HK AUDIO

CONCERT SOUND



COHEDRA™

COHEDRA™ COMPACT

MANUAL 3.2

ENGLISH

Important Safety Instructions

Before connecting, read instructions

- Read all of these instructions!
- Save these instructions for later use!
- Follow all warnings and instructions marked on the product!
- Do not use this product near water, i.e. bathtub, sink, swimming pool, wet basement, etc.
- Do not place this product on an unstable cart, stand or table. The product may fall, causing serious damage to the product or to persons!
- Slots and openings in the cabinet and the back or bottom are provided for ventilation; to ensure reliable operation of the product and to protect it from overheating, these openings must not be blocked or covered. This product should not be placed in a built-in installation unless proper ventilation is provided.
- This product should not be placed near a source of heat such as a stove, radiator, or another heat producing amplifier.
- Use only the supplied power supply or power cord. If you are not sure of the type of power available, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where persons will walk on the cord.
- Never break off the ground pin on the power supply cord.
- Power supply cords should always be handled carefully. Periodically check cords for cuts or sign of stress, especially at the plug and the point where the cord exits the unit.
- The power supply cord should be unplugged when the unit is to be unused for long periods of time.
- If this product is to be mounted in an equipment rack, rear support should be provided.
- This product should be used only with a cart or stand that is recommended by HK AUDIO®.
- Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in risk of fire or electric shock. Never spill liquid of any kind on the product.
- Do not attempt to service this product yourself, as opening or removing covers may expose you to dangerous voltage points or other risks. Refer all servicing to qualified service personnel.
- Clean only with dry cloth.
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for the safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Place the product always in a way that the mains switch is easily accessible.
- Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
- When the power cord or plug is damaged or frayed.
- If liquid has been spilled into the product.
- If the product has been exposed to rain or water.
- If the product does not operate normally when the operating instructions are followed.
- If the product has been dropped or the cabinet has been damaged.
- If the product exhibits a distinct change in performance, indicating a need of service!
- Adjust only these controls that are covered by the operating instructions since improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to -normal operation.
- Exposure to extremely high noise levels may cause a permanent hearing loss.
- Individuals vary considerably in susceptibility to noise induced hearing loss, but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a sufficient time. The U.S. Government´s Occupational Safety and Health Administration (OSHA) has specified the following permissible noise level exposures:

Duration Per Day In Hours	Sound Level dBA, Slow Response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

- According to OSHA, any exposure in excess of the above permissible limits could result in some hearing loss.
- Ear plug protectors in the ear canals or over the ears must be worn when operating this amplification system in order to prevent a permanent hearing loss if exposure is in excess of the limits as set forth above. To ensure against potentially dangerous exposure to high sound pressure levels, it is recommended that all persons exposed to equipment capable of producing high sound pressure levels such as this amplification system be protected by hearing protectors while this unit is in operation.
- Fuses: Replace with IEC 127 (5x 20 mms) type and rated fuse for best performance only.

- TO PREVENT THE RISK OF FIRE AND SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO MOISTURE OR RAIN. DO NOT OPEN CASE; NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

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Important Advice on Safety!

Please read before use and keep for later use!

- The unit has been built by HK AUDIO® in accordance with IEC 60065 and left the factory in safe working order. To maintain this condition and ensure non-risk operation, the user must follow the advice and warning comments found in the operating instructions. The unit conforms to Protection Class 1 (protectively earthed).
- HK AUDIO® ONLY GUARANTEE THE SAFETY, RELIABILITY AND EFFICIENCY OF THE UNIT IF:
- Assembly, extension, re-adjustment, modifications or repairs are carried out by HK AUDIO® or by persons authorized to do so.
- The electrical installation of the relevant area complies with the requirements of IEC (ANSI) specifications.
- The unit is used in accordance with the operating instructions.
- The unit is regularly checked and tested for electrical safety by a competent technician.

WARNING

- If covers are opened or sections of casing are removed, except where this can be done manually, live parts can become exposed.
- If it is necessary to open the unit this must be insulated from all power sources. Please take this into account before carrying out adjustments, maintenance, repairs and before replacing parts.
- The appliance can only be insulated from all power sources if the mains connection is unplugged.
- Adjustment, maintenance and repairs carried out when the unit has been opened and is still live may only be performed by specialist personnel who are authorized by the manufacturer (in accordance with VBG 4) and who are aware of the associated hazards.
- Loudspeaker outputs which have the IEC 417/5036 symbol (Diagram 1, below) can carry voltages which are hazardous if they are made contact with. Before the unit is switched on, the loudspeaker should therefore only be connected using the lead recommended by the manufacturer.
- Where possible, all plugs on connection cables must be screwed or locked onto the casing.
- Replace fuses only with IEC127 type and specified ratings.
- It is not permitted to use repaired fuses or to short-circuit the fuse holder.
- Never interrupt the protective conductor connection.
- Surfaces which are equipped with the "HOT" mark (Diagram 2, below), rear panels or covers with cooling slits, cooling bodies and their covers, as well as tubes and their covers are purposely designed to dissipate high temperatures and should therefore not be touched.
- High loudspeaker levels can cause permanent hearing damage. You should therefore avoid the direct vicinity of loudspeakers operating at high levels. Wear hearing protection if continuously exposed to high levels.

MAINS CONNECTION

- The unit is designed for continuous operation.
- The set operating voltage must match the local mains supply voltage.
- The unit is connected to the mains via the supplied power unit or power cable.
- Power unit: Never use a damaged connection lead. Any damage must be rectified by a competent technician.
- Avoid connection to the mains supply in distributor boxes together with several other power consumers.
- The plug socket for the power supply must be positioned near the unit and must be easily accessible.

PLACE OF INSTALLATION

- The unit should stand only on a clean, horizontal working surface.
- The unit must not be exposed to vibrations during operation.
- Place the product always in a way that the mains switch is easily accessible.
- Keep away from moisture and dust where possible.
- Do not place the unit near water, baths, wash basins, kitchen sinks, wet areas, swimming pools or damp rooms. Do not place objects containing liquid on the unit - vases, glasses, bottles etc.
- Ensure that the unit is well ventilated.
- Any ventilation openings must never be blocked or covered. The unit must be positioned at least 20 cm away from walls. The unit may only be fitted in a rack if adequate ventilation is ensured and if the manufacturer's installation instructions are followed.
- Keep away from direct sunlight and the immediate vicinity of heating elements and radiant heaters or similar devices.
- If the unit is suddenly moved from a cold to a warm location, condensation can form inside it. This must be taken into account particularly in the case of tube units. Before switching on, wait until the unit has reached room temperature.
- Accessories: Do not place the unit on an unsteady trolley, stand, tripod, base or table. If the unit falls down, it can cause personal injury and itself become damaged. Use the unit only with the trolley, rack stand, tripod or base recommended by the manufacturer or purchased together with the unit. When setting the unit up, all the manufacturer's instructions must be followed and the setup accessories recommended by the manufacturer must be used. Any combination of unit and stand must be moved carefully. A sudden stop, excessive use of force and uneven floors can cause the combination of unit and stand to tip over.
- Additional equipment: Never use additional equipment which has not been recommended by the manufacturer as this can cause accidents.
- To protect the unit during bad weather or when left unattended for prolonged periods, the mains plug should be disconnected. This prevents the unit being damaged by lightning and power surges in the AC mains supply.

Diagram 1

Diagram 2



Wichtige Sicherheitshinweise!

Bitte vor Gebrauch lesen und für späteren Gebrauch aufbewahren!

- Das Gerät wurde von HK AUDIO® gemäß IEC 60065 gebaut und hat das Werk in sicherheitstechnisch einwandfreiem Zustand verlassen. Um diesen Zustand zu erhalten und einen gefahrlosen Betrieb sicherzustellen, muss der Anwender die Hinweise und die Warnvermerke beachten, die in der Bedienungsanleitung enthalten sind. Das Gerät entspricht der Schutzklasse I (schutzgeerdet).
- DIE SICHERHEIT, ZUVERLÄSSIGKEIT UND LEISTUNG DES GERÄTES WIRD VON HK AUDIO® NUR DANN GEWÄHRLEISTET, WENN:
- Montage, Erweiterung, Neueinstellung, Änderungen oder Reparaturen von HK AUDIO® oder von dazu ermächtigten Personen ausgeführt werden.
- die elektrische Installation des betreffenden Raumes den Anforderungen von IEC (ANSI)-Festlegungen entspricht.
- das Gerät in Übereinstimmung mit der Gebrauchsanweisung verwendet wird.

WARNUNG

- Wenn Abdeckungen geöffnet oder Gehäuseteile entfernt werden, außer wenn dies von Hand möglich ist, können Teile freigelegt werden, die Spannung führen.
- Wenn ein Öffnen des Gerätes erforderlich ist, muss das Gerät von allen Spannungsquellen getrennt sein. Berücksichtigen Sie dies vor dem Abgleich, vor einer Wartung, vor einer Instandsetzung und vor einem Austausch von Teilen.
- Ein Abgleich, eine Wartung oder eine Reparatur am geöffneten Gerät unter Spannung darf nur durch eine vom Hersteller autorisierte Fachkraft (nach VBG 4) geschehen, die mit den verbundenen Gefahren vertraut ist.
- Lautsprecher-Ausgänge, die mit dem IEC 417/5036-Zeichen (Abb.1, s.unten) versehen sind können berührungsgefährliche Spannungen führen. Deshalb vor dem Einschalten des Gerätes Verbindung nur mit dem vom Hersteller empfohlenen Anschlusskabel zum Lautsprecher herstellen.
- Alle Stecker an Verbindungskabeln müssen mit dem Gehäuse verschraubt oder verriegelt sein, sofern möglich.
- Es dürfen nur Sicherungen vom Typ IEC 127 und der angegebenen Nennstromstärke verwendet werden.
- Eine Verwendung von geflickten Sicherungen oder Kurzschließen des Halters ist unzulässig.
- Niemals die Schutzleiterverbindung unterbrechen.
- Oberflächen, die mit dem "HOT"-Zeichen (Abb.2, s.unten) versehen sind, Rückwände oder Abdeckungen mit Kühlschlitzen, Kühlkörper und deren Abdeckungen, sowie Röhren und deren Abdeckungen können im Betrieb erhöhte Temperaturen annehmen und sollten deshalb nicht berührt werden.
- Hohe Lautstärkepegel können dauernde Gehörschäden verursachen. Vermeiden Sie deshalb die direkte Nähe von Lautsprechern, die mit hohen Pegeln betrieben werden. Verwenden Sie einen Gehörschutz bei dauernder Einwirkung hoher Pegel.

