

The LFT-10 Linear Field Transducer Car Audio
Loudspeaker

WARNING: Any car audio system should be installed only by experienced professionals. All components should be securely fastened to factory authorized locations with proper hardware. All wiring should be completed in accordance with the manufacturers recommendations. Injury could occur if components are not fastened properly.

Position and fasten components so that in the event of an accident, injuries will not occur.

Eminent Technology, Inc. is not responsible for loss or injury do to accidents or improper use of its products.

Hearing damage can result due to exposure to loud sounds. We recommend purchasing a sound pressure level meter (Radio Shack sells one for about \$30) and using it to learn to listen to your sound system at something less than 90 dB sound pressure levels. Hearing loss occurs slowly, you will not know you have lost your hearing until the damage is done.

Strong magnetic fields exist in and around the LFT-10. Be careful when handling hardware and tools during installation.

The LFT-10

The LFT-10 represents a technological breakthrough for sound reproduction in the automobile. It is the first planar magnetic loudspeaker specifically designed for use in car audio.

It is intended for car audiophiles who are serious about high quality sound reproduction. If this is the goal, the LFT-10 will fundamentally change the way sound is listened to in a car.

Most of the technical advances in loudspeaker technology for the automobile have been evolutionary. The LFT-10 represents a revolutionary change. Consider the following:

-- The LFT-10 has distortion 10 to 100 times less than cone speakers at moderate levels. It has distortion as low as amplifiers. For the first time in a car you will be able to hear distortion levels of the electronics and program material.

-- The LFT-10 is useable over a seven octave frequency range. Most other car loudspeakers are only useful only over a 3 to 5 octave range.

-- The LFT-10 has accurate phase response over its full operating range. Cone loudspeakers cannot make this claim. Because of the LFT-10's wide bandwidth, accurate phase response, and impulse response, a car sound system's clarity and imaging are improved to new levels.

-- The thin profile of the LFT-10 (less than 1 inch total) allows positioning where no other loudspeakers can go.

-- Because of its thin profile, placement is limited to the imagination of the installer.

-- The LFT-10 can be used as a dipole mounted on a small flat baffle in free space.

-- The LFT-10 has sensitivity and sound pressure level limitations which should be carefully considered for each application.

THE LINEAR FIELD TRANSDUCER

Eminent Technology's Linear Field Transducer, introduced as the LFT, represents a new approach to the design and construction of a high-quality car loudspeaker*. It builds on the strengths of previous planar designs while eliminating many of their drawbacks to allow use in a car.

DIAPHRAGM CONSTRUCTION

The construction of the LFT-10 begins by laminating a very thin sheet of aluminum foil to a half-mil-thick sheet of Mylar. A voice grid pattern, created by means of CAD (Computer-Aided Design) technology, is silk-screened onto the foil side; the remainder of the aluminum--the part not covered by ink from silk-screening is chemically etched away, in a manner similar to the etching of traces on a printed-circuit board. The ink is then washed away, leaving a voice grid of near perfect uniformity. This technique results in a diaphragm/voice coil grid that is still less than two mils in total thickness, and also permits relatively narrow spaces between the individual traces, so the diaphragm can be evenly driven over its entire surface.

