*	*220K*	*150K*	*150nF #*
75 Hz	330nF	4K53 (1%)	330nF	4K53 (1%)	220K	150K	150nF #
82 Hz	*330nF*	*3K9*	*330nF*	*3K9*	*220K*	*150K*	*100nF #*
91 Hz	330nF	3K74 (1%)	330nF	3K74 (1%)	220K	150K	100nF #
100 Hz	*33nF*	*33K*	*33nF*	*33K*	*220K*	*150K*	*68nF #*
110 Hz	33nF	30K9 (1%)	33nF	30K9 (1%)	220K	150K	68nF #
120 Hz	*33nF*	*27K*	*33nF*	*27K*	*220K*	*150K*	*68nF #*
130 Hz	33nF	26K1 (1%)	33nF	26K1 (1%)	220K	150K	68nF #
150 Hz	*33nF*	*22K*	*33nF*	*22K*	*220K*	*150K*	*68nF #*
160 Hz	33nF	21K3 (1%)	33nF	21K3 (1%)	220K	150K	68nF #
180 Hz	*33nF*	*18K*	*33nF*	*18K*	*220K*	*150K*	*68nF #*
200 Hz	33nF	16K9 (1%)	33nF	16K9 (1%)	220K	150K	68nF #
220 Hz	*33nF*	*15K*	*33nF*	*15K*	*150K*	*150K*	*47nF*
240 Hz	33nF	14K3 (1%)	33nF	14K3 (1%)	150K	150K	47nF
270 Hz	*33nF*	*12K*	*33nF*	*12K*	*150K*	*150K*	*47nF*
300 Hz	33nF	11K3 (1%)	33nF	11K3 (1%)	150K	150K	47nF
330 Hz	*33nF*	*10K*	*33nF*	*10K*	*150K*	*150K*	*47nF*
360 Hz	33nF	9K53 (1%)	33nF	9K53 (1%)	150K	150K	47nF
390 Hz	*33nF*	*8K2 (1%)*	*33nF*	*8K2 (1%)*	*150K*	*150K*	*47nF*

* FREQUENCY CARD GENERAL TABLE (CONTINUATION)							
FREQUENCY	**LOW PASS FILTER**		**HIGH PASS FILTER**		**ATTAC**	**RELEAS**	**Ø**
	C1,C2,C3 C4,C5,C6	R1	C7,C8 C9,C10	R2,R3			
430 Hz	33nF	7K87 (1%)	33nF	7K87 (1%)	150K	150K	47nF
470 Hz	*33nF*	*6K8*	*33nF*	*6K8*	*100K*	*100K*	*22nF*
510 Hz	33nF	6K65 (1%)	33nF	6K65 (1%)	100K	100K	22nF
560 Hz	*33nF*	*5K6*	*33nF*	*5K6*	*100K*	*100K*	*22nF*
620 Hz	33nF	5K49 (1%)	33nF	5K49 (1%)	100K	100K	22nF
680 Hz	*33nF*	*4K7*	*33nF*	*4K7*	*100K*	*100K*	*22nF*
750 Hz	33nF	4K53 (1%)	33nF	4K53 (1%)	100K	100K	22nF
820 Hz	*33nF*	*3K9*	*33nF*	*3K9*	*100K*	*100K*	*22nF*
910 Hz	33nF	3K74 (1%)	33nF	3K74 (1%)	100K	100K	22nF
1 KHz	*3,3nF*	*33K*	*3,3nF*	*33K*	*82K*	*47K*	*10nF*
1,1 KHz	3,3nF	30K9 (1%)	3,3nF	30K9 (1%)	82K	47K	10nF
1,2 KHz	*3,3nF*	*27K*	*3,3nF*	*27K*	*82K*	*47K*	*10nF*
1,3 KHz	3,3nF	26K1 (1%)	3,3nF	26K1 (1%)	82K	47K	10nF
1,5 KHz	*3,3nF*	*22K*	*3,3nF*	*22K*	*82K*	*47K*	*10nF*
1,6 KHz	3,3nF	21K3 (1%)	3,3nF	21K3 (1%)	82K	47K	10nF
1,8 KHz	*3,3nF*	*18K*	*3,3nF*	*18K*	*82K*	*47K*	*10nF*
2 KHz	3,3nF	16K9 (1%)	3,3nF	16K9 (1%)	82K	47K	10nF
2,2 KHz	*3,3nF*	*15K*	*3,3nF*	*15K*	*82K*	*47K*	*4,7nF*
2,4 KHz	3,3nF	14K3 (1%)	3,3nF	14K3 (1%)	82K	47K	4,7nF
2,7 KHz	*3,3nF*	*12K*	*3,3nF*	*12K*	*82K*	*47K*	*4,7nF*
3 KHz	3,3nF	11K3 (1%)	3,3nF	11K3 (1%)	82K	47K	4,7nF
3,3 KHz	*3,3nF*	*10K*	*3,3nF*	*10K*	*82K*	*47K*	*4,7nF*
3,6 KHz	3,3nF	9K53 (1%)	3,3nF	9K53 (1%)	82K	47K	4,7nF
3,9 KHz	*3,3nF*	*8K2*	*3,3nF*	*8K2*	*82K*	*47K*	*4,7nF*
4,3 KHz	3,3nF	7K87 (1%)	3,3nF	7K87 (1%)	82K	47K	4,7nF
4,7 KHz	*3,3nF*	*6K8*	*3,3nF*	*6K8*	*82K*	*47K*	*3,3nF*
5,1 KHz	3,3nF	6K65 (1%)	3,3nF	6K65 (1%)	82K	47K	3,3nF
5,6 KHz	*3,3nF*	*5K6*	*3,3nF*	*5K6*	*82K*	*47K*	*3,3nF*
6,2 KHz	3,3nF	5K49 (1%)	3,3nF	5K49 (1%)	82K	47K	3,3nF
6,8 KHz	*3,3nF*	*4K7*	*3,3nF*	*4K7*	*82K*	*47K*	*3,3nF*
7,5 KHz	3,3nF	4K53 (1%)	3,3nF	4K53 (1%)	82K	47K	3,3nF
8,2 KHz	*3,3nF*	*3K9*	*3,3nF*	*3K9*	*82K*	*47K*	*3,3nF*
9,1 KHz	3,3nF	3K74 (1%)	3,3nF	3K74 (1%)	82K	47K	3,3nF
10 KHz	*330pF*	*33K*	*330pF*	*33K*	*47K*	*47K*	*2,2nF*
11 KHz	330pF	30K9 (1%)	330pF	30K9 (1%)	47K	47K	2,2nF
12 KHz	*330pF*	*27K*	*330pF*	*27K*	*47K*	*47K*	*2,2nF*

NOTES:

*** THIS TABLE IS ONLY INFORMATIVE. THE ONLY FREQUENCIES THAT PROVIDE THE MANUFACTURE ARE THE INDICATED IN THE TABLE ON PAGE 13.**

- The lines in italic defines the frequencies in which are available resistor arrays.

 # If you use the frequency card as subwoofer, the Ø capacitor should be of 33nF.

OVERLAPPED FREQUENCY CARD CONFIGURATION:

Sometimes in order to increase the efficiency in low frequencies, or so that the system is more versatile and could work with or without subwoofer, it is necessary overlap the low and subwoofer bands. In order to carry out this should configure a frequency card with the low pass filter to the relevant frequency that wants for the subwoofer, and annul the high pass filter. The ATTACK and RELEASE resistors will belong to the frequency of the low pass filter, and the ∅ capacitor will be of 33nF because of being a subwoofer card.

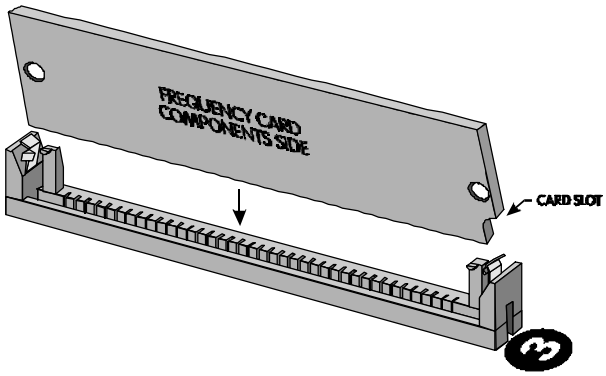
The next table shows the components value of a subwoofer frequency card overlapped at 100/ 0 Hz:

OVERLAPPED SUBWOOFER FREQUENCY CARD COMPONENTS (100/0 Hz)..						
LOW PASS FILTER (100 Hz)		**HIGH PASS FILTER (0 Hz)**		**ATTAC**	**RELEAS**	**∅**
C1,C2,C3,C4,C5,C6	R1	C7,C8,C9,C10	R2,R3			
33nF	33K	PUENTE	--	220K	150K	33nF

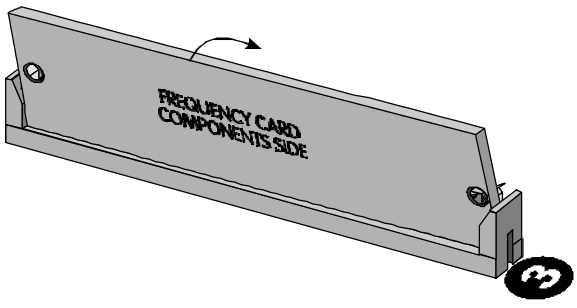
PLACING A FREQUENCY CARD

In order to place a frequency card, follow the next steps:

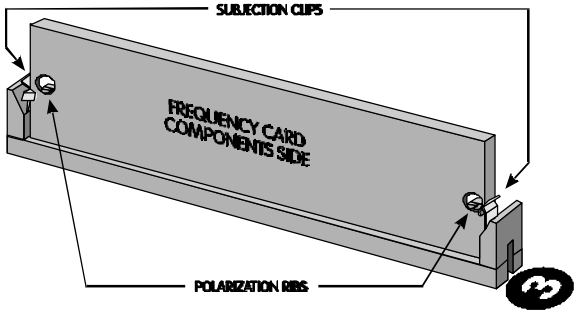
❶ Select the connector where wants to insert the frequency card.
❷ With an angle of about 60º with regard to the main board, takes the frequency card toward the connector socket, making sure that the polarization card slot is guided toward the printed number that defines to the main board connector.