NETZANSCHLUSS

- Das Gerät ist für Dauerbetrieb ausgelegt.
- Die eingestellte Betriebsspannung muss mit der örtlichen Netzspannung übereinstimmen.
- Der Anschluss an das Stromnetz erfolgt mit dem mitgelieferten Netzteil oder Netzkabel.
- Netzteil: Eine beschädigte Anschlussleitung kann nicht ersetzt werden. Das Netzteil darf nicht mehr betrieben werden.
- Vermeiden Sie einen Anschluss an das Stromnetz in Verteilerdosen zusammen mit vielen anderen Stromverbrauchern.
- Die Steckdose für die Stromversorgung muss nahe am Gerät angebracht und leicht zugänglich sein.

AUFSTELLUNGSORT

- Das Gerät sollte nur auf einer sauberen, waagerechten Arbeitsfläche stehen.
- Das Gerät darf während des Betriebs keinen Erschütterungen ausgesetzt sein.
- Feuchtigkeit und Staub sind nach Möglichkeit fernzuhalten.
- Das Gerät muss immer so aufgestellt werden, dass der Netzschalter frei zugänglich ist.
- Das Gerät darf nicht in der Nähe von Wasser, Badewanne, Waschbecken, Küchenspüle, Nassraum, Swimmingpool oder feuchten Räumen betrieben werden. Keine mit Flüssigkeit gefüllten Gegenstände -Vase, Gläser, Flaschen etc. auf das Gerät stellen.
- Sorgen Sie für ausreichende Belüftung der Geräte.
- Eventuelle Ventilationsöffnungen dürfen niemals blockiert oder abgedeckt werden. Das Gerät muss mindestens 20 cm von Wänden entfernt aufgestellt werden. Das Gerät darf nur dann in ein Rack eingebaut werden, wenn für ausreichende Ventilation gesorgt ist und die Einbauanweisungen des Her-stellers eingehalten werden.
- Vermeiden Sie direkte Sonneneinstrahlung sowie die unmittelbare Nähe von Heizkörpern und Heizstrahlern oder ähnlicher Geräte.
- Wenn das Gerät plötzlich von einem kalten an einen warmen Ort gebracht wird, kann sich im Geräteinnern Kondensfeuchtigkeit bilden. Dies ist insbesondere bei Röhrengeräten zu beachten. Vor dem Einschalten solange warten bis das Gerät Raumtemperatur angenommen hat.
- Zubehör: Das Gerät nicht auf einen instabilen Wagen, Ständer, Dreifuß, Untersatz oder Tisch stellen. Wenn das Gerät herunterfällt, kann es Personenschäden verursachen und selbst beschädigt werden. Verwenden Sie das Gerät nur mit einem vom Hersteller empfohlenen oder zusammen mit dem Gerät verkauften Wagen, Rack, Ständer, Dreifuß oder Untersatz. Bei der Aufstellung des Gerätes müssen die Anweisungen des Herstellers befolgt und muss das vom Hersteller empfohlene Aufstellzubehör verwendet werden. Eine Kombination aus Gerät und Gestell muss vorsichtigt bewegt werden. Plötzliches Anhalten, übermäßige Kraftanwendung und ungleichmäßige Böden können das Umkippen der Kombination aus Gerät und Gestell bewirken.
- Zusatzvorrichtungen: Verwenden Sie niemals Zusatzvorrichtungen, die nicht vom Hersteller empfohlen wurden, weil dadurch Unfälle verursacht werden können
- Zum Schutz des Gerätes bei Gewitter oder wenn es längere Zeit nicht beaufsichtigt oder benutzt wird, sollte der Netzstecker gezogen werden. Dies verhindert Schäden am Gerät aufgrund von Blitzschlag und Spannungsstößen im Wechselstromnetz.

Abb. 1



Abb. 2



Conseils de Securite Importants!

Priere de lire avant l'emploi et a conserver pour utilisation ulterieure!

- L'appareil a été conçu par HK AUDIO® selon la norme IEC 60065 et a quitté l'entreprise dans un état irréprochable. Afin de conserver cet état et d'assurer un fonctionnement sans danger de l'appareil nous conseillons à l'utilisateur la lecture des indications de sécurité contenues dans le mode d'emploi. L'appareil est conforme à la classification I (mise à terre de protection).
- SURETE, FIABILITE ET EFFICACITE DE L'APPAREIL NE SONT GARANTIS PAR HK AUDIO® QUE SI:
- Montage, extension, nouveau réglage, modification ou réparation sont effectués par HK AUDIO® ou par toute personne autorisée par HK AUDIO®.
- L'installation électrique de la pièce concernée correspond aux normes IEC (ANSI).
- L'utilisation de l'appareil suit le mode d'emploi.

AVERTISSEMENT

- A moins que cela ne soit manuellement possible, tout enlèvement ou ouverture du boîtier peut entrainer la mise au jour de pieces sous tension.
- Si l'ouverture de l'appareil est nécessaire, celui-ci doit être coupé de chaque source de courant. Ceci est à prendre en considération avant tout ajustement, entretien, réparation ou changement de pieces.
- Ajustement, entretien ou réparation sur l'appareil ouvert et sous tension ne peuvent être éffectués que par un spécialiste autorisé par le fabricant (selon VBG4). Le spécialiste étant conscient des dangers liés à ce genre de réparation.
- Les sorties de baffles qui portent le signe IEC 417/5036 (fig. 1, voir en bas) peuvent être sous tension dangereuse. Avant de brancher l'appareil utiliser uniquement le câble de raccordement conseillé par le fabricant pour raccorder les baffles.
- Toutes les prises des câbles de raccordement doivent être, si possible, vissées ou verrouillées sur le boîtier.
- L'utilisation de fusibles rafistolés ou court-circuites est inadmissible – seulement: IEC127.
- L'utilisation de fusibles rafistolés ou court-circuites est inadmissible.
- Ne jamais interrompre la connexion du circuit protecteur.
- Il est conseillé de ne pas toucher aux surfaces pourvues du signe "HOT" (fig. 2, voir en bas), aux parois arrières ou caches munis de fentes d'aération, éléments d'aération et leurs caches ansi qu'aux tubes et leurs caches. Ces éléments pouvant atteindre des températures élévées pendant l'utilisation de l'appareil.
- Les Niveaux de puissance élévés peuvent entrainer des lésions auditives durables. Evitez donc la proximité de haut-parleurs utilisés à haute puissance. Lors de haute puissance continue utilisez une protection auditive.

BRANCHEMENT SUR LE SECTEUR

- L'appareil est conçu pour une utilisation continue.
- La tension de fonctionnement doit concorder avec la tension secteur locale.
- Le raccordement au réseau éléctrique s'effectue avec l'adaptateur ou le cordon d´alimentation livré avec l'appareil.
- Adaptateur: Un câble de raccordement abimé ne peut être remplacé. L'adaptateur est inutilisable.
- Evitez un raccordement au réseau par des boîtes de distribution surchargées.
- La prise de courant doit être placée à proximité de l'appareil et facile à atteindre.

LIEU D'INSTALLATION

- L'appareil doit être placé sur une surface de travail propre et horizontale.
- L'appareil en marche ne doit en aucun cas subir des vibrations.
- Posez l'appareil en place de sorte que l'interrupteur du réseau reste accessible facilement.
- Evitez dans la mesure du possible poussière et humidité.
- L'appareil ne doit pas être placé à proximité d'eau, de baignoire, lavabo, évier, pièce d'eau, piscine ou dans une pièce humide. Ne placez aucun vase, verre, bouteille ou tout objet rempli de liquide sur l'appareil.
- L'appareil doit être suffisamment aéré.
- Ne jamais recouvrir les ouvertures d'aération. L'appareil doit être placé à 20 cm du mur au minimum. L'appareil peut être monté dans un Rack si une ventilation suffisante est possible et si les conseils de montage du fabricant sont suivis.
- Evitez les rayons de soleil et la proximité de radiateurs, chauffages etc.
- Une condensation d'eau peut se former dans l'appareil si celui-ci est transporté brusquement d'un endroit froid à un endroit chaud. Ceci est particulièrement important pour des appareils à tubes. Avant de brancher l'appareil attendre qu'il ait la température ambiante.
- Accessoires: L'appareil ne doit être placé sur un chariot, support, trépied, bâti ou table instable. Une chute de l'appareil peut entrainer aussi bien des dommages corporels que techniques. Utilisez l'appareil uniquement avec un chariot, Rack, support, trépied ou bâti conseillé par le fabricant ou vendu en combinaison avec l'appareil. Les indications du fabricant pour l'installation de l'appareil sont à suivre, et les accessoires d'installation conseillés par le fabricant sont à utiliser. Un ensemble support et appareil doit être déplacé avec précaution. Des mouvements brusques et des revêtements de sol irreguliers peuvent entrainer la chute de l´ensemble.
- Equipements supplémentaires: Ne jamais utiliser un équipement supplémentaire n'ayant pas été conseillé par le fabricant, ceci pouvant entrainer des accidents.
- Afin de protéger l'appareil pendant un orage ou s'il ne doit pas être utilisé pendant un certain temps, il est conseillé d'enlever la prise au secteur. Ceci évite des dommages dûs à la foudre ou à des coups de tension dans le réseau à courant alternatif.