THE MAGNET / FRAME STRUCTURE

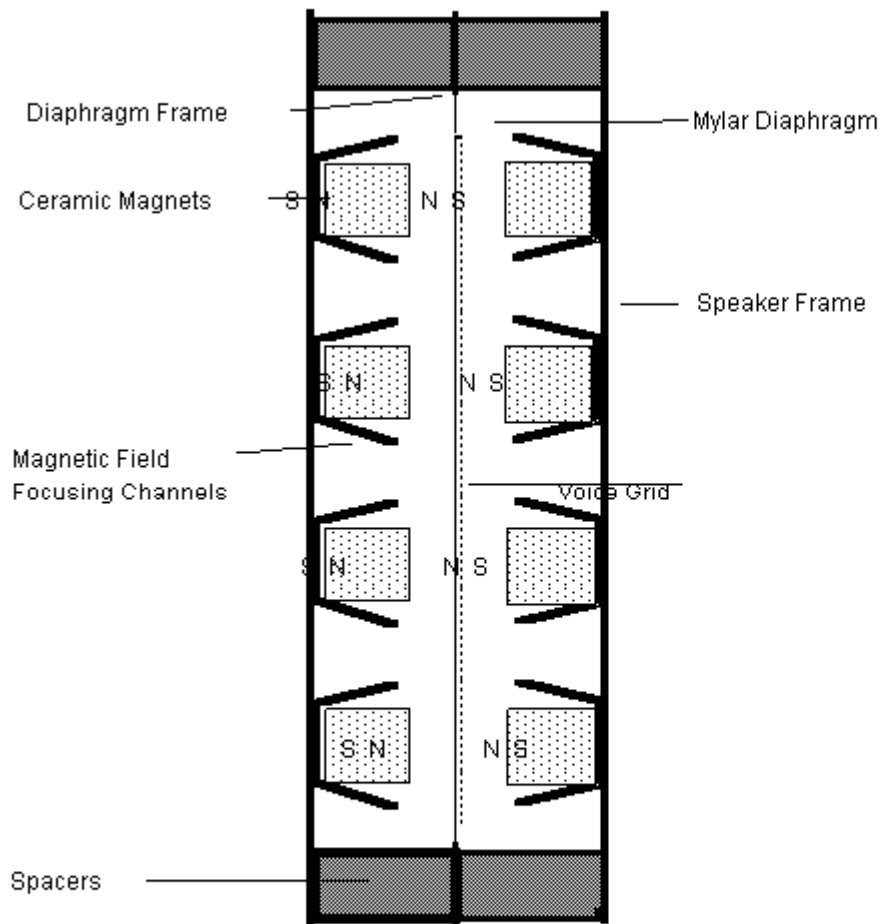
The magnet/frame structure developed for the LFT-10 is also unique. Eminent Technology builds its magnets into individual steel channels, the size and shape of which have been carefully designed to help "focus" the magnetic flux lines and concentrate the strength of the magnetic field on the appropriate area of the diaphragm/voice grid. These channels are then welded to steel frames, which in turn are bolted to the frame that holds the diaphragm in place.

Interestingly, one of the biggest challenges faced in creating a true push-pull dynamic speaker was not a design consideration but rather a matter of construction difficulty: to assemble a perfect rigid structure with very powerful permanent magnets at the front and the rear, both sides opposing each other with tremendous force. The second design challenge is making a planar speaker both small enough and efficient enough for use in car stereo.

* The design and construction of the LFT-10 is patented

By applying such new techniques to planar loudspeaker construction, Eminent Technology has been able to eliminate many of the flaws inherent in earlier designs

Cloth is used on the back side of the speaker to resistively load the diaphragm. This lowers the Q of the diaphragms free air resonance.



LFT-10 LINEAR FIELD TRANSDUCER

Top View Cross Section

Since it is now possible to have a powerful, precisely aligned magnet structure on both sides of the diaphragm, true push-pull operation has been achieved: Regardless of the degree of excursion the diaphragm undergoes, the voice element is always optimally positioned within the magnetic field. The result is extremely linear performance throughout the audible range, with a profound increase in dynamic range and an absolute minimum of distortion.

CHOOSING A MOUNTING LOCATION

Although the LFT-10 could be placed in a box it, was designed to operate in free space. Not having a sealed enclosure behind the LFT-10 is preferable to mounting it in an enclosure.

The LFT-10 is a dipole, meaning sound radiated from the back of the speaker is exactly the same as what comes from the front of the speaker. It is not necessary in the automotive environment to use the back wave.

The LFT-10 should not be mounted in a sealed or vented enclosure where a woofer's rear wave pressurizes the same cavity. Since the LFT-10's diaphragm is almost as light as the surrounding air and is very compliant, it would look like a hole in the box. Also, the diaphragm would bottom due to pressure changes in the box from the woofer.

Door, panel, headliner, or dash mounting is acceptable as long as there is a small amount of space behind the speaker. The cavity (even if it is a very small space) behind the LFT-10 should be porous (not sealed). This is critical to good lower midrange performance. The size of the cavity is not important, but it should not be sealed.

The LFT-10 could not be mounted on a rear deck with an open back to a trunk that also had a woofer using the trunk as its enclosure. In this case, the back of the LFT-10 would have to be sealed from the trunk in its own enclosure.

To make use of the wide frequency response of the LFT-10, the speaker should be positioned so that the listener is no more than 30 degrees off of the narrow axis or 10 degrees off of the wide axis.