❸ Once located the frequency card in the connector socket, push back the frequency card, until notes that the connector subjection clips have caught to the card.

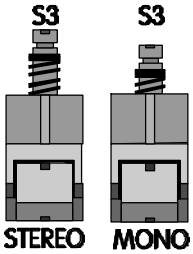


❹ In order to make sure that the frequency card is perfectly placed, observes that the connector clips of the main board, holds to the card, and that the lateral polarization ribs of the connector join with the frequency card holes.



MODES OF OPERATION CONFIGURATION

We saw in the operation section, inside the subsection modes of operation, the possibilities of configuration of the crossovers. This section is going to explain how takes place the modes of operation configuration of the crossover.



In order to configure the crossover in STEREO or MONO mode, there is a switch inside the unit. This switch is numerated in the components overlay as S3, and it placing the crossover frontal toward us, is placed at the high left corner of the unit (we could find it in the components overlay picture). With this switch depressed the crossover will be configured in STEREO mode, and pressed it will be configured in MONO mode.

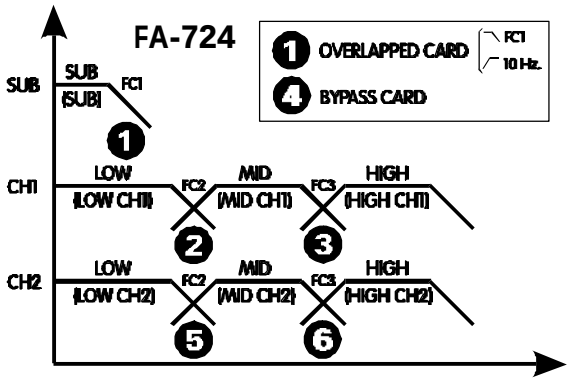
Once we have decided if we are going to work in STEREO or MONO mode, it is necessary to configure the number of ways that we want. In STEREO mode we could configure the FA-724 in three or two ways, and the FA-524 in two ways:

THREE STEREO WAYS (ONLY FA-724):

The FA-724 configured in three stereo ways, has a BYPASS card at position 4 and 5 frequency cards at positions 1,2,3,5 and 6.

Normally the subwoofer will go overlapped with the low output, because of what we should overlap the frequency card 1.

The correspondence of them gone out with the component overlay of the crossover is showed in the next picture.

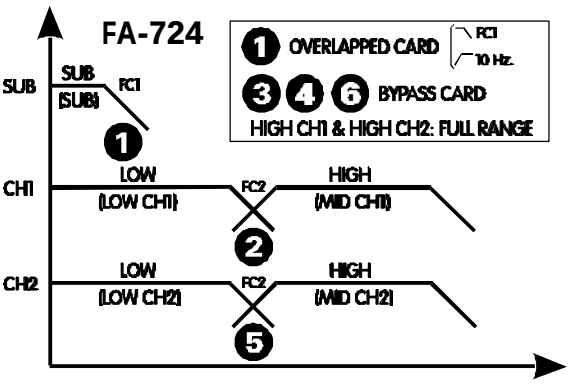


TWO STEREO WAYS:

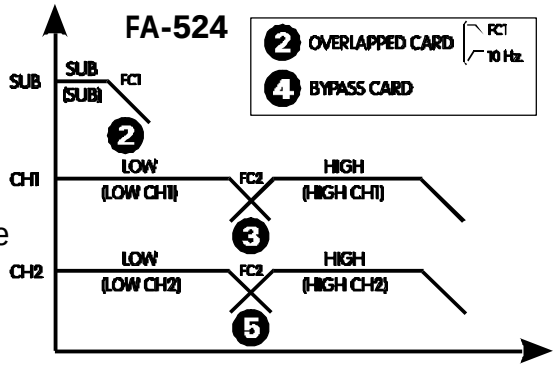
The FA-724, configured in two ways stereo, has 3 BYPASS cards at positions 3,4 and 6, and 3 frequency cards at the positions 1, 2 and 5.

Normally the subwoofer will go overlapped with the low output, because of what we should overlap the frequency card 1.

The correspondence of them gone out with the component overlay of the crossover is showed in the next picture. We will also have 2 outputs, HIGH CH1 and HIGH CH2 at FULL RANGE.



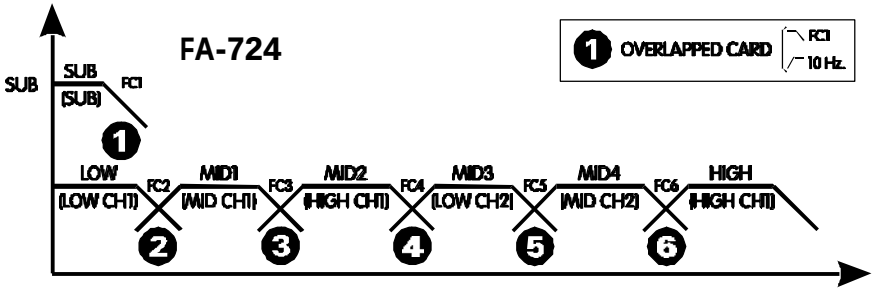
The FA-524, configured in two stereo ways, has 1 BYPASS card located at position 4 and 3 frequency cards at positions 2, 3 and 5. Normally the subwoofer will go overlapped with the low output, because of what the frequency card at position 1 will go overlapped. The correspondence of them gone out with the component overlay of the crossover is showed in the next picture.



On the other hand if we configured the crossover in MONO mode, we will have 6, 5, 4 or 3 MONO ways in the FA-724 and of 4 or 3 MONO ways in the FA-524:

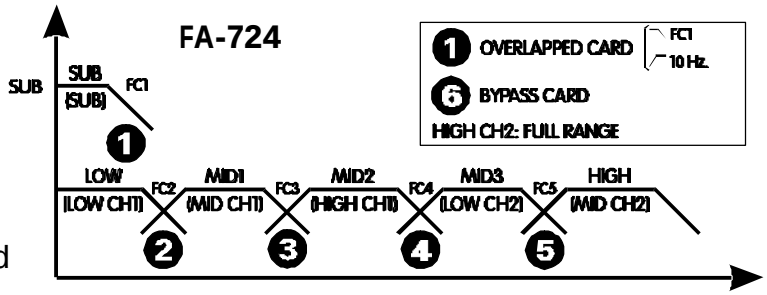
SIX MONO WAYS (ONLY FA-724):

In order to configure the divisor of frequency FA-724 in six mono ways, we should place the 6 frequency cards at positions 1,2,3,4,5 and 6. Doesn't have BYPASS cards. Normally the subwoofer will go overlapped with the low output, because of what the frequency card at position 1 will go overlapped. The correspondence of them gone out with the component overlay of the crossover is showed in the next picture.



FIVE MONO WAYS (ONLY FA-724):

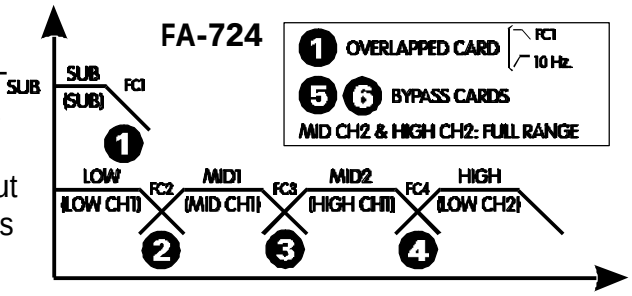
The FA-724, configured in five mono ways, has 1 BYPASS card placed at position 1 and 5 fre–quency cards at positions 1, 2, 3, 4 and 5. Normally the subwoofer will go overlapped with the low output, because of what the frequency card at position 1 will go overlapped.



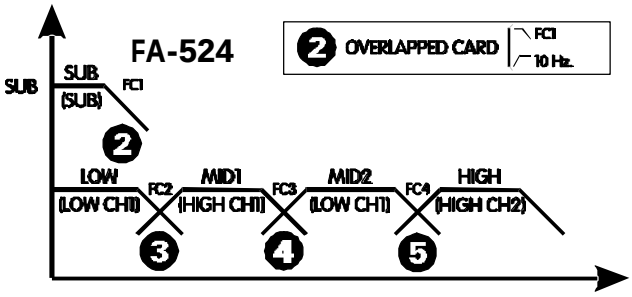
The correspondence of them gone out with the component overlay of the crossover frequency is showed in the next picture. We will also have the HIGH CH2 output at FULL RANGE.