Fig. 1 

Fig. 2 

Importanti avvertimenti di sicurezza!

Leggere attentamente prima dell'uso e conservare per un utilizzo successivo:

- L'apparecchio è stato costruito dalla HK AUDIO® secondo la normativa europea IEC 60065 ed ha lasciato il nostro stabilimento in stato ineccepibile. Per garantire il mantenimento di tale stato e un utilizzo assolutamente privo di rischi l'utente è tenuto ad osservare le indicazioni e gli avvertimenti di sicurezza contenuti nelle istruzioni per l'uso. L'apparecchio rispecchia il livello di -sicurezza I (collegato a terra).
- Sicurezza, affidabilità e prestazioni dell'apparecchio vengono garantiti dalla HK AUDIO® solo ed esclusivamente se:
- Montaggio, ampliamento, rimessa a punto, modifiche e riparazioni vengono eseguite dalla HK AUDIO® stessa o da personale da essa autorizzato.
- Gli impianti elettrici nei locali prescelti per l'uso dell'apparecchio rispondono alle normative stabilite dall'ANSI.
- L'apparecchio viene utilizzato come indicato nel libretto delle istruzioni per l'uso.

AVVERTIMENTI

- In caso di apertura di parti di rivestimento o rimozione di parti dell'involucro, a meno che non si tratti di pezzi rimovibili semplicemente a mano, possono venire alla luce parti dell'apparecchio conduttrici di tensione.
- Se l'apertura dell'apparecchio dovesse risultare necessaria è indispensabile staccare precedentemente quest'ultimo da tutte le fonti di tensione. Rispettare tale misura di prevenzione anche prima di un allineamento, di operazioni di manutenzione, della messa in esercizio o della sostituzione di componenti all'interno dell'apparecchio.
- Allineamento, operazioni di manutenzione o eventuali riparazioni dell'apparecchio in presenza di tensione vanno eseguite esclusivamente da personale -specializzato ed autorizzato, in grado di eseguire tali operazioni evitandone i rischi connessi.
- Le uscite degli altoparlanti contrassegnate dai caratteri IEC 417/5036 (vedi illustrazione 1 a fondo pag.) possono essere conduttrici di tensione pericolosa con cui evitare il contatto. Per questo motivo, prima di accendere l'apparecchio, collegare quest'ultimo agli altoparlanti servendosi esclusivamente del -cavetto d'allacciamento indicato dal produttore.
- Tutte le spine e i cavi di collegamento devono essere avvitati o fissati all'involucro dell'apparecchio per quanto possibile.
- Utilizzare esclusivamente fusibili del tipo IEC 127 con la indicata corrente nominale.
- L'utilizzo di fusibili di sicurezza non integri e la messa in corto circuito del sostegno di metallo sono proibite.
- Non interrompere mai il collegamento con il circuito di protezione.
- Superfici contrassegnate dalla parola "HOT" (vedi illustrazione 2 a fondo pag.), cosi come griglie di aerazione, dispositivi di raffreddamento e i loro rivestimenti di protezione, oppure valvole e i relativi rivestimenti protettivi possono surriscaldarsi notevolmente durante l'uso e per questo motivo non vanno toccate.
- L'ascolto di suoni ad alto volume può provocare danni permanenti all'udito. Evitate perciò la diretta vicinanza con altoparlanti ad alta emissione di suono e utilizzate cuffie protettive in caso ciò non sia possibile.

ALIMENTAZIONE

- L'apparecchio è concepito per il funzionamento continuo.
- La tensione di esercizio deve corrispondere alla tensione di rete a cui ci si allaccia.
- L'allacciamento alla rete elettrica avviene tramite alimentatore o cavetto d'alimentazione consegnato insieme all'apparecchio.
- Alimentatore: un cavo di connessione danneggiato non può essere sostituito. L'alimentatore non può più essere utilizzato.
- Evitate un allacciamento alla rete di corrente utilizzando cassette di distribuzione sovraccariche.
- La spina di corrente deve essere situata nelle vicinanze dell'apparecchio e facilmente raggiungibile in qualsiasi momento.

LOCALI DI COLLOCAMENTO

- Opportuno collocare l'apparecchio su una superficie pulita e orizzontale.
- Non sottoporre l'apparecchio in funzione a scosse e vibrazioni.
- L'apparecchio deve essere posizionato sempre in modo da assicurare il libero accesso all'interruttore di alimentazione.
- Proteggere l'apparecchio per quanto possibile da umidità e polvere.
- Non collocare l'apparecchio vicino ad acqua, vasche da bagno, lavandini, lavelli da cucina, locali umidi o piscine. Non appoggiare recipienti contenenti liquidi - vasi, bicchieri, bottiglie, ecc. - sull'apparecchio.
- Provvedere ad una buone aerazione dell'apparecchio.
- Eventuali aperture previste per la ventilazione dell'apparecchio non vanno ne bloccate, ne mai coperte. L'apparecchio va collocato ad almeno 20 cm di distanza dalle pareti circostanti e può essere inserito tra altre componenti di un impianto solo in caso di sufficiente ventilazione e qualora le direttive di montaggio del produttore vengano rispettate.
- Evitare di esporre l'apparecchio ai raggi del sole e di collocarlo direttamente nelle vicinanze di fonti di calore come caloriferi, stufette, ecc.
- Se l'apparecchio viene trasportato rapidamente da un locale freddo ad uno riscaldato può succedere che al suo interno si crei della condensa. Ciò va tenuto in considerazione soprattutto in caso di apparecchi a valvole. Attendere che l'apparecchio abbia assunto la temperatura ambiente prima di accenderlo.
- Accessori: non collocare l'apparecchio su carrelli, supporti, treppiedi, superfici o tavoli instabili. Se l'apparecchio dovesse cadere a terra potrebbe causare danni a terzi o danneggiarsi irreparabilmente. Utilizzate per il collocamento dell'apparecchio supporti, treppiedi e superfici che siano consigliate dal produttore o direttamente comprese nell'offerta di vendita. Per il collocamento dell'apparecchio attenetevi strettamente alle istruzioni del produttore, utilizzando esclusivamente accessori da esso consigliati. L'apparecchio in combinazione ad un supporto va spostato con molta attenzione. Movimenti bruschi o il collocamento su pavimenti non piani possono provocare la caduta dell'apparecchio e del suo supporto.
- Accessori supplementari: non utilizzate mai accessori supplementari che non siano consigliati dal produttore, potendo essere ciò causa di incidenti.
- Per proteggere l'apparecchio in caso di temporali o nel caso questo non venisse utilizzato per diverso tempo si consiglia di staccarne la spina di corrente. In questo modo si evitano danni all'apparecchio dovuti a colpi di fulmine o ad improvvisi aumenti di tensione nel circuito di corrente alternata.

Illustrazione 1 

Illustrazione 2 

¡Indicaciones de seguridad importantes!

¡Léanse antes de utilizar el aparato y guardense para so uso posterior!

- El aparato ha sido producido por HK AUDIO® según el IEC 60065 y salió de la fábrica en un estado técnicamente perfecto. Para conservar este estado y asegurar un funcionamiento sin peligros el usuario debe tener en cuenta las indicaciones y advertencias contenidas en las instrucciones de manejo. El aparato corresponde a la clase de protección I (toma de tierra protegida).
- LA SEGURIDAD, LA FIABILIDAD Y EL RENDIMIENTO DEL APARATO SOLO ESTÁN GARANTIZADOS POR HK AUDIO® CUANDO:
- el montaje, la ampliación, el reajuste, los cambios o las reparaciones se realicen por HK AUDIO® o por personas autorizadas para HK AUDIO®;
- la instalación eléctrica del recinto en cuestión corresponda a los requisitos de la determinación del IEC (ANSI);
- el aparato se use de acuerdo con las indicaciones de uso.

ADVERTENCIA

- Si se destapan protecciones o se retiran piezas de la carcasa, exceptuando si se puede hacer manualmente, se pueden dejar piezas al descubierto que sean conductoras de tensión.
- Si es necesario abrir el aparato, éste tiene que estar aislado de todas las fuentes de alimentación. Esto se debe tener en cuenta antes del ajuste, de un entretenimiento, de una reparación y de una sustitución de las piezas.
- Un ajuste, un entretenimiento o una reparación en el aparato abierto y bajo tensión sólo puede ser llevado a cabo por un especialista autorizado por el productor (según VBG 4) que conozca a fondo los peligros que ello conlleva.
- Las salidas de altavoces que estén provistas de la característica IEC 417/5036 (figura 1, véase abajo) pueden conducir tensiones peligrosas al contacto. Por ello es indispensable que antes de poner en marcha el aparato; la conexión se haya realizado únicamente con el cable de empalmes recomendado por el productor.
- Las clavijas de contacto al final de los cables conectores tienen que estar atornilladas o enclavadas a la carcasa, en tanto que sea posible.
- Sólo se pueden utilizar fusibles del tipo IEC 127 con la intensidad de corriente nominal indicada.
- El uso de fusibles reparados o la puesta en cortocircuito del soporte es inadmisible.
- El empalme del conductor de protección no se puede interrumpir en ningún caso.
- Las superficies provistas de la característica "HOT" (figura 2, véase abajo), los paneles de fondo trasero o las protecciones con ranuras de ventilación, los cuerpos de ventilación y sus protecciones, así como las válvulas electrónicas y sus protecciones pueden alcanzar temperaturas muy altas durante el funcionamiento y por ello no se deberían tocar.
- Niveles elevados de la intensidad de sonido pueden causar continuos daños auditivos; por ello debe evitar acercarse demasiado a altavoces que funcionen a altos niveles. En tales casos utilice protecciones auditivas.