LOW FREQUENCY SYSTEM

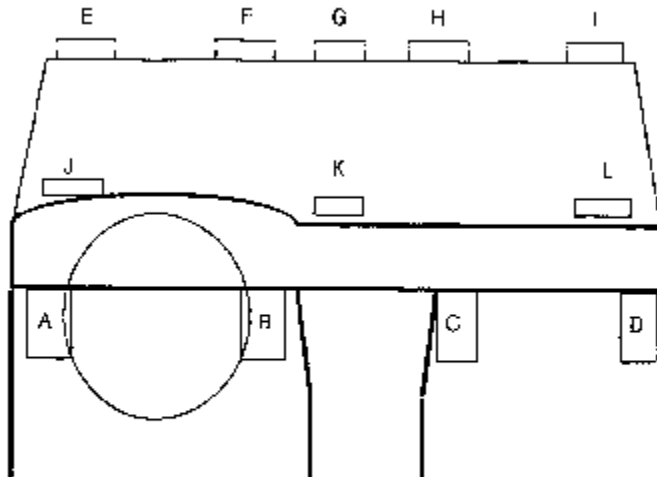
The LFT-10 must be supported by a low frequency system with good lower midrange (up to 400 Hz) response to blend smoothly. High quality bass/midbass 4" to 8" drivers that are rated to several Khz are preferable to bring up the low frequencies and lower midrange to the LFT-10. Larger drivers should not be used (10" or greater) to attempt to blend with the LFT-10 due to poor lower midrange performance. They can, of course, be used as subwoofers crossed over to the midbass drivers.

DASH MOUNTING

The LFT-10 can be mounted in any number of positions within the dash. The absolute best performance will be obtained when separate stereo environments are created for each seating position. Locations A, B, C, D and E, F, H, I are examples of this. These positions will give the best imaging because the ear depends on time and amplitude cues for location. Both parameters will be kept when the right and left speakers are an equal distance from the listener's ears.

Positions J,L and E, I are less desirable for imaging but still take advantage of the LFT-10's clarity and low distortion. Positions J, L use glass to disperse high frequency energy. If possible, the LFT-10 can be mounted below the dash or radiate through the existing perforations.

Positions K and G are excellent choices for center channel operation.



HEADLINER / SUN VISOR MOUNTING

Because of its thin profile, the LFT-10 can be mounted in a headliner or in place of a sun visor. If the LFT-10 is positioned where a sun visor is normally located, for best performance, material behind the speaker should be sound absorbing. If the headliner is made of cloth with padding behind it, this will be sufficient. If the area behind the LFT-10 is reflective (vinyl or plastic), this should be cut away and a sound absorbing material added directly behind the speaker. (Good sound absorbing materials are cloth, felt, open cell foam rubber, pillow stuffing, bed foam, carpet, carpet foam, etc.).

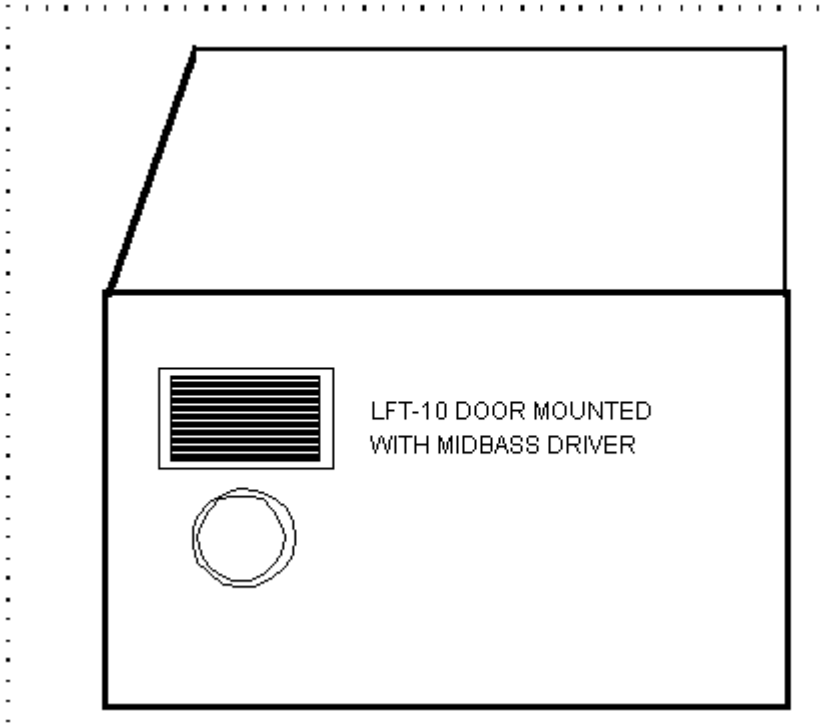
If the LFT-10 is to be placed behind the headliner, the fabric in front of the speaker should be changed to a less sound absorbent type. Synthetic fabrics are generally best in front of speakers (polyester, dacron, nylon, rayon, etc.) and there are many other choices at fabric stores. A simple test for good sound transmission is to hold the fabric up to a light or window. If it appears to pass at least 20% of the light when viewed through the fabric, it will probably work in front of a speaker without much high frequency alteration.