FOUR MONO WAYS

The FA-724, configured in four ways mon-key has 2 BYPASS cards placed at positions 5 and 6 and 4 frequency cards at positions 1, 2, 3 and 4. Normally the subwoofer will go over-lapped with the low output, because of what the frequency card at position 1 will go over-lapped. The correspondence of them gone out with the component overlay of the crossover is showed in the next picture. We will also have the MID CH2 and HIGH CH2 outputs at FULL RANGE.

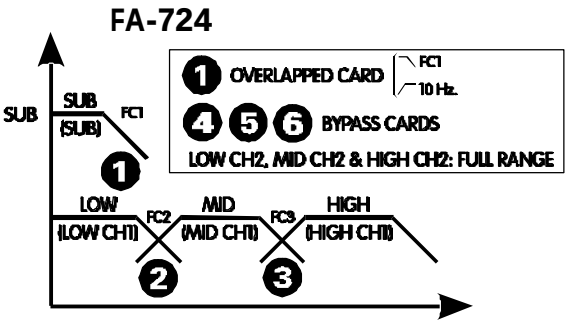


The FA-524, configured in four mono ways, has 4 frequency cards at positions 2, 3, 4 and 5. Normally the subwoofer will go overlapped with the low output, because of what the frequency card at position 2 will go overlapped. The correspondence of them gone out with the component overlay of the crossover is showed in the next picture.

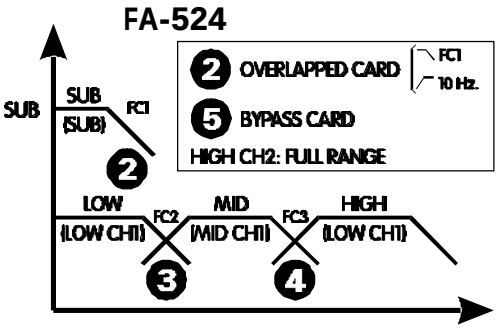


THREE MONO WAYS

The FA-724, configured in three mono ways, has 3 BYPASS cards placed at positions 4, 5 and 6, and 3 frequency cards at positions 1, 2 and 3. Normally the subwoofer will go overlapped with the low output, because of what the frequency card at position 1 will go overlapped. The correspondence of them gone out with the component overlay of the crossover is showed in the next picture. We will also have the LOW CH2, the MID CH2 and the HIGH CH2 outputs at FULL RANGE.



The FA-524, configured in three mono ways, has 1 BYPASS card placed at position 5, and 3 frequency cards at positions 2, 3 and 4. Normally the subwoofer will go overlapped with the low output, because of what the frequency card at position 2 will go overlapped. The correspondence of them gone out with the component overlay of the crossover is showed in the next picture. We will also have the HIGH CH2 output at FULL RANGE.



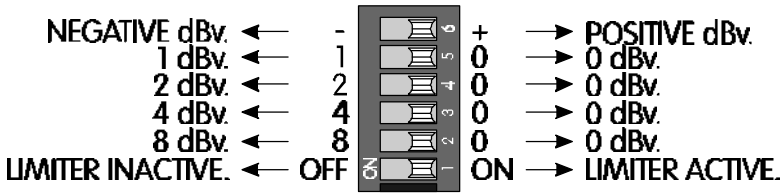
LIMITER ADJUSTMENT

Each crossover way has an adjustable limiter between ±15 dBv (0dBv = 0,776 V. RMS), in steps of 1 dBv, with an attack and recovery time optimized to each relevant frequency (the attack and recovery time adjusts are placed in the frequency cards), and with a compression ratio of 10: 1.

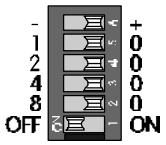
The limiter adjustment takes place by means of a switch block (one per band), each block contains 6 separate switches. The correspondence of each switch block with the way to which belongs it show in the following table:

LIMITER CONFIGURATION SWITCHES							
	DSW1	**DSW2**	**DSW3**	**DSW4**	**DSW5**	**DWS6**	**DWS7**
FA-724	SUBWOOFER	LOW CH1	MID CH1	HIGH CH1	LOW CH2	MID CH2	HIGH CH2
FA-524	--	SUBWOOFER	LOW CH1	HIGH CH1	LOW CH2	HIGH CH2	--

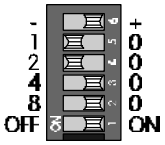
Each switch block of limiter configuration has 6 switches, whose meaning is explained in the following picture:



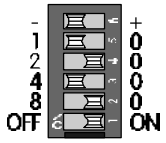
As seen in the previous picture, the switch 1 activates (at right) or disables (at left) the limiter (with the limiter inactive, the configuration of the other switches is indifferent). With the switch 6 you can configure positive dBv (at right) or negative (at left). The other switches 2,3,4 and 5 configure the number of dBv, in a binary addition manner, so that the number of configured dBv is the sum of these switches that are located at left, those that are located at right will always be in 0 dBv. Next is illustrated a series of limiter configuration examples:



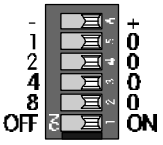
Limiter inactive.



Limiter adjusted at +3 [dBv].



Limiter adjusted at- 5 [dBv].



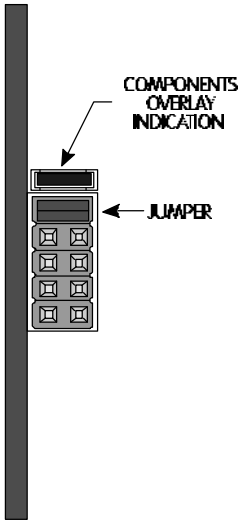
Limiter adjusted at 0 [dBv].

EQUALIZER CARD

It is available an equalizer card as option, that has a point of parametric equalization, because of it has the three parameters of a equalization point adjustable: gain, frequency and Q (bandwidth). Each way of the crossover could have two equalizer cards. In the next table are shown the connectors of the main board where these equalizers cards could go, in function of the way that you want insert a point of equalization:

EQUALIZER CARD INSERT CONNECTORS							
	SUBWOOFER	**LOW CH1**	**MID CH1**	**HIGH CH1**	**LOW CH2**	**MID CH2**	**HIGH CH2**
FA-72	J1, J2	J4, J5	J7, J8	J10, J11	J13, J14	J16, J17	J19, J21
FA-52	J4, J5	J7, J8	--	J10, J11	J13, J14	--	J16, J17

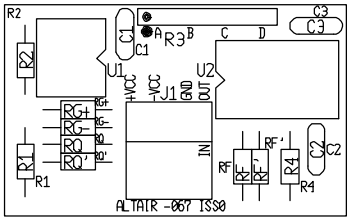
If any of these connectors doesn't have an equalizer card, or how you will see later on of delay card, this way should have a jumper in the connector as you can see in the next picture, since of if this way doesn't have this jumper, the signal would remain off and therefore that way wouldn't work. Keep in mind this circumstance whenever you change, update or place for the first time an equalizer or a delay card. Of course in order to insert the equalizer or delay card, you should remove the connector jumper in which you want to place the equalizer or delay card.



As seen in the main board component overlay, the jumper goes placed beside an indication. It is important notice well where the jumper goes located, because place it in other location could cause a short circuit in the power supply, and cause the crossover break.

EQUALIZER CARD CONFIGURATION:

The next picture shows the component overlay of an equalizer card. As seen in the picture, there are 6 resistors called RG+, RG-, RQ, RQ,' RF and RF' . This resistors define the gain (RG+ or RG-), the bandwidth (RQ and RQ') and the center frequency (RF and RF') of the equalization point:



Before adjusting a equalizer card, you should decide the gain, bandwidth and center frequency that you want to implement, for this could use a parametric equalizer or a graphic equalizer and the results will be verified with a spectrum analyzer. The use of a parametric equalizer is more advisable since the adjustment parameters coincide with the equalizer card one. Keep in mind if you use a graphic equalizer that could introduce only two points of equalization for way, because of that don't use a lot of equalizer bands.

GAIN CALCULATION:

There are two resistors in the equalizer card, called RG+ and RG- that configure the equalization point gain. For the gain you should only place a resistor, if you want positive gains should place it in RG+, and if you want gains negatives should place it in RG-.

The maximum gain of the equalization point is of 15 dB, since this resistor could not be less than 2KΩ. If you want unitary gain don't place any resistance.

The next table shows the resistors that you should use for gains between 1 and 15 dB, in 1 dB steps. If you want an intermediate gain you are able to calculate an intermediate value:

GAIN	5% RESISTORS	1% RESISTORS
1 dB	82 K	82,5 K
2 dB	39 K	38,3 K
3 dB	24 K	24,3 K
4 dB	18 K	16,9 K
5 dB	13 K	13 K
6 dB	10 K	10 K
7 dB	8,2 K	8,06 K
8 dB	6,8 K	6,65 K
9 dB	5,6 K	5,62 K
10 dB	4,7 K	4,64 K
11 dB	3,9 K	3,92 K
12 dB	3,3 K	3,32 K
13 dB	3 K	2,87 K
14 dB	2,4 K	2,49 K
15 dB	2,2 K	2,21 K

It is always advisable that use 1% resistors, since if use 5% resistors, the gain has more variation with regard to the table.