ACOMETIDA A LA RED

- El aparato está proyectado para un funcionamiento continuo.
- La tensión de funcionamiento ajustada tiene que coincidir con la tensión de la red del lugar.
- La conexión a la red eléctrica se efectuará con la fuente de alimentación o con el cable de red que se entreguen con el aparato.
- Fuente de alimentación: una linea de conexión dañada no se puede sustituir. La fuente de alimentación no puede volver a ponerse en funcionamiento.
- Evite una conexión de la red eléctrica a distribuidores con muchas tomas de corriente.
- El enchufe para el suministro de corriente tiene que estar cerca del aparato y ser de fácil acceso.

SITUACION

- El aparato debería estar situado en una superficie limpia y totalmente horizontal.
- El aparato no puede estar expuesto a ningún tipo de sacudidas durante su funcionamiento.
- Coloque el dispositivo de forma que el interruptor de la red quede accessible facilmente.
- Se deben evitar la humedad y el polvo.
- El aparato no puede ponerse en funcionamiento cerca del agua, la bañera, el lavamanos, la pila de la cocina, un recinto con tuberías de agua, la piscina o en habitaciones húmedas. Tampoco se pueden poner objetos llenos de líquido - jarrones, vasos, botellas, etc. - encima de él.
- Procure que el aparato tenga suficiente ventilación.
- Las aberturas de ventilación existentes no se deben bloquear ni tapar nunca. El aparato debe estar situado como mínimo a 20 cm de la pared. El aparato sólo se puede montar en un rack, si se ha procurado la suficiente ventilación y se han cumplido las indicaciones de montaje del productor.
- Evite los rayos del sol directos así como la proximidad a radiadores, electro--radiadores o aparatos similares.
- Si el aparato pasa repentinamente de un lugar frío a otro caliente, se puede condensar humedad en su interior. Esto se debe tener en cuenta sobretodo en los aparatos con válvulas electrónicas. Antes de poner en marcha el aparato se debe esperar hasta que éste haya adquirido la temperatura ambiental.
- Accesorios: el aparato no se puede colocar encima de carros, estantes, trípodes, soportes o mesas inestables. Si el aparato se cae puede causar daños personales y se puede estropear. Coloque el aparato sólo en un carro, rack, estante, trípode o soporte recomendado por el productor o que se le haya vendido junto con el aparato. En la instalación se deben seguir las indicaciones del productor así como utilizar los accesorios recomendados por el mismo para colocarlo encima. El conjunto del aparato con el pedestal se debe mover con mucho cuidado. Un paro brusco, la aplicación de una fuerza desmesurada o un suelo irregular puede ocasionar la caida de todo el conjunto.
- Piezas adicionales: no utilice nunca piezas adicionales que no estén recomendadas por el productor, ya que se podrían provocar accidentes.
- Para protejer el aparato de una tormenta o si no se supervisa ni utiliza durante algún tiempo, se debería desconectar la clavija de la red. Así se evitan daños en el aparato a causa de un rayo y golpes de tensión en la red de corriente alterna.

Figura 1

Figura 2

PREFACE

This manual is addressed to all technicians who are responsible for setting up, operating and maintaining the HK Audio® Cohedra™ Compact system. In addition, we would like to explain in detail the principles and functions of HK Audio® Cohedra™ technology to all interested planning and installation engineers.

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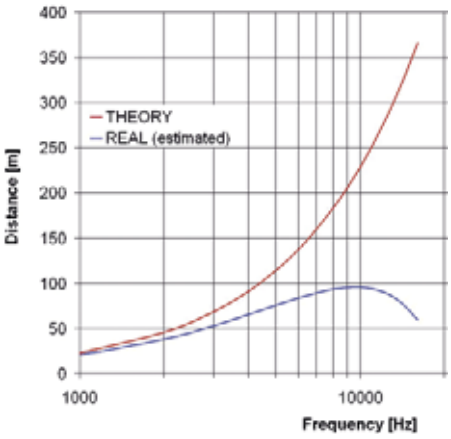


Figure 1: Comparison of a 4 m array's near-to-far field transition in theory and practice

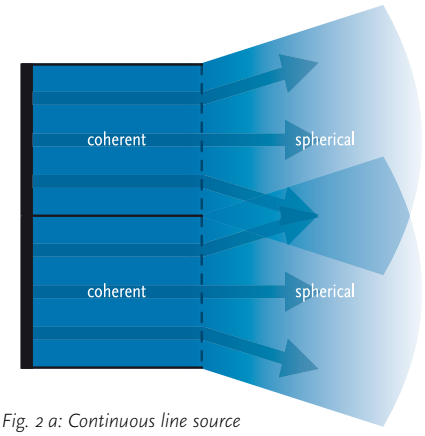


Fig. 2 a: Continuous line source

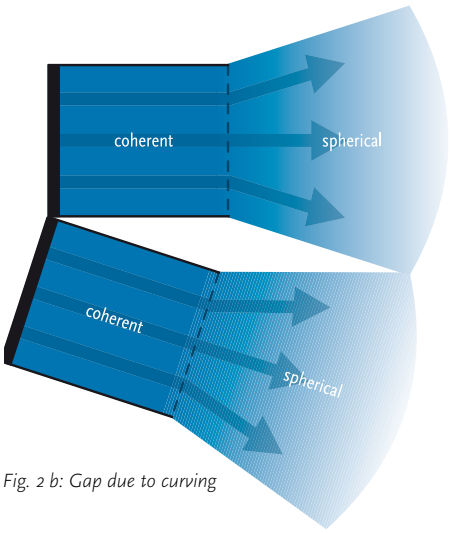


Fig. 2 b: Gap due to curving

1 Line Array Approaches in Recent Years

Line arrays are a fixture on the contemporary sound reinforcement scene. The design principle has its origins in the stacks of cone loudspeakers that were popular in the '70s.
Some 20 years later, the coherent wave front's ingress into the high frequency range through waveguides and acoustical mirrors ushered in a second generation of line arrays.

Here a line source makes use of the near field's diffusion. At a certain distance, the radiated cylindrical wave front's near field transitions into a spherical wave front. This transition from a cylindrical to a spherical wave is contingent upon the length of the radiator and the radiated frequency. The following formula by Christian Heil serves to calculate the distance at which this transition occurs:

$$d_B = \frac{3}{2} FH^2 \sqrt{1 - \frac{1}{(3FH)^2}}$$

H in meters, f in kHz

Mark Ureda, in turn, proposed a somewhat different formula for calculating the ratio between the near and far fields:

$$r \approx \frac{l^2 \cdot f}{700}$$

l in meters, f in Hz

However, when these formulae are charted in a graphical comparison, it is evident that their results are quite similar.

Though in general it would appear that all aspects of modern line arrays have been described ex-haustively, practical applications reveal some deficiencies.

According to the aforementioned formulae, at a frequency of 16 kHz the near field of a line array with the length of 4 m extends out to 380 m!
Anyone who has heard a line array of comparable size perform is sure to confirm that this great a range cannot be attained in a real-world scenario.
The fact is that these values must be scaled down substantially (see Fig. 1). Consequently, the aforementioned formulae for a continuous line source are more theoretical in nature.

Why these differences between theory and practice, and why does a cylindrical wave transition into a spherical wave front rather than diffuse infinitely?

The answer is quite simple in view of the molecular structure of air. Air molecules offer frictional resistance, impeding the sound wave's diffusion.
Some sound molecules drift outwards when the wave's impact excites inert molecules at its fringes. The cylindrical wave front's keen edges are smoothed by degrees, gradually transforming the cylindrical wave into a spherical wave front.
In mathematical terms, this can be described as a sound vector pointing slightly outward at its fringes. Because the velocity of propagation remains constant, the cylindrical wave slowly tran-sition into a spherical wave.

Technical literature describes the molecular frictional resistance of air as atmospheric absorption of sound, which increases exponentially as the frequency rises. Accordingly, frictional resistance is greater at higher frequencies, meaning that at higher frequencies, the transition described occurs at a closer distance (or smaller ratio).

Similar effects have been observed in analog technology where a square signal is smoothed by a low-pass filter. It can be said that at some point the signal regains a sine-like form.

Values that are possible in theory are again reduced in practice because the line source is not in fact continuous in the high frequency range; instead, it is composed of individual segments. Even with the most painstaking effort, it is impossible to prevent interference with or drop-outs of the continuous line source in practical applications because housings and edge diffraction inevitably cause some interference.

Furthermore, in theory this continuous line source would always be linear! However, gaps are created in the air when an array is curved, tearing the line source apart and further reducing the range.
In order to preclude the phenomenon of gaps created by curving, a line array would have to consist of very many individual elements (N=>00), which unfortunately is practically infeasible (see Fig. 2 a, 2 b).

An effort to take these deficiencies into account led to a next generation line array, with the following section examines.

Consequently, all the aforementioned formulae concerning a continuous line source are purely theoretical nature and must be qualified considerably in practical applications.

2 Development Objectives

2.1 High Frequency Range

The tweeter should radiate coherent waves throughout its frequency range. In addition, the phase position should be fine-tuned and tweaked to harmonize with the midrange woofer to afford the highest possible fidelity and natural response. In order to ensure uniform dispersion of sound, the driver should channel into a constant directivity horn that is free of undesirable diffractive effects and does not adulterate the sonic image.