DIRECTIVITY

The general rule is the smaller the speaker, the better its dispersion will be at high frequencies. As a result, along the narrow axis, the LFT-10 has better high frequency dispersion and is useable farther off axis. Because the LFT-10 has a large flat diaphragm, it is highly directional at high frequencies. The best performance will be obtained when the LFT-10's are used on axis (meaning positioned so they are pointed directly toward the listeners ears).

If the LFT-10 is only going to be used as a midrange unit and not a tweeter, then placement is less restrictive.

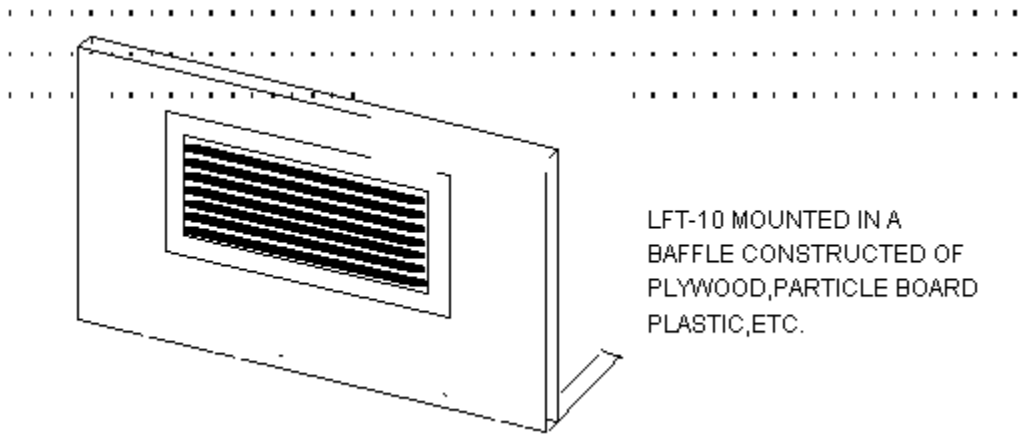
If the LFT-10 is to be door mounted, it should be positioned horizontally as close as possible to the listening position and angled up toward the listener.



BAFFLE MOUNTING

The LFT-10 does not have to be panel mounted. It can be mounted in free space on a baffle.

A baffle is nothing more than a flat plate. The LFT-10 is a dipole, meaning the same sound is radiated from the front and back of the speaker. Because the rear wave is out of phase with the front wave, longer wavelengths (lower frequencies) will come around the speaker and cancel out (This is why a woofer has no bass when operated in free space). A baffle helps prevent back wave cancellation and a larger baffle lowers the cutoff frequency (the frequency where cancellation occurs). Baffle mounting or just using the panel by itself in free space opens up a lot of possibilities regarding installation. Use your imagination.