You should be careful with the high gains adjustment (higher than 6 dB), since the crossover dynamic decreases considerably.

FILTER FREQUENCY CALCULATION:

There are two resistors in the equalizer card called RF and RF,' that configure the center frequency of the equalization point. These two resistors should be equal: RF= RF.'

The next table shows the resistors that should use for the thirty frequencies ISO standard. If you want an intermediate frequency, are able to calculate an intermediate value:

FREQUENCY	5% RESISTORS	1% RESISTORS
25 Hz.	2 M	1,91 M
31,5 Hz.	1,5 M	1,54 M
40 Hz.	1,2 M	1,21 M
50 Hz.	910 K	953 K
63 Hz.	750 K	768 K
80 Hz.	620 K	604 K
100 Hz.	470 K	487 K
125 Hz.	390 K	383 K
160 Hz.	300 K	301 K
200 Hz.	240 K	243 K
250 Hz.	200 K	191 K
315 Hz.	150 K	154 K
400 Hz.	120 K	121 K
500 Hz.	91 K	95,3 K
630 Hz.	75 K	76,8 K
800 Hx.	62 K	60,4 K
1 KHz.	47 K	48,7 K
1,25 KHz.	39 K	38,3 K
1,6 KHz.	30 K	30,1 K
2 KHz.	24 K	24,3 K
2,5 KHz.	20 K	19,1 K
3,1 KHz.	16 K	15,4 K
4 KHz.	12 K	12,1 K
5 KHz.	10 K	9,76 K
6,3 KHz.	7,5 K	7,68 K
8 KHz.	6,2 K	6,04 K
10 KHz.	4,7 K	4,87 K
12,5 KHz.	3,9 K	3,83 K
16 KHz.	3 K	3,01 K
20 KHz.	2,4 K	2,43 K

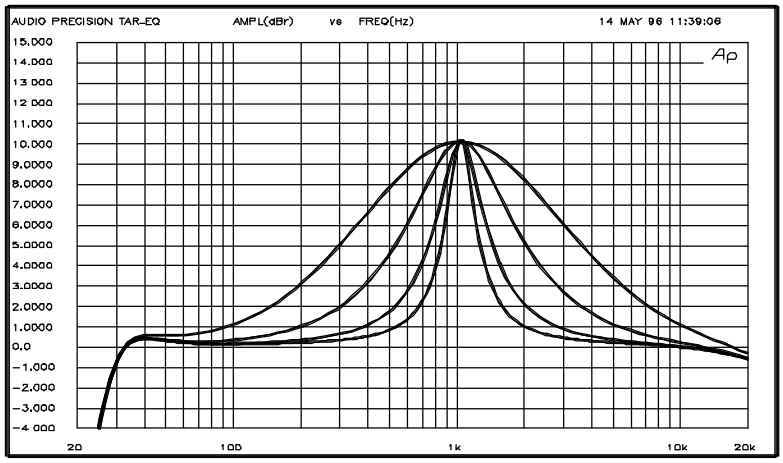
If you don't find the resistances for low frequencies, since they are very big, you could change the capacitors C2 and C3 to 33 nF, and divide the resistor value of the table by 10. This could only be made between frequencies in the range of 25 Hz and 2 KHz, since the RF and RF' resistors could never be less than 2 KΩ.

As in the gain calculation, it is always advisable that use 1% resistors, since if use 5% resistors, the frequency has more variation with regard to the table.

BANDWIDTH CALCULATION (Q):

The Q is the filter bandwidth. So that the Q is the filter center frequency divided by the difference of the higher and lower frequency, which the amplitude response is three dB down from the filter center frequency: Q= (Fc/ (Fs-Fi)).

The next picture show a filter with different Q at the same frequency and gain. How you could see a high value of Q indicates a small bandwidth and a low value of Q a big bandwidth.



F = 1 KHz. Q=0,5 Q=1,0 Q=2,5 Q=5

There are two resistors in the equalizer card called RQ and RQ,' that configure the bandwidth (Q) of the equalization point. These two resistors should be equal RQ = RQ.'

The next table shows the resistor that you should use for bandwidths (Q) from 0.1 to 10. The maximum value allowed for the RQ and RQ' resistors are of 150 KΩ. If you want an intermediate bandwidth, you are able to calculate an intermediate value:

Q	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
5% RESISTORS	*1 K*	*2 K*	*3 K*	*3,9 K*	*5,1 K*	*6,2 K*	*6,8 K*	*8,2 K*	*9,1 K*	*10 K*
1% RESISTORS	*1 K*	*2 K*	*3,01 K*	*4,02 K*	*4,99 K*	*6,04 K*	*6,98 K*	*8,06 K*	*9,09 K*	*10 K*
Q	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2
5% RESISTORS	*11 K*	*12 K*	*13 K*	--	*15 K*	*16 K*	--	*18 K*	--	*20 K*
1% RESISTORS	*11,0 K*	*12,1 K*	*13,0 K*	*14,0 K*	*15,0 K*	*16,2 K*	*16,9 K*	*18,2 K*	*19,1 K*	*20,0 K*
Q	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9	3
5% RESISTORS	--	*22 K*	--	*24 K*	--	--	*27 K*	--	--	*30 K*
1% RESISTORS	*21,0 K*	*22,1 K*	*23,2 K*	*24,3 K*	*24,9 K*	*26,1 K*	*26,7 K*	*28,0 K*	*28,7 K*	*30,1 K*

Q	3,1	3,2	3,3	3,4	3,5	3,6	3,7	3,8	3,9	4
5% RESISTORS	--	--	*33 K*	--	--	*36 K*	--	--	*39 K*	--
1% RESISTORS	*30,9 K*	*32,4 K*	*33,2 K*	*34,0 K*	*34,8 K*	*35,7 K*	*37,4 K*	*38,3 K*	*39,2 K*	*40,2 K*
Q	4,1	4,2	4,3	4,4	4,5	4,6	4,7	4,8	4,9	5
5% RESISTORS	--	--	*43 K*	--	--	--	*47 K*	--	--	--
1% RESISTORS	*41,2 K*	*42,2 K*	*43,2 K*	*44,2 K*	*45,3 K*	*46,4 K*	--	*47,5 K*	*48,7 K*	*49,9 K*
Q	5,1	5,2	5,3	5,4	5,5	5,6	5,7	5,8	5,9	6
5% RESISTORS	*51 K*	--	--	--	--	*56 K*	--	--	--	--
1% RESISTORS	*51,1 K*	*52,3 K*	--	*53,6 K*	*54,9 K*	*56,2 K*	--	*57,6 K*	*59,0 K*	*60,4 K*
Q	6,1	6,2	6,3	6,4	6,5	6,6	6,7	6,8	6,9	7
5% RESISTORS	--	*62 K*	--	--	--	--	--	*68 K*	--	--
1% RESISTORS	--	*61,9 K*	*63,4 K*	--	*64,9 K*	--	*66,5 K*	*68,1 K*	--	*69,8 K*
Q	7,1	7,2	7,3	7,4	7,5	7,6	7,7	7,8	7,9	8
5% RESISTORS	--	--	--	--	*75 K*	--	--	--	--	--
1% RESISTORS	*71,5 K*	--	*73,2 K*	--	*75 K*	--	*76,8 K*	--	*78,7 K*	--
Q	8,1	8,2	8,3	8,4	8,5	8,6	8,7	8,8	8,9	9
5% RESISTORS	--	*82 K*	--	--	--	--	--	--	--	--
1% RESISTORS	*80,6 K*	--	*82,5 K*	--	*84,5 K*	--	*86,6 K*	--	*88,7 K*	--
Q	9,1	9,2	9,3	9,4	9,5	9,6	9,7	9,8	9,9	10
5% RESISTORS	*91 K*	--	--	--	--	--	--	--	--	*100 K*
1% RESISTORS	*90,0 K*	--	*93,1 K*	--	*95,3 K*	--	--	*97,6 K*	--	*100 K*

One could see in the table, that there are Q values for which don't exist resistors. In that case you should approach to the nearest Q.

As in the others cases, it is always advisable that use 1% resistors, since if use 5% resistors, the Q has more variation with regard to the chart.

BAND GAIN VARIATION:

Apart from the gain, frequency and Q variations, you could vary the total band gain in which it is insert the equalization point. This one could carry out varying the R1 resistor of the equalizer card.

The formula that give us the gain is: G= 20* log (10000/ R1) or with R1 clear, R1= 10000/ (10exp (G/ 20)), the gain in dB and the resistor in Ω. The factory value for R1 is 10 KΩ, that as you could check give a gain of 0 dB. For example, for a gain of 6 dB, the resistor R1 would be of 5.1 KΩ 5% or of 4.99 KΩ 1%, and for a gain of - 6 dB, the resistor R1 would be of 20 KΩ 5% or of 20 KΩ 1%. You should never put a less value of 2 KΩ for this resistor.

You should be careful in the adjustment of high gains (great of 6 dB), since the cross-over dynamic diminishes considerably.