2.2 Middle Frequency Range

Midrange frequencies should be projected in short, dry bursts. Homogenous dynamic response appropriate to the tweeter is also desirable. Like the tweeter's time-aligned frequencies, the midrange woofer should be time-aligned for all frequencies that it transmits. To fulfill a line array system's handling potential, its mid/high unit should satisfy the requirements of full-range voice applications.

2.3 Low Frequency Range

Low frequency energy should be dispersed into the air faster and with the greatest possible dynamic precision. A bass array with a large near field is desirable. Subwoofers should be designed for versatility, affording greatest flexibility in setup options.

3 Emphasized Radiation Technology™

So how does one go about developing a next generation line array? Emphasis is a familiar concept in analog technology. What this means is that those signal components that will later be dampened are emphasized first. To apply this concept to wave fronts, the fringes that are later smoothed must be emphasized first. In this case, emphasis means simply that the edge areas are projected earlier in time, forming a slightly inward curving wave front whose sound vectors face slightly inwards (see Figure 3 a).

When applied to a continuous line source, this creates a waveform as shown Fig. 3 b. Because large line arrays typically consist of several identical segments, a dedicated speaker would be required for each segment. Apart from the fact that such a continuous line source would be hard to implement, practical applications also mandate great flexibility, rendering such a concept in-feasible.

For these reasons, every element is curved slightly. (Fig. 3 c). Due to the gaps between the elements, which as stated above are inevitable anyway, both ends of every element's wave fronts are reshaped in the same way. A line source forms again at a certain distance (Fig. 3.1). Emphasized Radiation technology is thus able to sustain the even wave for a longer period, thereby significantly extending the line array's near field in the high frequency range!

To clarify the influence of the gap, the following examines the directivity of an ideal line array without gaps and of a line array with evenly and unevenly distributed gaps. Basically, it can be said that every line source is always accompanied by undesirable side lobes. Like interference, these side lobes are clearly audible artifacts and therefore extremely undesirable. Unfortunately, they cannot be avoided altogether, so it is important to minimize their level.

Figure 5 shows that an unevenly distributed gap (pink) causes more irregular and more pronounced side lobes. Without a gap (red) present, the array's first side lobe occurs at a level of -13.58 dB. When distributed across four elements of the same size (blue) with the gap accounting for 18 percent of the surface area, the level increases to -12.83 dB. If these gaps are distributed unevenly, the level of the first side lobe rises to -11.93 dB. This is nearly 1 dB higher than the level attained with the unevenly distributed gap alone!

It is very important that the gap is distributed as uniformly as possible across the full breadth of the radiator. COHEDRA® achieves this by using two different housing shapes for the mid/high array, affording the greatest possible uniformity in gap size for all typical configurations. This also ensures minimum variation in gap size for the J array, a configuration that today is used almost exclusively.

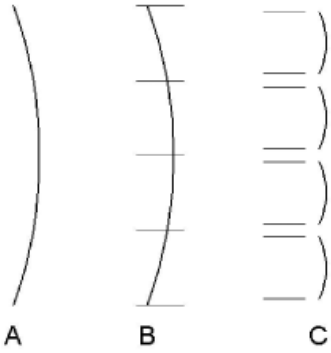


Figure 3 a-c: Emphasized radiation in a line array

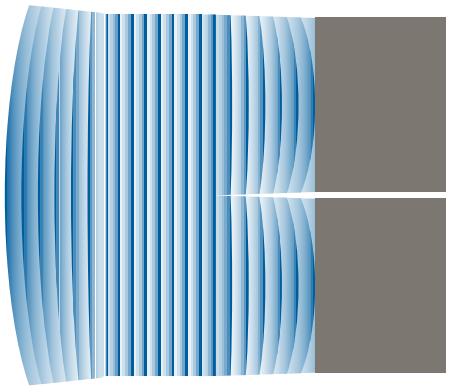


Figure 3.1: Extended line Array near-field

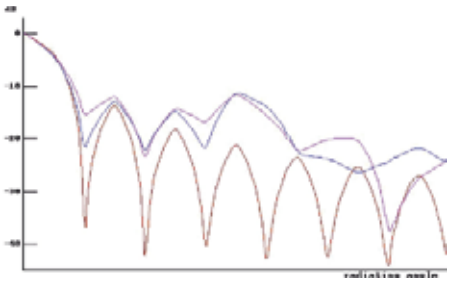


Figure 4: Effect without gap (red), with evenly distributed gap (blue), and with unevenly distributed gap (pink)

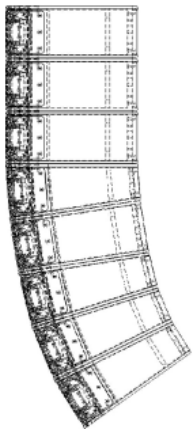


Figure 5: Typical J shape

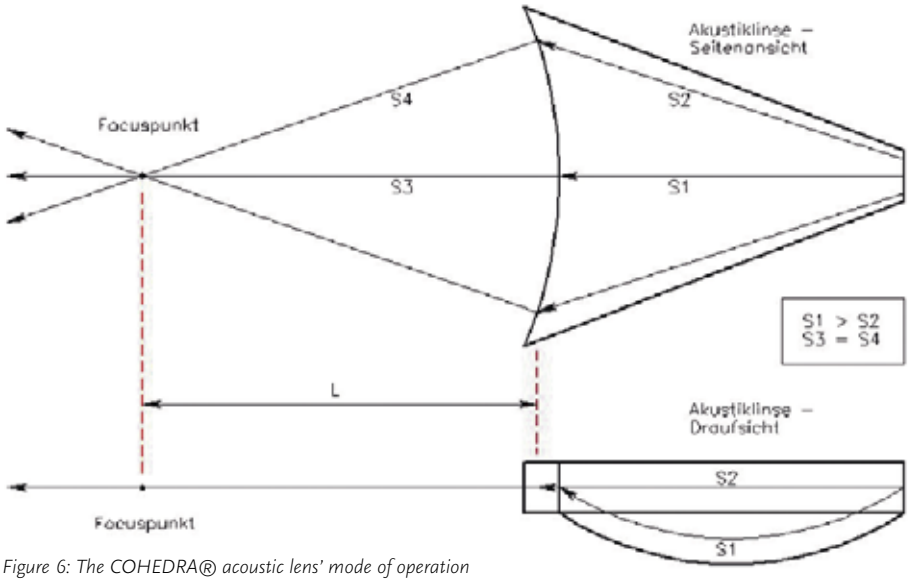


Figure 6: The COHEDRA® acoustic lens' mode of operation

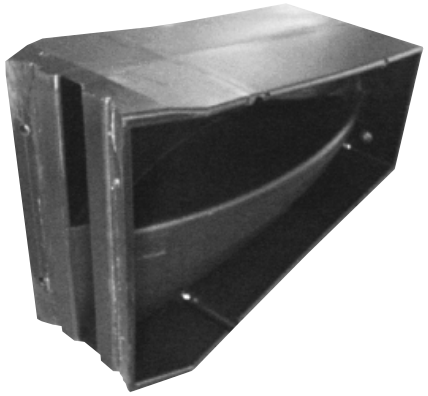


Figure 7: The COHEDRA® acoustic lens

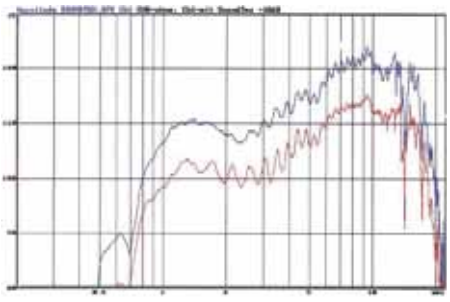


Figure 8: Effect of the synthetic fiber fleece

3.1 The High Frequency Wave Front

A specially developed and patented acoustic lens serves to curve the wave front. It transforms the spherical wave emitted by the high frequency driver into an inward curving wave front.

To shape a curved wave front, the sound wave's inner components are re-channeled into a bisected, centrically symmetrical array. In contrast to an axial symmetrical array, a centrically symmetrical array has the advantages of lower manufacturing tolerances. What's more the subdivided cavity enables fewer standing waves, thereby reducing interference.

Typically, these constructions are relatively long to minimize the differences between S1 and S2. However, acoustically speaking this creates something approaching an organ pipe. The only remedy is to connect a very large horn, an option that for technical reasons is often infeasible. A covering with a porous absorber is another possibility. Designed to reduce the velocity jump in sound particle acceleration, this covering must be acoustically very transparent.

To this end, COHEDRA® employs a special synthetic fiber fleece with defined aerodynamic resistance. This absorber reduces the velocity jump in sound particle acceleration, thereby helping considerably to homogenize frequency response. Figure 8 illustrates the fleece's effect. The red curve shows amplitude without fleece, the blue curve with fleece. The two curves are depicted in staggered formation only for the purpose of illustration.

3.2 Midrange

A frequently occurring and often cited drawback of line arrays is their sensitivity to wind. A look at the construction of conventional line arrays reveals that many do without a CD horn. Therefore, the HF pattern of throw is increasingly constricted. It is not uncommon for a radiation angle of an HF unit nominally rated for 120° to come to just 50° at 16 kHz. A light wind from the side audibly carries away the HF signal. In the case of conventional speaker clusters this is not so significant because several HF units are arrayed horizontally and these pick up the slack to provide HF sound reinforcement. In a line array, however, it is always just one HF unit that is arrayed horizontally to target a predetermined audience area!

A special speaker cover is located in front of the two 8" midrange speakers. Designed to shape the horn contour with CD characteristic in front of the acoustic lens, it is free of undesirable diffractive effects and does not adulterate the sonic image. It does not constrict the HF range and ensures greater stability in the face of gusts of wind.
The sound of the 8" speakers emanates through slots on the top and bottom of this cover. This enhances the dynamic balance in the range of 130 to 900 Hz.

