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TCX924 THREE WAY ELECTRONIC TIME DELAYED CROSSOVER

SMART products are designed to deliver unsurpassed quality in workmanship and performance. The following information gives detailed instructions on the installation and operation of the SMART TCX924 crossover. We strongly encourage new owners of the TCX924 to thoroughly read this entire manual before placing their new SMART product into service. This will ensure that the TCX924 will be operated properly to give the superior performance that it was designed to deliver.

For service or installation assistance, please call our
Technical Support Department between the hours of
8 a.m-5 p.m. E.S.T., Mon.-Fri.
1-800-45-SMART

LIMITED WARRANTY: SMART products and accessories are warranted against malfunction or failure due to defects in workmanship or materials for a period of one year from the date of shipment. If a problem occurs during the warranty period, the unit will be repaired, or replaced at our option, without charge for materials or labor. If air freight is requested by the dealer, the difference between air and surface charges will be billed to the dealer. This limited warranty does not cover products that have been abused, altered, modified, or operated in other than specified conditions. Prior factory approval is required on all returns. Returned equipment or defective parts must be shipped freight prepaid to us by the dealer or customer.

Our limited warranty does not cover damages resulting from accident, misuse or abuse, lack of responsible care, or failures not attributable to manufacturing defects, except as provided herein. SMART Devices, Inc. makes no warranties, express or implied, including warranties of merchantability or fitness for a particular purpose.

RETURN POLICY: Factory authorization MUST be obtained before returning any product. A 15% restocking charge will be issued on unused equipment (in original box) that is returned for credit. Credit is issued to the dealers account. The credit may be used against future purchases and no cash transactions are offered. All returns must be shipped freight prepaid by the dealer. Equipment returned without a factory RA (Return Authorization) will be refused.

SECTION 1
INTRODUCTION

The TCX924 Three Way Time-Corrected Electronic Crossover is a multi-channel electronic crossover designed specifically for cinema use. This product contains features not found in other products of its type.

The TCX924 contains three identical crossover channels for the stage speakers, along with its own AC power supply that can operate from 110-120 VAC or 220-240VAC 50/60 Hz line voltages. Each channel has its own adjustment for time correction of the high frequency/horn driver and the low frequency woofer(s) to align acoustically relative to the midrange speaker. Although it is desirable to use identical stage speakers for stereo in an auditorium, non-similar types can be accommodated and the time correction for each channel can be individually adjusted.

Three Way Electronic Crossover. The standard TCX924 divides an audio signal into three frequency bands: 300 Hz and lower, 300 to 2500 Hz, and 2500 Hz and higher. Alternate "Crossover points" are available upon request from the SMART factory. The crossover slopes are 24 dB per octave (utilizing 4 pole active filters) to provide a smooth blend of sounds from the low, mid and high frequency components. The steep 24 dB slope also provides maximum protection for the high frequency driver during loud sound passages.

Time Correction. When a 2-way speaker reproduces a note at (or near) the crossover frequency, both the HF and LF speakers are working at that frequency. Because the HF driver cannot be physically aligned with the LF woofer, the HF sound arrives at the listener's ears slightly behind the sound created by the LF woofer. This creates a muddy, confused sound in the overlap frequencies where misaligned pressure fronts of the corresponding frequencies cancel each other out. For example, if a 2.5 kHz tone is electrically delayed in the high frequency band so that the corresponding tone from the midrange band arrives at the same time at the listener's ear, the tones combine acoustically in phase and produce a clear, transparent sound. Jumpers have been provided in the circuitry of the TCX924 to align most of the common stage speakers by varying the delay. Figure 2 shows mechanical misalignment of the a 3 way speaker arrangement.

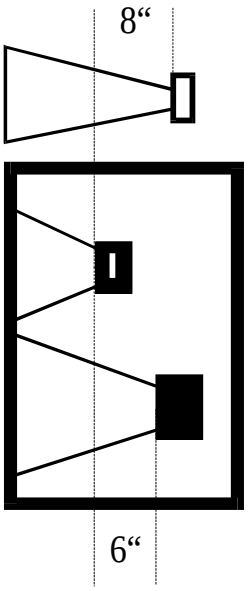

Figure 2. Acoustically unaligned 3 way speaker system.

CD horn compensation. The new constant directivity horns offered by most major loudspeaker manufacturers hold their published dispersion patterns very nicely. Early design horns used in cinemas until the early 1960's were very directional at higher frequencies. A horn may have a 90-degree by 40-degree pattern at the crossover frequency, but as the frequency tone went up, the pattern could narrow as low as 10 degrees. You could only hear all tones directly on-axis of the horn.