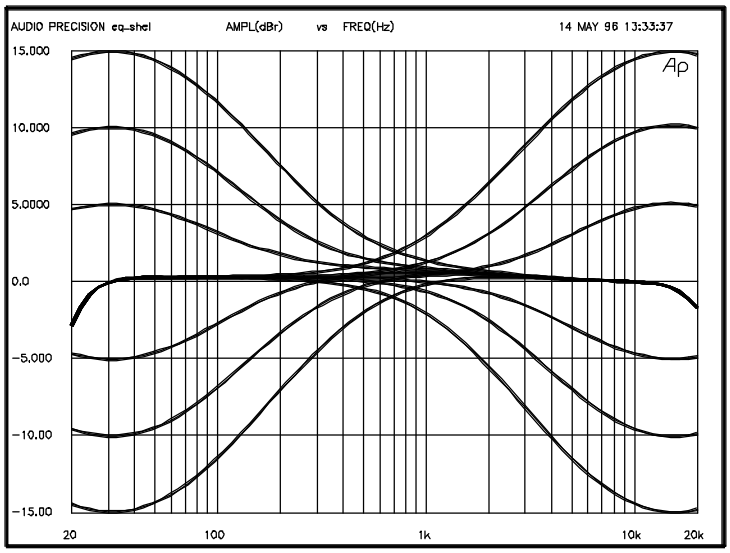
The next table shows the value of R1 resistor for different gains:

GAIN		+6 dBv	+4 dBv	+2 dBv	-2 dBv	-4 dBv	-6 dBv
R1	5%	5K1	6K2	7K5	12K	16K	20K
	1%	4K99	6K34	7K87	12K4	15K8	20K

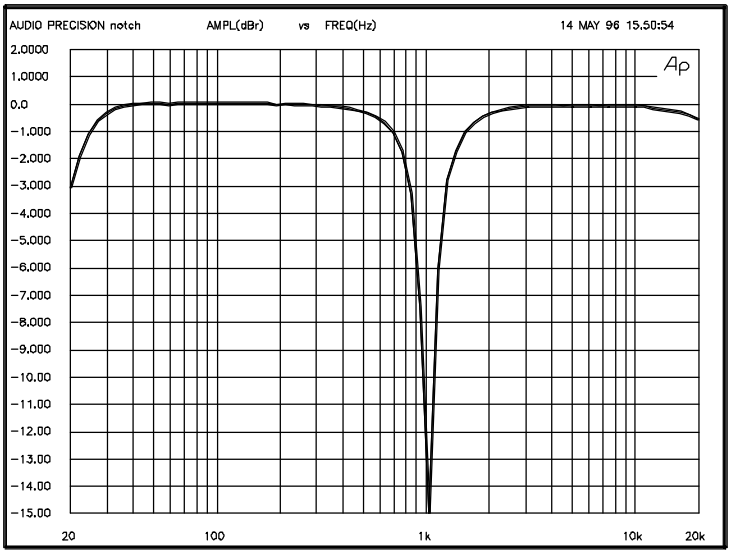
NON STANDARD EXAMPLES CONFIGURATION:

With the parametric equalization point, you also could simulate shelving and notch filters.

In order to carry out a shelving filter, you should select the frequency 35 Hz for low frequencies or 16 KHz for high frequencies and a very small Q of 0.4 for example. The next picture shows different answers of the equalizer card simulating shelving filters for low and high frequencies, at different gains and attenuations +5, +10, +15, -5, -10 & -15:



You could also make a filter type notch, selecting the high Q (15) that the equalizer card allows. The next picture shows a filter type notch of 15 dB of attenuation at 1 KHz:



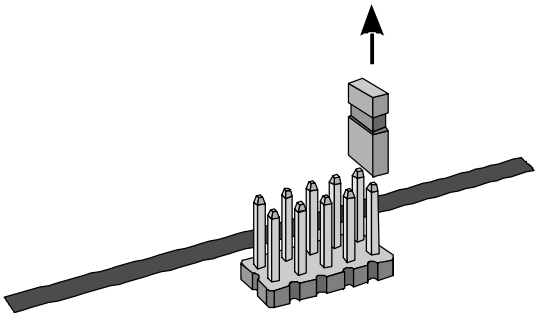
PLACING AN EQUALIZER CARD:

Before placing the equalizer card you should adjust it, for this it is recommended that read the previous sections carefully, if you haven't done yet.

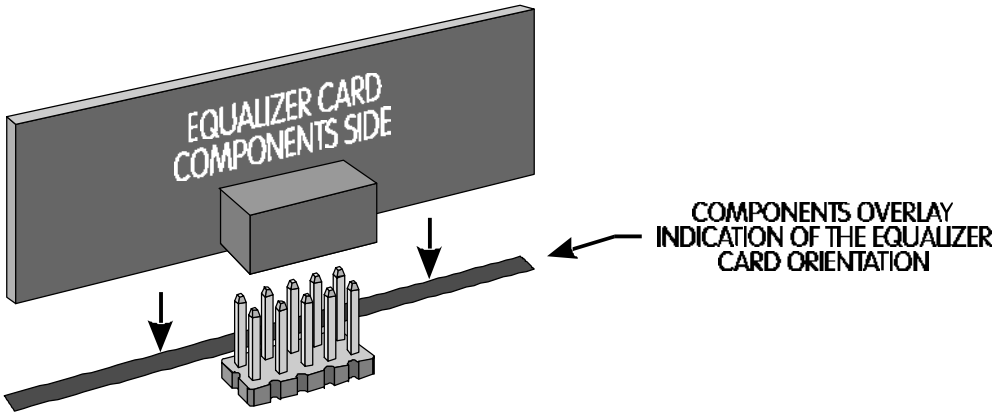
In order to place an equalizer card in the main board, follow the next steps:

❶ Turn off the crossover and disconnect it of the mains.

❷ Remove the connector jumper where you want to insert the equalizer card (the connectors where you could insert the equalizer card are indicated in a table on page 24).



❸ Insert the equalizer card in the connector, guiding the printed circuit board toward the component overlay indication of the card orientation in the main board. Take care to insert the connector carefully, and don't move it forward, behind, left or right. All the main board male conector contacts should join in the female equalizer card connector.



WARNING: Before carrying out any operation inside the crossover, disconnect it of the mains.Upon being connected to the mains, the crossover contains elements with high tensions, and if for a negligence you touch one of those parts could cause a short circuit through your body with the rising danger for your health.

CAUTION: Do not insert an equalizer card with the crossover turn on, this could cause its break.

CAUTION: After placing the equalizer card in a insert connector, and before turning on the crossover, make sure that the equalizer card is placed correctly in the main board connector, and that any of the connector contacts is out of it. A wrong placement of the equalizer card, could cause that the crossover and the equalizer card break.

DELAY CARD

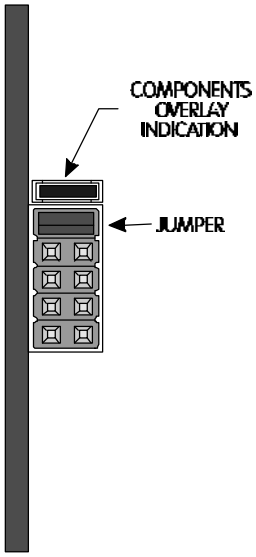
It is available a delay card as option, with two basic configurations: 2 ms (70 cm) valid up to 2 KHz and of 500 µs (17 cm), valid up to 8 KHz.

Each crossover way could have a delay point. The next table show the main board connectors where you could insert these delay cards, depending on the way in which you want to introduce the delay:

DELAY CARD INSERT CONNECTORS							
	SUBWOOFER	**LOW CH1**	**MID CH1**	**HIGH CH1**	**LOW CH2**	**MID CH2**	**HIGH CH2**
FA-72	J2	J5	J8	J11	J14	J17	J21
FA-52	J5	J8	--	J11	J14	--	J17

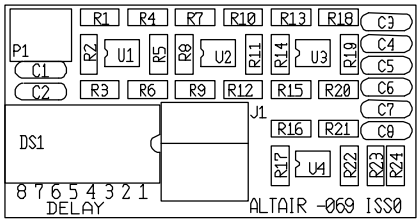
If any of these connectors doesn't have an equalizer card , should have a jumper in the connector as you can see in the picture, since of if this way doesn't have this jumper the signal would remain off and therefore that way wouldn't work. Keep in mind this circumstance whenever you change, update or place for the first time an equalizer card or a delay card. Of course in order to insert the equalizer or delay card, you should remove the connector jumper in which you want to place the equalizer or delay card.

As seen in the main board component overlay, the jumper goes placed beside an indication. It is important notice well where the jumper goes located, because place it in other location could cause a short circuit in the power supply, and cause the crossover break.



DELAY CARD CONFIGURATION:

The next picture shows the delay card component overlay. As seen in the picture, there are a switch of 8 positions called DS1 and one trimmer potentiometer called P1.



The first delay step (the switch placed at position 1) it is lineal, and it have the range of 0 to 250 µs in the case of the 2 ms (70 cm) delay card and of 0 to 62.5 µs in the case of the 500 µs (17 cm) delay card. This step is controlled by the potentiometer P1. The next steps (switch at positions 2 to 8), are discreet of 250 µs in the case of the 2 ms (70 cm) delay card and of 62.5 µs in the case of the 500 µs (17 cm) delay card.