In addition, the cover creates a compression chamber that behaves like an acoustical filter, suppressing frequencies that lie above the rendered frequency range. Rather than being dissipated, the energy is displaced to a lower frequency range, thereby substantially increasing efficiency in the rendered frequency range! Because the speaker now acts against a limited volume of air, distortion decreases so that very high levels can be achieved with little distortion, much like in a horn.

3.3 The Subwoofer-Truest Dynamic Response

A great drawback of conventional woofers is the considerable moving mass of the speaker (generally, 18"). As a result, low frequency reproduction is marred by dynamic distortion.
There is only way to satisfy the desire for the driest, cleanest possible low end response; that is to achieve the best possible impulse behavior. By definition, this requires a smaller speaker membrane with less moving mass. The answer is a special 10" woofer. Compared below is a typical 18"+12"+2" combination and the COHEDRA® solution. Notably, the speaker membrane's moving mass in the low and middle frequency ranges is clearly reduced.

Superior impulse behavior is also evident in the 10" speaker's transient response. In comparison with an 18" woofer, the membrane of the 10" woofer is able to move much faster because its transients are shorter.

The blue curve shows the in theory ideal response and the red curve indicates the 10" speaker's transient response. The purple curve shows the transient response of the 18" woofer. Measurements were taken using a second order, 130Hz low-pass filter.
New filtering approaches were necessary to make the most of the 10" woofer's capabilities, which is why the housing also sports some special design features. In combination with the bass reflex channel, the baffle boards form a horn, resulting in a higher level in the low frequency range. The long, lean chassis supports the formation of bass arrays as well as ground coupling. In addition, extremely compact clusters can be configured by setting enclosures on end. Because the loudspeaker chassis is tropic-proof, the enclosure can do without a level-dampening front covering.

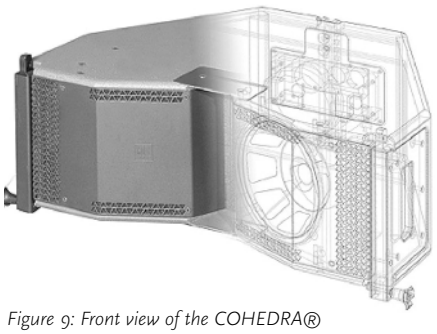


Figure 9: Front view of the COHEDRA® CDR 208 mid/high enclosure



Figure 10: 8" speaker cover serving as a CD horn and part of the compression chambe

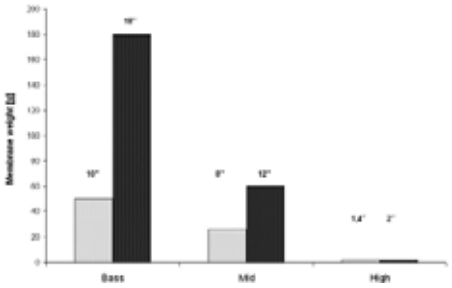


Figure 11: Comparison of moving masses

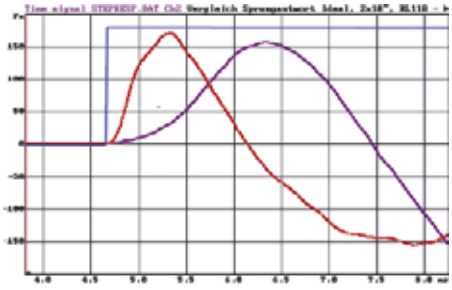


Figure 12: Impulse response: ideal (blue), 10" (red), 18" (purple)

CHAPTER B

THE COHEDRA® LOUDSPEAKERS

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Fig. 4: Cohedra CDR 210 F Sub 13

1 COHEDRA® LOUDSPEAKERS

1.1 CDR 208 S AND CDR 208 T MID/HIGH ENCLOSURES

Design and Construction of the Mid/High Enclosures
Two types of housings are available, the purpose of the different design being to optimize the typical "J" form of mid/high arrays. The CDR 208 S is housed in a straight rather than slanted cabinet. The CDR 208 T (T is short of trapezoidal) enclosure's top and bottom are slanted at 4.5° angles, a design that enables the configuration of sharply curving down-fills. CDR 208 S and CDR 208 T enclosures are made of 19 mm, 13-ply birch plywood and coated with water-repellent, black acrylic enamel. The baffle board cover consists of a metal grille that also serves as a compression chamber and a horn channel for the 1.4" driver.

The CDR 208 S and CDR 208 T weigh 30 kg. They are 65 cm wide, 25.5 and 24 cm high, respectively, and 60 cm deep (including rigging attachments). Two slot grips have been routed into the side panels for easy transport and set-up.

Serving to fly the enclosures are fully integrated rigging attachments comprising four quick-release pins and three rigging connectors, two mounted on the sides and one in the rear.

Electrical and Acoustical Data
CDR 208 S (T) enclosures feature two horn-loaded 8" cone chassis speakers and a 1.4" B&C high frequency driver with a front-mounted acoustic lens in a CD horn configuration. Aligned in a tri-axial array, the drivers are addressed via an internal passive crossover with a separating frequency of 800 hertz.

CDR 208 S (T) enclosures' nominal electrical power-handling capacity is 500 watts RMS at 8 ohms impedance. They produce a sound pressure level of 108 dB (1W@1m), measured under half-space conditions. Maximum SPL measured under the same conditions at a distance of one meter is 139 dB at 10% THD.

The CDR 208 S (T) enclosures' horizontal dispersion pattern is 80°. Frequency response ranges from 88 Hz to 16 kHz (±3 dB). The CDR 208 S (T) enclosures are thus able to provide sound reinforcement public address applications calling speech only without requiring a subwoofer.

Connections
The connector panel on the rear of CDR 208 S (T) enclosures is recessed to protect the ports from harm. On these enclosures, you'll find two Speakon NL 4 connectors. Both ports' four pins are wired in parallel. Pin assignments are:
pin 1+ = mid/high +, 1- = mid/high -,
2+ = sub +, 2- = sub 2-.

CDR 208 S and CDR 208 T Enclosures' Technical Data
Power handling (RMS): 500 watts
Power handling (program): 1,000 watts
Impedance: 8 ohms
Chassis: 2x 8" / 1.4" B&C

Frequency range (±3 dB): 88 Hz to 16 kHz
Frequency range (-10 dB): 75 Hz to 19 kHz

SPL (1W / 1m, half-space): 108 dB
SPL (maximum, half-space) *): 139 dB @ 10 % THD
SPL (peak, half-space) *): 146 dB

Crossover frequency: 800 Hz
Horizontal dispersion: 80°, constant directivity
Vertical dispersion: Depends on the no. of stacked enclosures and curving configuration

Connections
Ports: 2 Speakon NL 4 ports, wired in parallel
Pin assignments: 1+ = mid/high +, 1- = mid/high,
2+ = sub +, 2- = sub 2-

Housing
Material: 19-mm, 13-ply birch plywood
Coating: Black acrylic enamel
Handles: Two slot grips on the sides
Rigging hardware: Integrated side and rear rigging attachments with quick-release pins.

Weight:

CDR 208 T	30 kg	66 lbs.
CDR 208 S	30 kg	66 lbs.

Dimensions (W x H x D):
CDR 208 T: 65 x 25.5 x 60 [cm]
25 10/16" x 10 1/16" x 23 10/16" [inch]
CDR 208 S: 65 x 24 x 60 [cm]
25 10/16" x 9 8/16" x 23 10/16" [inch]

*) Specifications refer to a cluster of four Cohedra components.

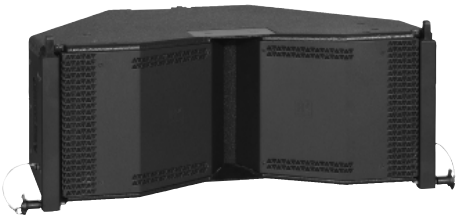


Figure 1: Cohedra CDR 208 T

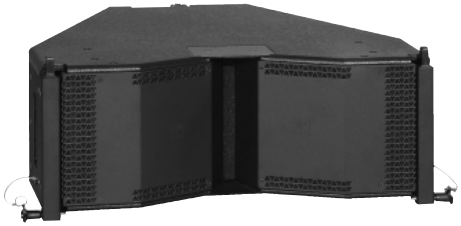


Figure 2: Cohedra CDR 208 S



Figure 3: Cohedra CDR 210 Sub

1.2 CDR 210 SUB SUBWOOFER

Design and Construction of the Subwoofer
The CDR 210 Sub enclosure is made of 19 mm, 13-ply birch plywood and coated with water-repellent, black acrylic enamel. The baffle board cover consists of a metal grille.
The CDR 210 Sub weighs 33 kg.
It is 110 cm wide, 32 high and 40 cm deep.
Two slot grips have been routed into the side panels for easy transport and set-up.

Electrical and Acoustical Data
The CDR 210 Sub enclosure features two 10" woofers. The loudspeakers are treated with a special coating protecting them against dirt and moisture.

The CDR 210 Sub enclosure's nominal electrical power-handling capacity is 600 watts RMS at 8 ohms impedance. It produces a sound pressure level of 104 dB (1W@1m), measured under half-space conditions. Maximum SPL measured under the same conditions at a distance of one meter is 139 dB at 10% THD. The frequency response of the CDR 210 Sub ranges from 47Hz to fx (± dB).

Connections
The connector panel on the rear of the CDR 210 Sub enclosure is recessed to protect the ports from harm. On this enclosure, you'll find two Speakon NL 4 connectors. Both ports' four pins are wired in parallel. Pin assignments are:
pin 1+ = mid/high +, 1- = mid/high -,
2+ = sub +, 2- = sub 2-.