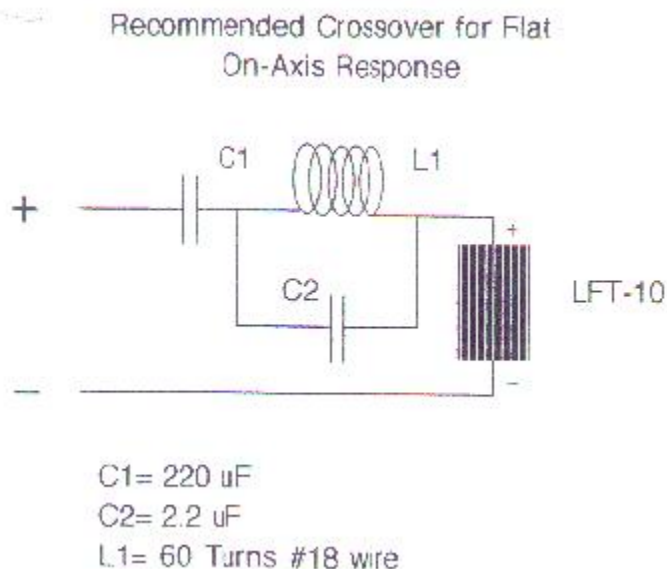
The best low midrange performance is attained when a baffle is used. Its size is not critical, but a larger baffle allows a lower crossover frequency.

The LFT-10 mounted in a baffle can be installed in the rear area of fastback/hatchback or rear deck of cars without the loss of much space. With this type of installation, the LFT-10 can be directed toward the listener. When used as a dipole, the back of the speaker should be at least 1" from any surface behind it, but the side of the baffle can be against the side of the interior space.

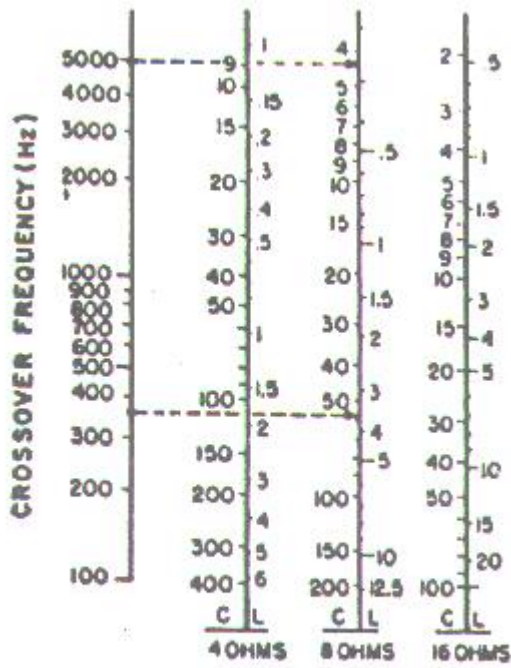
A baffle can be constructed of plywood or particle board (or strips) as shown. It could be painted or fabric wrapped to match an interior.

CROSSOVER

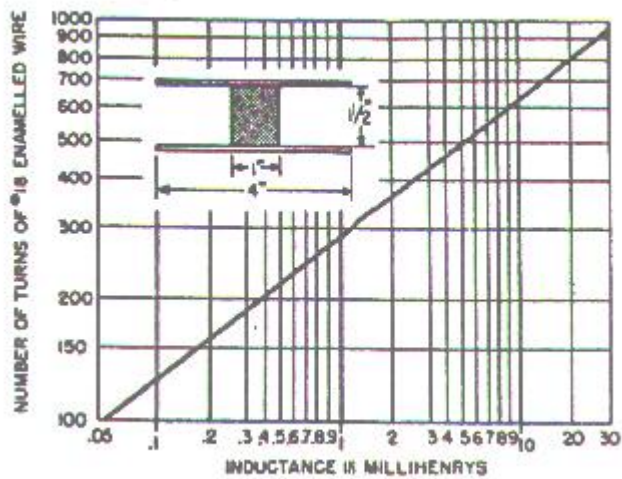
An electronic or passive crossover can be used with the LFT-10. If an electronic crossover is used, a high pass section with its lower frequency limit set between 200-400 Hz is acceptable. Some overlap in the crossover frequency signal being fed to the LFT-10 is acceptable and may help in blending with the midbass drivers through the crossover region. The midbass driver should be rolled off at 400 Hz quickly to prevent midrange coloration. The LFT-10 is acoustically limited to about 350 Hz and resistive loading prevents substantial output below that frequency. This allows some overlap in the crossover frequencies. Eminent Technology can supply passive crossover components on request.