The potentiometer P1, rotated totally to the left (delay card top view) gives us the minimum delay, and rotated totally to the right the maximum one.

The next table shows the different delays of the two standard cards, for the different positions of the switch DS1, depending on the position of the potentiometer P1:

DELAY CARD EFFECT, DEPENDING ON DS1 SWITCH								
DS1	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
2ms	0-250µs	250-500µs	500-750µs	750-1000µs	1000-1250µs	1250-1500µs	1500-1750µs	1750-2000µs
500µs	0-62,5µs	62,5-125µs	125-187,5µs	187,5-250µs	250-312,5µs	312,5-375µs	375-437,5µs	437,5-500µs

The theoretical adjustment of a delay card is carried out measuring the distance b tween reels in a speaker system. Keeping the way that is more advanced in the sound of the speaker system as reference, will measure the distance of their reel with the oth ones. The delay that should insert in the other ways is gave by the next formula:

$$Tr = \frac{Db\ (mm)}{Vs\ (m/s)}\ (ms).$$

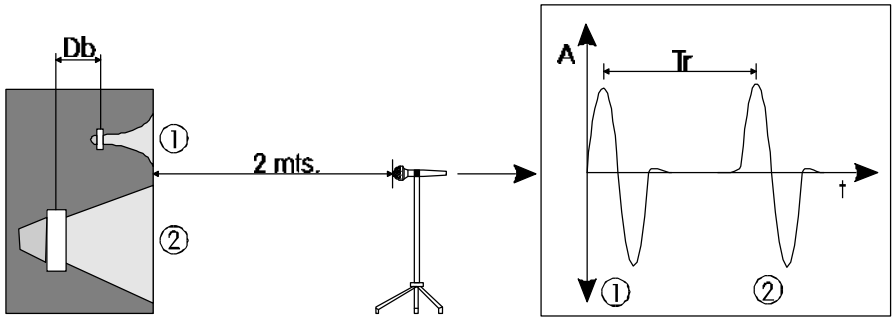
Where Db is the distance between the reels in millimeters, Vs is the sound speed meters per second (340 m/ s) and Tr is the delay time, in milliseconds.

For example, if you have a two ways speaker system cabinet, with the reel advanc cm with regard to the low reel, you would obtain the next result:

$$Tr = \frac{30\ (mm)}{340\ (m/s)} = 0.088\ ms = 88\ \mu s.$$

Therefore, in order to align this system, you will introduce a delay of 88 µs in the high way. As seen the theoretical calculus it is not complicated and allows us to adjust the between the different ways obtaining a good addition among them.

When the real measure of the distance between sound planes is complicated or ir act as it is the case of folded horn bass bin, you will be appealed to the experimental me sure with gauge instruments. To make this, you will excite both speakers simultaneously a pulse generator and you will visualize the waveform in a oscilloscope with the help o microphone and a console. As pulse generator could be used a portable one of the en ees in order to measure the phase between speakers. The scheme of the procedure of measuring could be observed in the next picture:

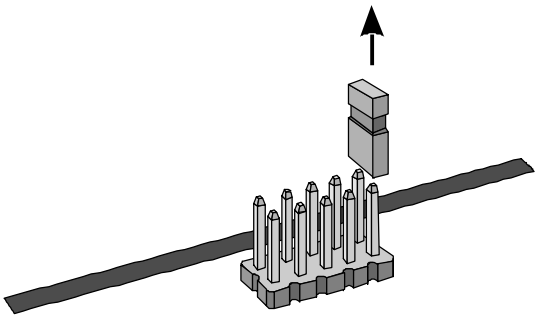


PLACING A DELAY CARD:

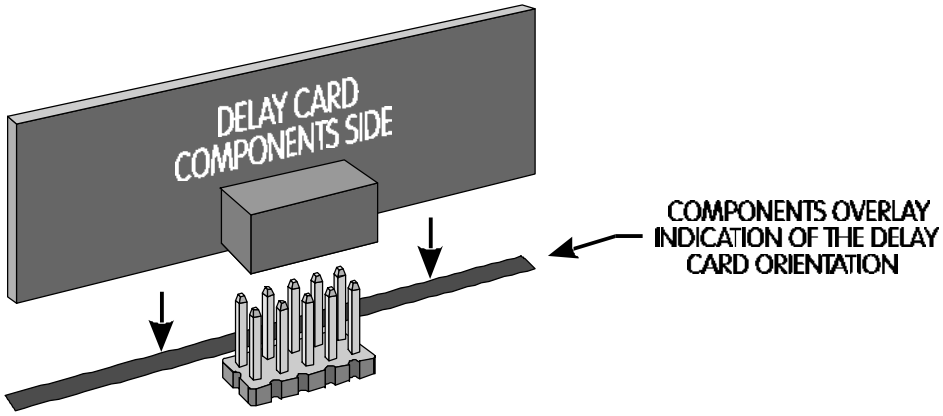
Before placing the delay card you should adjust it, for this it is recommended that the previous sections carefully, if you haven't done yet.

In order to place a delay card in the main board, follow the next steps:

❶ Turn off the crossover and disconnect it of the mains.
❷ Remove the connector jumper where you want to insert the delay card (the connectors where you could insert the delay card are indicated in a table on page 31).



❸ Insert the delay card in the connector, guiding the printed circuit board toward the component overlay indication of the card orientation in the main board. Take care to insert the connector carefully, and don't move it forward, behind, left or right. All the main board connector should join in the female delay card connector.



WARNING: Before carrying out any operation inside the crossover, disconnect it of the mains. Upon being connected to the mains, the crossover contain elements with high tensions, and if for a negligence you touch one of those parts could cause a short circuit through your body with the rising danger for your health.

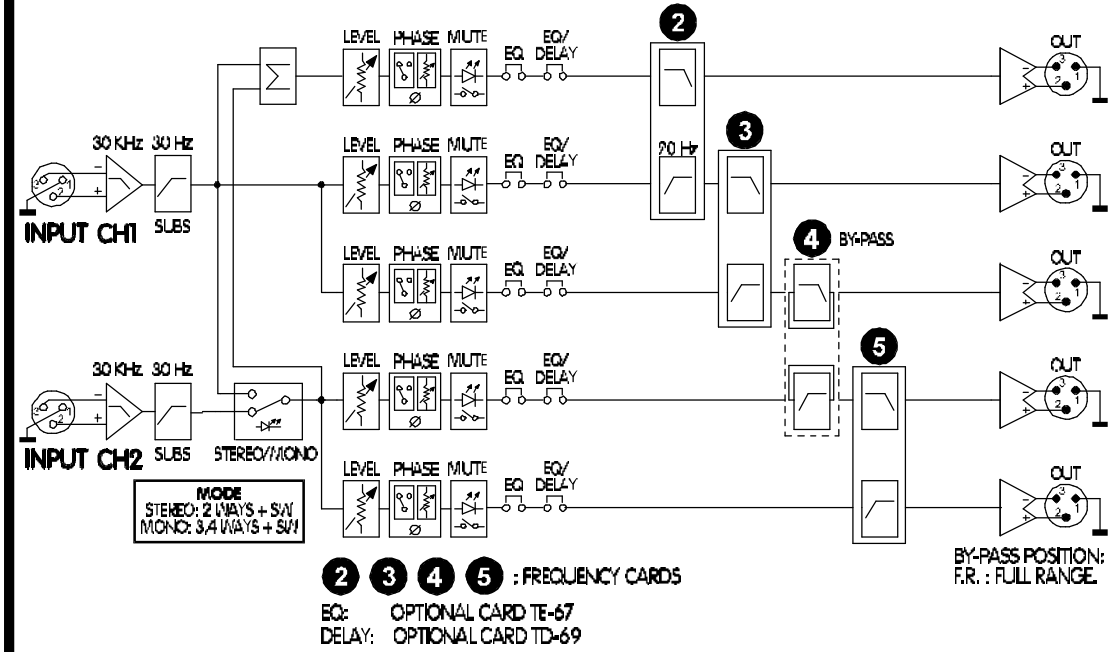
CAUTION: Do not insert never delay card with the crossover turn on, this could cause its break.

CAUTION: After placing the delay card in a insert connector, and before turning on the crossover, make sure that the delay card is placed correctly in the main board connector, and that any of the connector contacts is out of it. A wrong placement of the delay card, could cause that the crossover and the delay card break.

7. BLOCK DIAGRAM AND OPERATION EXPLAIN

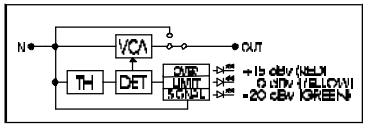
The diagram block pictures show the seven and five ways that the crossover has.