The Cohedra CDR 210 Sub Subwoofer's Technical Data
Power handling (RMS): 600 watts
Power handling (program): 1200 watts
Impedance: 8 ohms
Chassis: 2x 10"

Frequency range (±3 dB): 47 Hz to f_x
Frequency range (-10 dB): 39 Hz to f_x

SPL (1W / 1m, half-space): 104 dB
SPL (maximum, half-space) *): 139 dB @ 10% THD
SPL (peak, half-space) *): 142 dB

Connections
Ports: 2 Speakon NL 4 ports, wired in parallel
Pin assignments: 1+ = mid/high +, 1- = mid/high -, 2+ = sub +, 2- = sub 2-

Housing
Material: 19-mm, 13-ply birch plywood
Coating: Black acrylic enamel
Handles: Two slot grips on the sides

Weight:
33 kg / 72.6 lbs

Dimensions (W x H x D):
110 cm x 32 cm x 40 cm
43 2/16" x 12 4/16" x 15 5/16"

*) Specifications refer to a cluster of four COHEDRA® components.



Figure 4: Cohedra CDR 210 F Sub

1.3 THE CDR 210 F SUB SUBWOOFER

Design and Construction of the Subwoofer
The CDR 210 F Sub's enclosure is made of 19 mm, 13-ply birch plywood and coated with water-repellent, black acrylic enamel. The baffle board cover consists of a metal grille.
The CDR 210 F Sub weighs 40 kg. It is 65.5 cm wide, 48 cm high and 60 cm deep. Two slot grips have been routed into the side panels for easy transport and set-up.

Electrical and Acoustical Data
The CDR 210 F Sub enclosure features two 10" woofers. The enclosures are provided with a special coating that protects them against dirt and water.

The CDR 210 F Sub enclosure's nominal electrical power-handling capacity is 600 watts RMS at 8 ohms impedance. It produces a sound pressure level of 104 dB (1W@1m), measured under half-space conditions. Maximum SPL measured under the same conditions at a distance of one meter is 139 dB at 10% THD. Frequency response ranges from 47 Hz to f_x (± dB).

Connections
The connector panel on the rear of the CDR 210 F Sub is recessed to protect the ports from harm. On these enclosures, you'll find two Speakon NL 4 connectors. Both ports' four pins are wired in parallel.
Pin assignments are pin 1+ = mid/high +, 1- = mid/high -, 2+ = sub +, 2- = sub 2-.

The CDR 210 F Sub Enclosure's Technical Data
Power handling (RMS): 600 watts
Power handling (program): 1200 watts
Frequency range (±3 dB): 47 Hz to f_x
Frequency range (-10 dB): 39 Hz to f_x
SPL (1W / 1m, half-space): 104 dB
SPL (maximum, half-space) *): 139 dB @ 10% THD
SPL (peak, half-space) *): 142 dB
Impedance: 8 ohms
Chassis: 2 x 10"

Connections
Ports: 2 Speakon NL 4 ports, wired in parallel
Pin assignments: + = mid/high +, 1- = mid/high -, 2+ = sub +, 2- = sub 2- 2-

Housing
Material: 19-mm, 13-ply birch plywood
Coating: Black acrylic enamel
Handles: Two slot grips on the sides
Weight: 40 kg/ 88 lbs.
Dimensions (W x H x D): 65.5 cm x 48.2 cm x 60 cm
25 3/4" x 20" x 23 5/8"

*) Measured using four 4 CDR 210 F Sub enclosures.

CHAPTER B 1

THE COHEDRA® COMPACT LOUDSPEAKERS

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1 COHEDRA® COMPACT ENCLOSURES

1.1 THE CDR 108 C MID/HIGH UNIT

Design and Construction
The CDR 108 C Mid/High unit's top and bottom panels are sloped at an angle of 4.5°. Made of 19 mm, 13-ply birch plywood, the enclosure is coated with water-repellent, black acrylic enamel. For the purpose of curving the array, your choices of angles (or splay) are 0°, 1.5°, 3°, 4.5°, 6°, 7.5° and 9°. The baffle board cover consists of a metal grille; located behind it is a compression chamber for the 8" speaker and a CD horn equipped with an acoustical lens for the two 1" drivers.
The CDR 108 C weighs 17.9 kg. It is 50 cm wide, 26 cm high and 32.5 cm deep (including rigging attachments). Two grips on the side panels facilitate transport and set-up.

Serving to fly the mid/high units are fully integrated rigging attachments comprising four quick-release pins and three rigging connectors, two mounted on the sides and one in the rear.

Electrical and Acoustical Data
The CDR 108 C enclosure is loaded with an 8" cone chassis speaker and two 1" B&C high frequency drivers with a front-mounted acoustical lens in a CD horn configuration. The drivers are addressed via an internal passive crossover with a separating frequency of 800 hertz.

The CDR 108 C enclosure's nominal electrical power-handling capacity is 250 watts RMS at 16 ohms impedance. It produces a sound pressure level of 107 dB (1W@1m), measured under half-space conditions. Maximum SPL measured under the same conditions at a distance of one meter is 136 dB at 10% THD.

The CDR 108 radiates at a horizontal angle of 100°. Frequency response ranges from 88 Hz to 19 kHz (±3 dB). The enclosure is thus able to provide speech reinforcement for public address applications without requiring a subwoofer.

Connections
The connector panel on the rear of the CDR 108 C is recessed to protect the ports from harm. On this enclosure, you'll find two Speakon® NL 4 connectors. Both ports' four pins are wired in parallel. Pin assignments are: pin 1+ = mid/high +, 1- = mid/high -, 2+ = sub +, 2- = sub 2-.

The CDR 108 C Enclosures' Technical Data
Nominal power handling :
250 watts RMS, 500 watts program
Frequency range: ± 3 dB: 88 Hz – 19 kHz

SPL, 1W @ 1m*: 107 dB
SPL, max. SPL @ 1m*: 136 dB @ 10% THD**

Impedance: 16 ohms
Woofer/midrange speaker: 1x 8" with compression chamber
High-frequency driver: 2x 1" with COHEDRA® Acoustic Lens
Horn: 100° CD horn
Crossover frequency: 800 Hz, 12 dB/ octave

Ports: Speakon® NL 4 connectors
Pin assignments: 1+ = mid/ high +, 1- = mid/ high -, 2+ = sub +, 2- = sub 2-

Housing
Material: 15-mm (5/8"), 13-ply birch plywood
Coating: Black acrylic enamel
Front grille: Metal

Rigging hardware: Integrated rigging attachments
Variable splay for curving arrays: 0°, 1.5°, 3°, 4.5°, 6°, 7.5°, 9°

Weight: 17.9 kg / 39.4 lbs
Dimensions (W x H x D):
50 x 26 x 32.5 cm
19-5/8" x 10-1/4" x 12-3/4"

*) SPL measured under half-space conditions
**) measured with 4 CDR 108 Cs

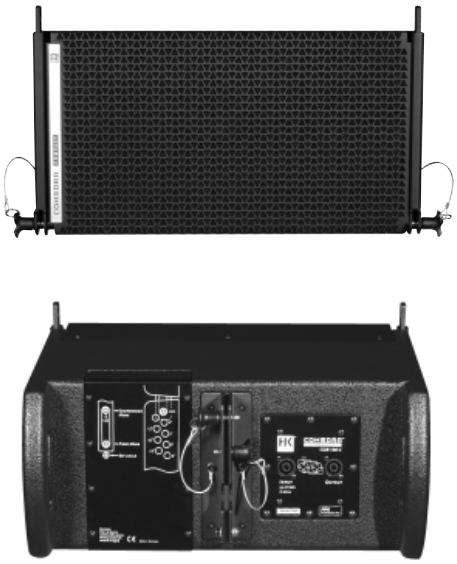


Figure 1: Cohedra Compact CDR 108 C



Figure 2: Cohedra Compact CDR 210 C

1.2 THE SUBWOOFER CDR 210 C

Design and Construction of the Subwoofer
Made of 19 mm, 13-ply birch plywood, the CDR 210 C enclosure is coated with water-repellent, black acrylic enamel. The baffle board cover consists of a metal grille.
The CDR 210 C weighs 48 kg. It is 55 cm wide, 60 high and 63 cm deep. Two slot grips have been routed into the top, bottom and back panels for easy transport and set-up.

Electrical and Acoustical Data
The CDR 210 Sub enclosure is loaded with two 10" woofers. The loudspeakers are treated with a special coating protecting them against dirt and moisture.

The CDR 210 C enclosure's nominal electrical power-handling capacity is 600 watts RMS at 8 ohms impedance. It produces a sound pressure level of 104 dB (1W@1m), measured under half-space conditions. Maximum SPL measured under the same conditions at a distance of one meter is 139 dB at 10% THD**. The frequency response of the CDR 210 C ranges from 47Hz to fx (± dB).

Connections
The connector panel on the rear of the CDR 210 C enclosure is recessed to protect the ports from harm. On this enclosure, you'll find two Speakon® NL 4 connectors. Both ports' four pins are wired in parallel. Pin assignments are pin 1+ = mid/high +, 1- = mid/high -, 2+ = sub +, 2- = sub -.