The following graphs will aid in determining values for any passive crossover:

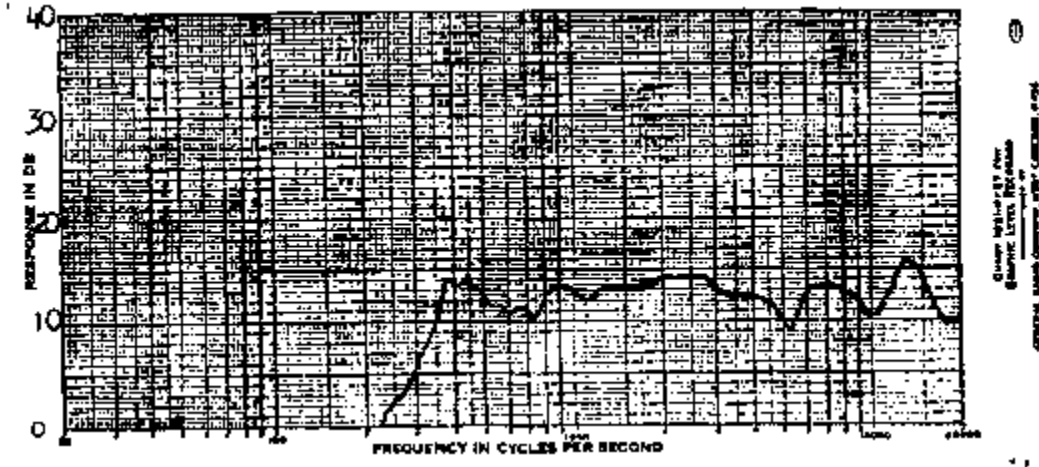


C IS IN MICROFARADS
L IS IN MILLIHENRYS



FREQUENCY RESPONSE

The LFT-10's frequency response is not flat. On axis the frequency response rises 6dB/octave. At about 30 degrees off axis the frequency response is essentially flat. If the speaker is used on axis (which will give the best performance) electronic equalization or the passive crossover shown will give on axis flat response to beyond 40 KHz. The frequency response below is measured on axis with the suggested passive crossover in place.



SENSITIVITY AND POWER AMPLIFIER REQUIREMENTS

The LFT-10 is somewhat, if not substantially, less efficient than cone type loudspeakers. It is rated at 86 dB for 1 watt input at 1 KHz. Since cone type loudspeakers usually have sensitivity ratings of 90 dB or better, this means the LFT-10 will require 2-4 times as much power at its input to maintain the same sound pressure level output.

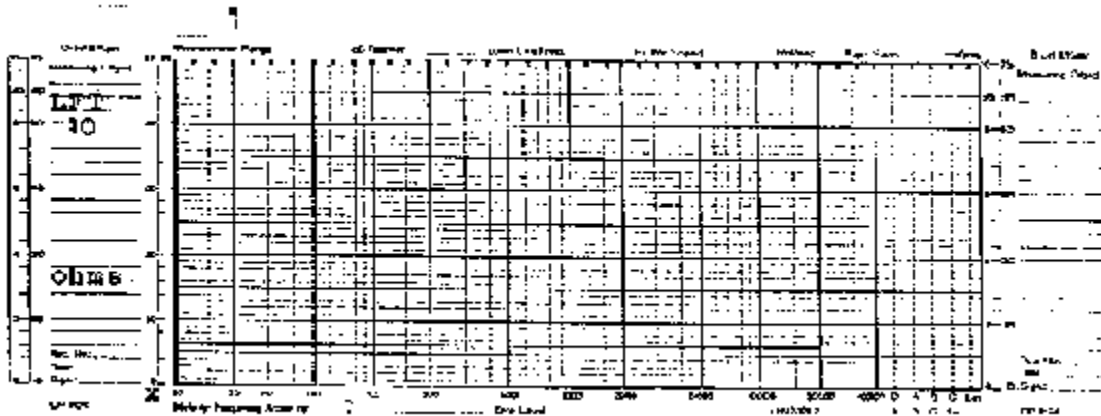
We recommend a minimum amplifier power rating of 50 watts per channel. If two LFT-10's are operated in parallel, the amplifier needs to have a continuous 2 ohm rating and also be installed in a well ventilated area.

The lower sensitivity also means that in the LFT-10's frequency range, less maximum sound pressure level will be available. Because the LFT-10 has very low distortion, the onset of amplifier clipping will be easier to detect further limiting the useable maximum sound pressure level.