FA-524
BLOCK DIAGRAM

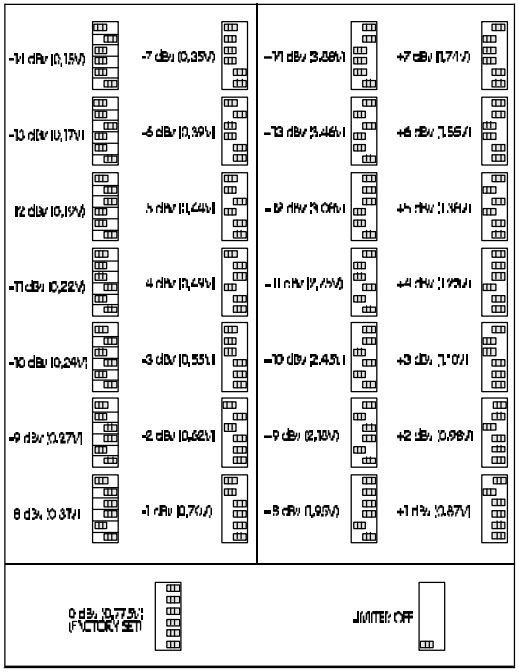


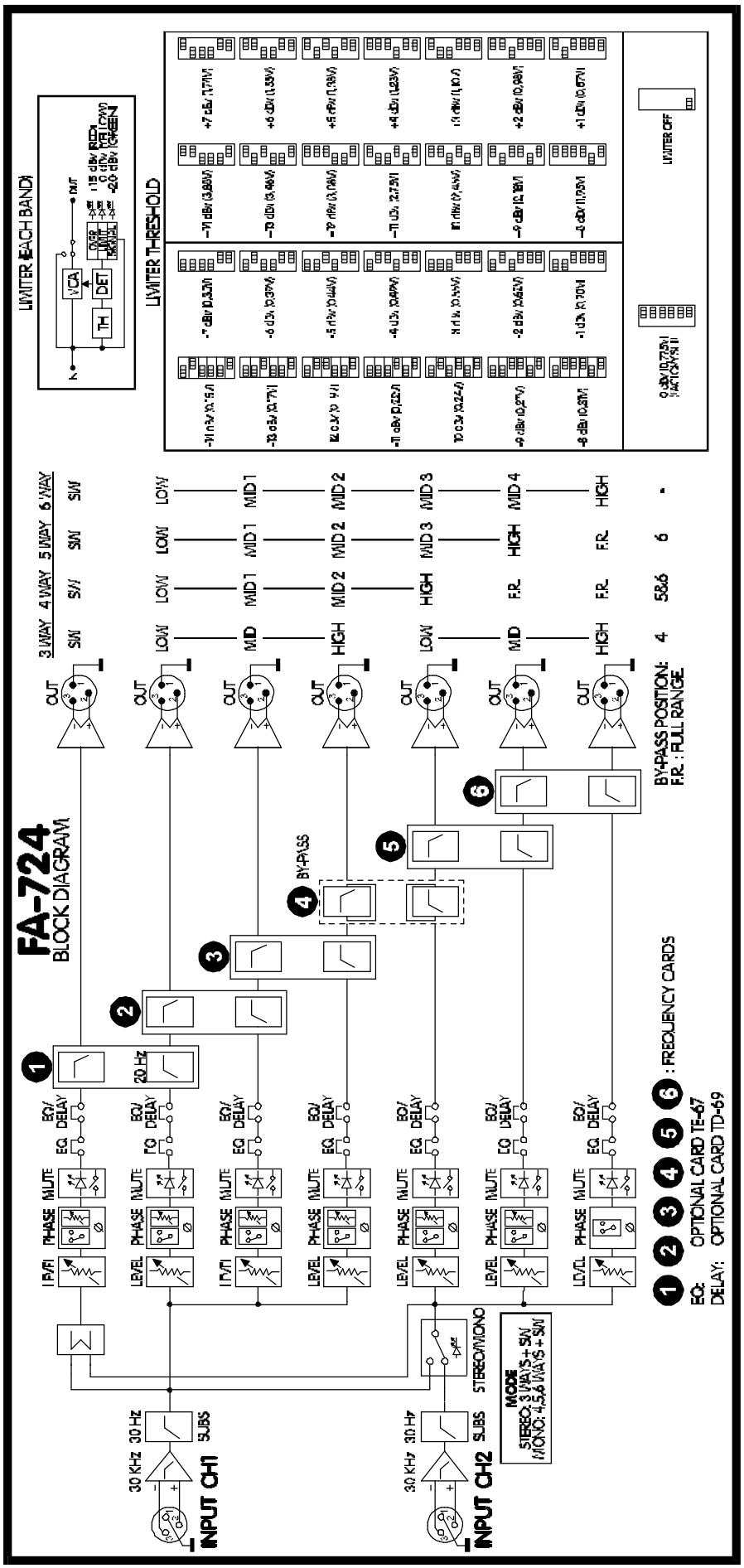
2 WAY	3 WAY	4 WAY
S/W	S/W	S/W
LOW	LOW	LOW
HIGH	MID	MID 1
LOW	HIGH	MID 2
HIGH	F.R.	HIGH
4	5	-

LIMITER (EACH BAND)



LIMITER THRESHOLD




FA-724
BLOCK DIAGRAM
LIMITER EACH BAND
LIMITER THRESHOLD
LIMITER OFF
3 WAY 4 WAY 5 WAY 6 WAY
SW SW SW SW
LOW LOW LOW LOW
MID MID1 MID1 MID1
HIGH MID2 MID2 MID2
MID3 MID3
MID4
HIGH HIGH HIGH
F.R. F.R. F.R.
4 5&6 6 -
BY-PASS POSITION:
F.R. : FULL RANGE
BY-PASS
: FREQUENCY CARDS
EQ: OPTIONAL CARD TE-67
DELAY: OPTIONAL CARD TD-69
INPUT CH1
INPUT CH2
30 KHz
30 Hz
SUBS
STEREO/MONO
MODE
STEREO: 3 WAYS + SW
MONO: 4,5,6 WAYS + SW
EQ/
DELAY
EQ
MUTE
PHASE
LEVEL
OUT

In the input, the signal crosses the two RFI filters and its electronically unbalanced. Later, the signal go through two filters, the ultrasonic filter placed at 30 KHz and the subsonic one placed at 30 Hz. In the INPUT CH2 the signal crosses the STEREO/MONO switch and it takes the signal of this input when the switch is at position STEREO or of the INPUT CH1 when the switch is at position MONO. The subwoofer way (SW) has a sum amplifier which converts the two input signals in a single mono signal, because of this way is mono.

The next section is composite for the LEVEL amplifier, the phase change and the phase adjustment, besides the MUTE switch. The last way (HIGH_R) doesn't have phase adjustment, although it has phase change. This is because in the phase adjustment, this way leaves as reference, because of what it is not necessary adjust its phase.

Later was the insert points of EQ and EQ/ DELAY, that interrupts the signal because of what it is necessary introduce the jumpers (refer to the sections placing a equalizer or delay card for more information).

The frequency cards share ways as you could observe in the diagram, always the low pass filter belong to the previous way and the high pass filter to the hind one. All the ways have two filters, except for the subwoofer way (SW) and the HIGH_R one, since in these two ways are not necessary use more than one filter. Also one could observe that the only that should make in order to overlap ways, are don't use the same relevant frequency for the high pass filter that for the low pass one.

Lastly the signal is electronically balanced, and it arrives to the output connector. The output connector is the place where in the turn on/off the relays momentarily begin to ground the outputs (both terminal 2 and 3) in order to avoid turn on/off transitory.

In a box inside the diagram, is printed the limiter configuration, in which the voltage controlled amplifier (VCA), limits the output tension (if it is active) when the signal goes over the VCA threshold (TH). Also the level indicators take the input signal of this part of the circuit.

Beside the output connectors, it is the output configuration schematics depending on the crossover configuration, as well as the bypass card position.

8. REPAIR GUIDE

In order to carry out a repair the crossover unit must be open, removing the eight screws of their top cover.

NOTE: This type of operations, takes place with the unit open, because of what should be carried out by qualified technical personal.

WARNING: Before opening the unit, disconnect it of the mains. It is important mark that although the unit is turned off (with the power switch at position 0), if it continues connected to the main there is different parts of the unit that are subjected to high tension.

CAUTION: Don't subject the divisor of frequency to humidity or rain, above all if it is open. If it comes to produce, disconnect it of the mains and warns to qualified technical service.

Keep in mind that all the ways are symmetrical, because of what once certain the way that is failing, you could exchange components, except for the circuits that are common to all the ways as could be the power supply, or the delay turn on.

Before beginning to change anything in a unit, before carries out a meticulous visual exam (burnt resistors, potenciometers with a broken trace, etc.). This exam many times gives

us the key in order to begin to look for the problem, saving us time and unnecessary efforts.

Keep in mind when remove an element of the main board, that it is double layer printed circuit, because of what the components PADs goes joined of one layer to another one through a metal tube (VIA), because of what could not do much strength for if pulled up the VIA. This is important mainly in components that have many pins (integrated circuits, connectors, etc.), for which it is recommended to have a good desoldering station.

Next they are detailed some fails, so that the personal technical qualified could try to repair them:

1) If a fuse break because of a mains transitory, change it (keeps in mind of changing it for the correct for the mains voltage at which it is working. For more information reviews the section changing the fuse, placed on page 6 of this manual). If it breaks again, checks the overvoltage protections placed in the voltage selector. If they are broken, substitute them by equivalent (VARISTOR of 130 volts).