New CD horns can hold their pattern throughout the high audio frequency range. Because the pattern is so wide, the higher frequencies are spread over a bigger and appear not to be as loud as their lower counterparts. The TCX924 has CD horn compensation built in. The smooth high frequency boost is up 12 dB at 10kHz from the Crossover frequency of 2.5 kHz. This high frequency boost is valuable for movie theatres because of screen attenuation losses at high frequencies. Equalization is easier and smoother with the CD horn correction added.

SECTION 2
INSTALLATION

Mount the TCX924 in the equipment rack where it is in proximity to the power amplifiers. An ideal location is where the TCX924 output leads can easily reach the

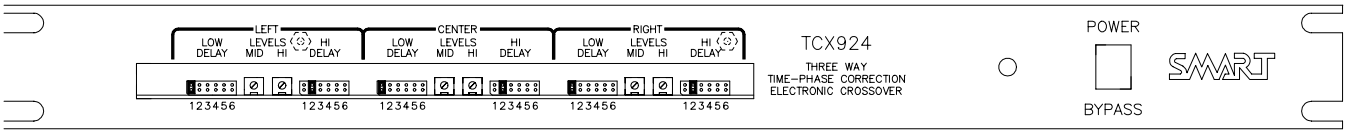

Figure 1. The TCX924 Front panel with Security Cover removed.

inputs of the power amplifiers with a minimum run of cable.

Wire the outputs to the respective inputs of each power amplifier making sure the LF outputs arrive at the LF amplifier inputs. Mixing the LF, MF, and HF signals can cause damage to the drivers.

Wire each stereo processor channel to its respective input at the TCX924. All connections are made to the Phoenix brand connector on the back of the chassis. Keep all wiring from this connector away from the AC lines and speaker output lines from the power amplifiers.

The TCX924 has unbalanced outputs. Wire the inputs of the power amplifiers for this mode.

Allow ventilation space for the electronic crossover. It is not good practice to wedge the crossover between two power amplifiers without the vent panels separating the units.

SECTION 3
CALIBRATION

Remove the front security cover with the allen wrench provided with the product.

Make sure the power switch is in the ON position. The OFF position is also the bypass mode that allows the audio signals from each channel to pass to the amplifiers. A special protection circuit is included in the bypass circuits to protect the MF and HF drivers from damage from low frequency energy. The LF woofers will receive full range audio when the TCX924 is in the bypass mode. This is not a problem because the woofers will not reproduce HF audio very well.

With pink noise playing adjust the MF and HF level controls for the smoothest crossover while observing the response on the real time analyzer set up to monitor the auditorium. The levels should be set to match at the crossover frequencies of 300 Hz and 2.5 kHz. Do not be concerned with the level of the other parts of the audio spectrum at this time.

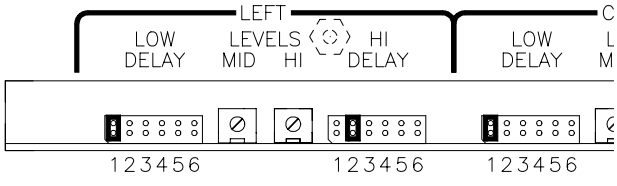

Figure 3. Front Panel LOW and HI delay positions and MID and HI level control. NOTE: A jumper must be installed in one of the six delay positions or no sound will reach the output.

With a ruler, measure the distance from the point where the voice coil of the woofer is to the voice coil/diaphragm of the MF driver. This is the acoustic difference between the two components. Also measure the distance between the coil/diaphragms of the MF driver and the HF driver. The TCX924 is configured so that the HF and LF may be positioned behind the MF driver. Refer to the following CROSSOVER DELAY chart to determine the best setting of the jumper "shunts" for each channel and each delay of the TCX924 (See figure 3 for diagram of front panel shunt positions). You may wish to reposition the mechanical alignment of the horn/HF driver before securing it to the enclosure for an even multiple of 2.5". For example, if the horn/HF driver is 11 inches behind the MF woofer voice coil, slide the HF assembly back 1.5 inch so that it is an even 12.5 inches difference. Secure the horn/HF driver assembly to the main enclosure.

CROSSOVER DELAY

2.5 kHz High Frequency Delay

Position	Acoustic Distance
1	0"
2	2.5"
3	5"
4	7.5"
5	10"
6	12.5"

300 Hz Low Frequency Delay

Position	Acoustic Distance
1	0"
2	6"
3	12"
4	18"
5	24"
6	30"

Some manufacturers of cinema loudspeaker stage systems recommend reversing the HF driver connections when using a 24 dB 4-pole filter crossover. Observe your real time analyzer response to determine the best wiring scheme.

All channels should be set to the same time correction setting when using identical model speakers.

Leave the security cover off the TCX924 until you have completed your room equalization. This will allow you to make minor adjustments to the HF level setting as you continue to tune for the flattest response.