The maximum power the LFT-10 can handle is 150 Watts. This is a music power rating where 150 Watt peaks are encountered short term and is based on peak to peak diaphragm limitations. More power can be used, but physical and thermal limits of the speaker will be exceeded.

IMPEDANCE

The LFT-10 represents a load to an amplifier that looks like a resistor. This means that for any frequency, the load the amplifier sees will always be 6 ohms. The LFT-10 will draw more current from an amplifier because of low sensitivity for a given sound pressure level in a system. This means the amplifier will run hotter. The amplifier chosen should be rated to handle low impedance loads and positioned in a well ventilated area. The test shows a perfectly straight line at 6 ohms.



CENTER CHANNEL OPERATION

The LFT-10 might represent the ideal center channel driver because of its directivity. It will have naturally rolled off response (400 Hz to 10 kHz) off axis mounted in the center of the headliner, dash, or rear deck. Center channels are usually attenuated relative to the right and left channels so the LFT-10's lower sensitivity should not pose a problem when matched with an already existing system.

PHASE

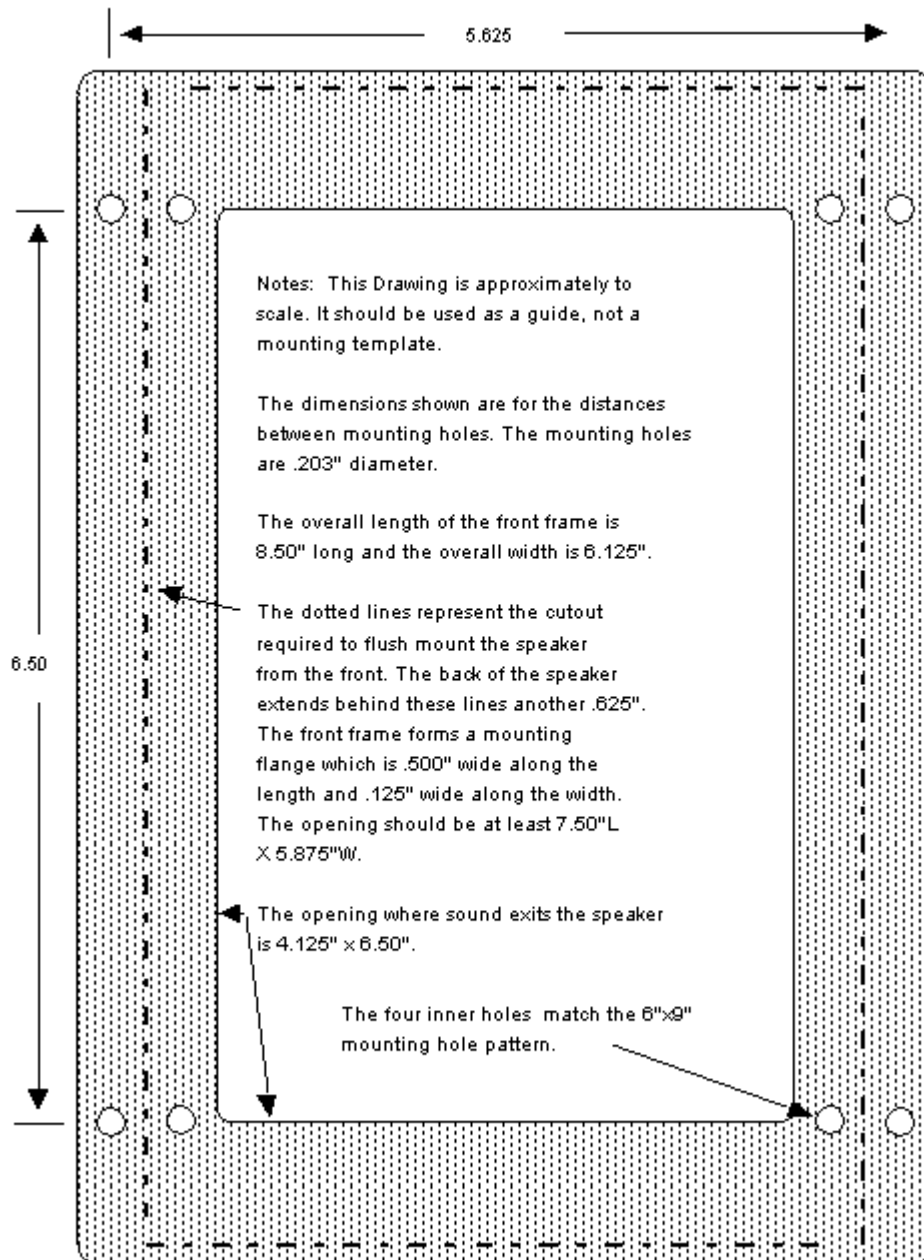
All drivers in an audio system should ideally operate in phase. Careful consideration should be paid to the correct polarity of all loudspeakers. The LFT-10's positive terminal with a positive signal applied will displace the diaphragm toward the front of the speaker.