2) If fails the power supply, the unit will remain in MUTE mode. In this case it is necessary to check the bridge (D64), the filters capacitors (C111, C112, C120 and C121) and the regulators (U44 and U51). Keep in mind that if the unit has been turned on, the radiators of the regulators could be hot, with the rising danger of burns.

Once changed the element damaged, it is necessary to verify that no element is overheating in the main board, since being is able to this element causes the break in the power supply.

3) The potentiometers have a half life, they could dirty and produce noise upon moving them. It is important that you don't use sprays cleaners over the potentiometers, since they shorten the half life of these, in order to clean them use compressed air.

In order to change a potentiometer, it is necessary to remove the top and bottom covers of the crossover (be careful with the bottom cover, since its join with the toroidal transformer), the frontal and the panel behind it. In order to remove the frontal, extracts the four visible screws, and a nut behind the subfrontal (be careful with this nut since is difficult see it). The panel behind the frontal is join to the chassis by four screws located in the chassis side, and by the potentiometers. Upon introducing the frontal again, be careful with the LEDs, since it is necessary to introduce them in the frontal and it is a delicate operation.

4) Normally the signal reductions in the crossover are produced by three causes: the LEVEL potentiometers, the unbalanced circuit and the electronic balanced circuit. In the unbalanced and electronic balanced circuits, normally the signal reduction that takes place is of 6 dBv (half of the signal). The LEVEL potentiometers could give rise to signal reductions or increases, as well as to swinging signals.

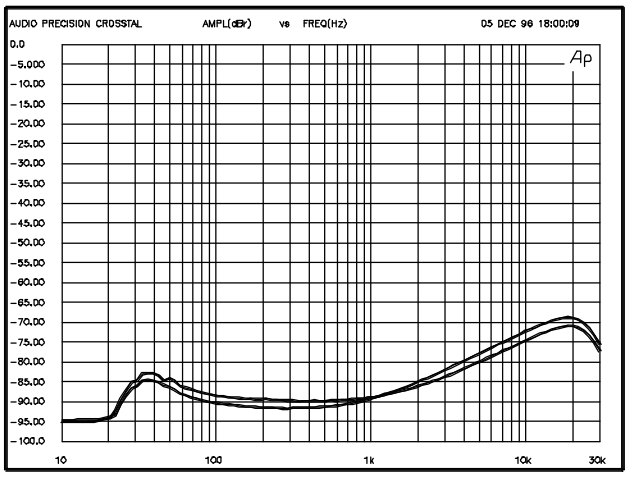
9. TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS	
Input impedance.	10 KOhms Electronically balanced.
Input level.	0 dBv. nominal / +21 dBv. maximum.
Gain/Attenuation.	±6 dB. Level control by calibrated rotatory potentiometer.
Output impedance.	100 Ohms Electronically balanced.
Output level.	0 dBv nominal / +21 dBv maximum.
Filters.	24 dB/oct. LINKWITZ-RILEY type.
Crossover frequencies.	Selectable by plug in frequency cards.
Limiter.	Adjustable by 1 dB. steps, between ±15 dBv., inside. Attack and release time optimized for each frequency card. Compression ratio: 10:1.
Noise.	-92 dBv. at any output from 20 Hz. to 20 KHz. unweighted.
Distortion.	Less than 0.05% at +4 dBv. with limiter.
Phase.	Change of 180º with the polarity switch. Adjustable from 0 to 180º between ways by calibrated pot.
Crosstalk.	- 70 dB., from 20 Hz to 20 KHz.
Input connectors.	XLR-3-31.
Output connectors.	XLR-3-32.
Indicators.	MUTE red LED on each way. Tricolored LED on each way: . GREEN (-20 dBv.). . ORANGE (LIMITER THRESHOLD). . RED (+15 dBv.). MONO green LED. STEREO green LED.
Mains supply.	Selectable between 115 and 230 VAC ±12% 50-60 Hz.
Power requirement.	30 VA.
Net weight.	4 Kg.
Dimensions.	483x45x245 mm. (19" x 1u).

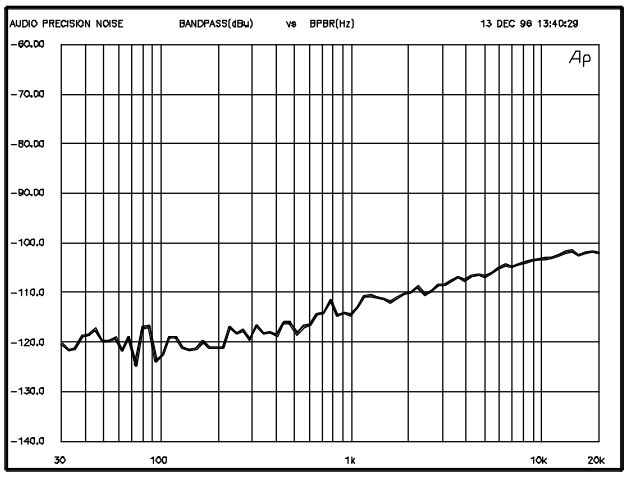
NOTE: 1) 0 dBv. = 0.775 V;

2) Equipos Europeos Electrónicos reserves the right to modify the technical specifications without previous notice.

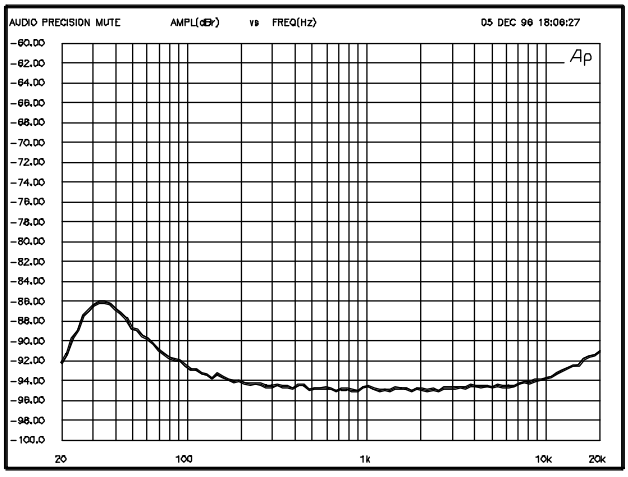
10. GRAPHS



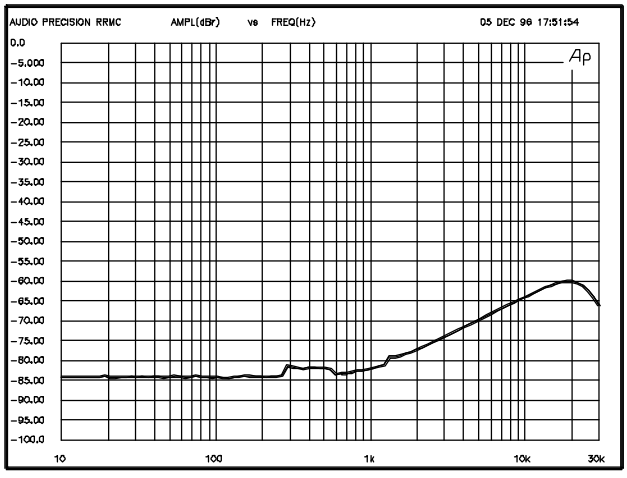
Typical crosstalk.



Typical noise at one output.



Typical attenuation of the MUTE switch.



Typical common mode relation ratio (CMRR).

11. WARRANTY

This unit is warranted by Europeos Electrónicos Equipos to the original user, against flaws in the manufacturing and in the materials, for a period of one year, starting from the date of sale.

Flaws due to wrong use of the unit, internal modifications or accidents, are not covered by this warranty.

There is no other warranty expressed or implicit.

Any faulty unit must be sent, to the dealer or the manufacturer. The serial number should of the unit must be included with any request for the technical service.

Equipos Europeos Electrónicos reserves the right to modify the prices or the technical specifications without notice.

SERIAL NUMBER .....

ALTAiR

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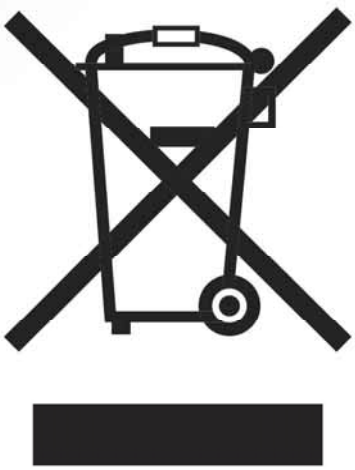
European Union
Waste Electronics Information
Unión Europea
Información sobre residuos electrónicos

Waste from Electrical and Electronic Equipment (WEEE) directive
The WEEE logo signifies specific recycling programs and procedures for electronic products in countries of the European Union. We encourage the recycling of our products. If you have further questions about recycling, contact your local sales office.



Directiva sobre Residuos de Aparatos Eléctricos y Electrónicos (RAEE)
El logotipo de la Directiva RAEE se refiere a los programas y procedimientos específicos de reciclaje para aparatos electrónicos de países de la Unión Europea. Recomendamos el reciclaje de nuestros productos. Si tiene alguna consulta, póngase en contacto con su Distribuidor.

Information based on European Union WEEE Directive 2002/96/EC
Información basada en la Directiva de la unión europea RAEE 2002/96/EC y el Real Decreto 208/2005

AUDIO ELECTRONICS DESIGN

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