The LFT-10 has accurate phase and impulse response. This means there is no time delay between low and high frequencies electronically entering and acoustically leaving the speaker.

In the LFT-10, if a low and high frequency signal appear at the input to the speaker at the same time- they will (as sound) leave the speaker at the same time. In a cone speaker, this is usually the case only over a very narrow range of frequencies.

This presents problems when interfacing speakers and also with crossover design and type. Some crossovers are phase inverting through the crossover frequency, some are not.

Since there are no hard and fast answers to the problem of phase for combining drivers, we recommend listening to the LFT-10's and midbass drivers wired all in phase and then inverted relative to each other to see which wiring method sounds best. This applies to any system and driver combination.



WARRANTY

Eminent Technology, Inc. warrants the LFT Loudspeaker to be free from defects in materials and workmanship for a period of 30 days from the date of purchase. Within that period, any failure of the LFT will be corrected without charge for parts, labor, or transportation from the factory. After this period, pending receipt of warranty form (filled out and mailed to Eminent Technology, and postmarked no later than one month after the date of purchase), the above warranty will be extended to three years for parts and one year for labor. This warranty is transferable to subsequent owners, pending notification from the original owner, in writing, within 10 days of the personal sale.

The obligation of Eminent Technology, Inc. under the terms of this warranty does not extend to:

- 1.) Any LFT installed or operated without regard for the instructions contained in this manual.
- 2.) Any LFT while under performance testing, or after being used in such a test, by any personnel or facility not authorized by Eminent Technology.
- 3.) Any other component or part connected to or operated in conjunction with the LFT.
- 4.) Any traumatic, accidental damage, or damage incurred in shipping, or defects which upon examination by Eminent Technology and in its sole opinion have been caused by abuse, neglect, improper or abnormal installation, or operation for extended periods in industrial applications.
- 5.) Any personal injury occurred as a direct or indirect use of the LFT.

This warranty is not applicable if any part of the LFT has been removed or taken apart, repaired, altered, or modified by anyone without prior authorization in writing from Eminent Technology, nor if the serial numbers have been defaced or rendered illegible.

If an Eminent Technology product is removed from the country in which the original consumer purchase was made, Eminent Technology dealers and distributors in other countries are not obligated by the terms of this warranty. Eminent Technology reserves the right to incorporate design refinements and changes to its products without notice or obligation. If practical, such design modifications will be made available to owners of existing units for a reasonable charge.

Under the terms of this warranty, Eminent Technology expressly does not insure for loss of use of the LFT due to failure or periods of repair. Warranty repairs will be carried out by the factory. The LFT must be returned prepaid in its original factory carton to:

Eminent Technology, Inc.

225 East Palmer Street

Tallahassee, FL 32301

(850) 224-5999

ERRATA

Remember there are about 750 Watts per horsepower. Never construct a car audio system that draws more power than the engine can produce.

If a fuse is used to protect an amplifier, sometimes the amplifier will blow to protect the fuse. There is an equivalent corollary for each component in the chain.

Your gas mileage may vary. The louder you play your car stereo system, the less mileage you will get.

The ratio of the cost of the car stereo over the cost of the car defines your level of enthusiasm for this hobby.

This manual has been written to help you evaluate and use the LFT-10. The probability of it containing mistakes is high (about 100%). We know you will think this manual is the literary equivalent of the local bus schedule, which is because we do not have a staff of writers to do this stuff. This product could not sell very well and this manual will go out of print, or it could succeed beyond our wildest dreams. Whatever way it comes out, think up your own suggestions and send them into us. This would help us and we would consider them in the future. Thank you for your interest in our products.