The Cohedra CDR 210 C Subwoofer's Technical Data
Power handling (RMS): 600 watts RMS,
1200 watts program
Frequency range (±3 dB): 47 Hz to fx
Frequency range (-10 dB): 39 Hz to fx

SPL, 1W @ 1m*: 104 dB
SPL, max. SPL @ 1m*): 139 dB @ 10% THD**

Impedance: 8 ohms
Woofers: 2x 10"

Connections: 2 NL 4 Speakon® ports, wired in parallel Pin assignments: 1+ = mid/ high +, 1- = mid/ high -, 2+ = sub +, 2- = sub 2-

Housing
Material: 19-mm (3/4"), 13-ply birch plywood
Coating: Black acrylic enamel
Front grille: Metal
Handles: Four slot grips

Rigging hardware: Integrated pick points

Weight: 48 kg (105.6 lbs)
Dimensions (W x H x D): 50 cm x 60 cm x 63 cm
19 3/4" x 23 3/4" x 24 3/42

*) SPL measured under half-space conditions
**) measured with 4 CDR 210 Cs *)

Chapter C

COHEDRA® Transport Solution

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Figure 1: COHEDRA® Mid/ High Case



Figure 2: COHEDRA® Subwoofer Dolly

THE COHEDRA® TRANSPORT SOLUTION

1.1 MID/HIGH ENCLOSURES

A specially designed case serves to transport the COHEDRA® CDR 208 S, CDR 208 T mid/high and the CDR 210 F Sub enclosures.
The floor of the mid/high enclosure case is adjustable to 0° and 4.5°. This enables you to configure the S and T model housing as desired without having to disassemble clusters consisting of up to four mid/high enclosures for transport.

1.2 SUBWOOFERS

Serving to transport subwoofers is a dolly designed to carry four stacked subwoofers. Subwoofers are secured to the dolly using a cargo strap.

1.3 DIMENSIONS AND WEIGHTS OF THE CASES AND BASS BIN DOLLIES:

Case for four CDR 208s or two CDR 210 F Sub:
Width: 80 cm (31 1/2")
Depth: 74 cm (29 1/8")
Height: 131 cm (51 5/8")
Weight: approx. 150 kg (330 lbs.)

Four CDR 210 Subs with dolly and strap:
Height: 148 cm (58 1/4"), casters included
Width: 40 cm (15 3/4")
Depth: 110 cm (43 1/4")
Weight: 138 kg (304 lbs.)

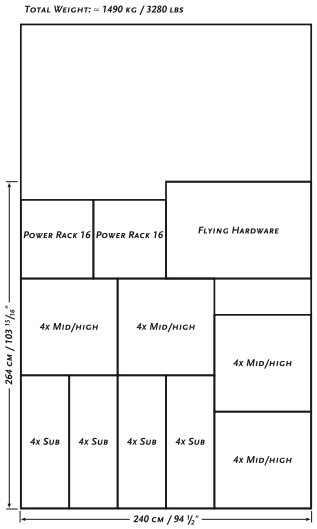
PR 16 (lying):
Width: 60 cm (23 5/8")
Height: 65.5 cm (25 3/4") (depth, when standing on casters)
Depth: 95 cm (37 3/8") (height, when standing on casters)
Weight: approx. 125 kg (275 lbs.)

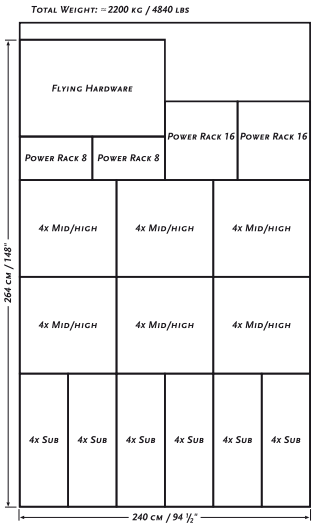
PR 8 (lying):
Width: 60 cm (23 5/8")
Height: 38.5 cm (15 3/16") (depth, when standing on casters)
Depth: 95 cm (37 3/8") (height, when standing on casters)
Weight: approx. 65 kg (143 lbs.)

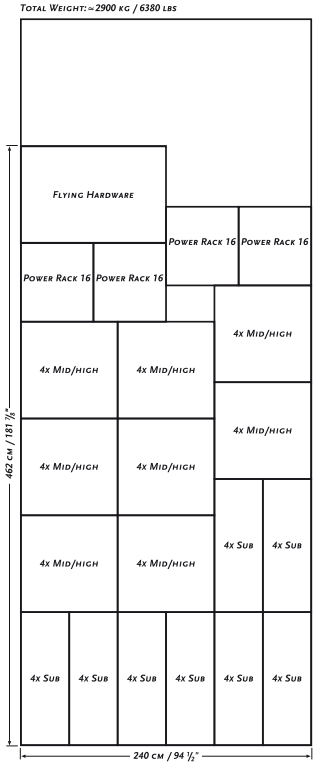
Flying Hardware Case (on casters):
Width: 120 cm (47 1/4")
Depth: 80 cm (31 1/2")
Height: 58 cm (22 3/4")
Weight: approx. 90 kg (198 lbs.)

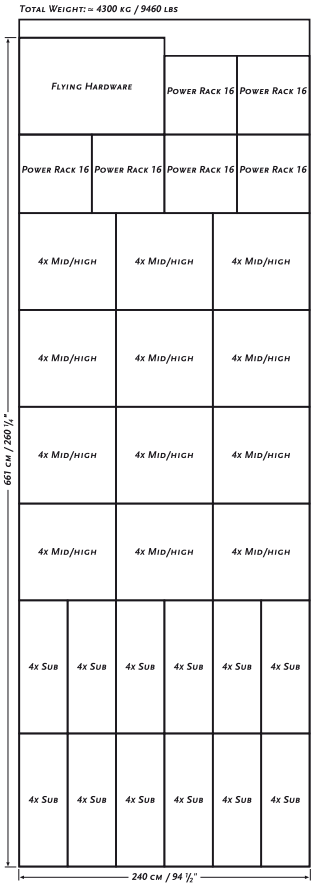
1.4 COHEDRA® Truck Space

The dimensions of COHEDRA® cases, racks and dollies were selected specifically to make the most of available truck space. The diagrams below offer suggestions on how to load different COHEDRA® systems into a truck with a width of 240 cm.









CHAPTER C 1

COHEDRA® COMPACT TRANSPORT SOLUTION

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Figure 1: COHEDRA® Compact Mid/High Case

1 COHEDRA® Compact Transport Solution

1.1 CDR 108 C Mid/ High Case

A specially designed case serves to transport COHEDRA® Compact CDR 108 C mid/high enclosures. One case accommodates four CDR 108 Cs and a standard rigging frame each.

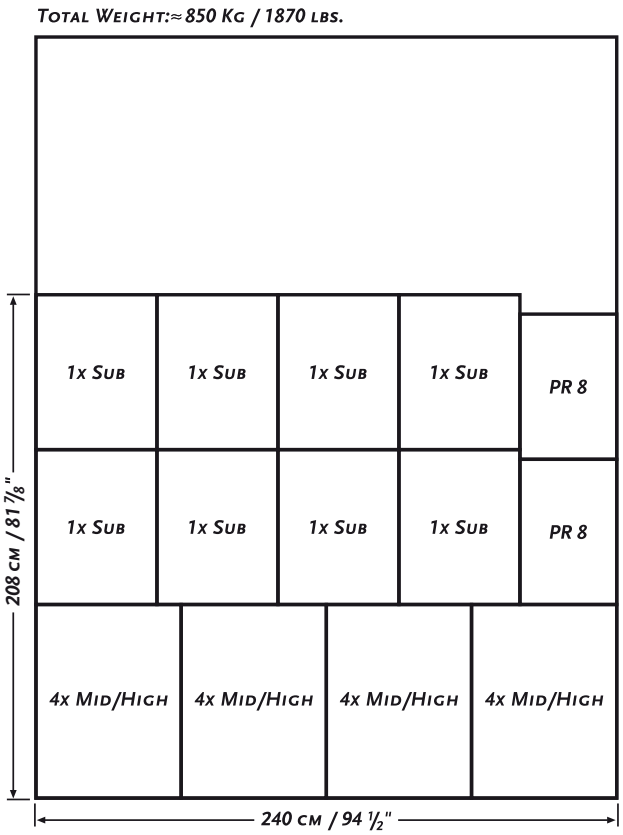
1.2 Dimensions and Weights

Case for four CDR 208 s:
Width: 80 cm/ 31 1/2"
Depth: 60 cm/ 23 5/8"
Height (standing on casters): 70 cm/ 27 1/2"
Weight (without rigging frame) : approx. 98 kg/ 215 lbs.
Weight (with rigging frame) : approx. 108 kg/ 238 lbs.

PR 16 (lying):
Width: 60 cm/ 23 5/8"
Height: 65.5 cm/ 25 3/4"
Depth (standing on casters): 95 cm/ 37 3/8"
Weight: approx. 125 kg/ 275 lbs.

PR 8 (lying):
Width: 60 cm/ 23 5/8"
Height: 38.5 cm/ 15 1/8"
Depth (standing on casters): 95 cm/ 37 3/8"
Weight: approx. 65 kg/ 143.3 lbs.

CDR 210 C:
Width: 50 cm/ 19 3/4"
Height: 60 cm/ 23 1/4"
Depth (standing on casters): 75 cm/ 29 1/2"
Weight: approx. 48 kg/ 105.6 lbs.



CHAPTER D

RIGGING & CURVING THE COHEDRA® SYSTEM

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RIGGING AND CURVING COHEDRA® MID/HIGH CABINETS

Please read these instructions carefully before you begin setting up the system!

1 USE

1.1 INTENDED USE

Specifications for intended use include the following:

- When mounting mid/high range enclosures, make sure that the load is centreed directly under the suspension point on the rigging frame.
- The rigging frame may not be tilted more than 10% (that is, at angles greater than 6°). Note that the specifications for intended use require you to read and heed all of the operating instructions and comply with inspection and maintenance requirements.

Any use other than specified is unintended.
The manufacturer shall not be liable for damages resulting from unintended use.

1.2 UNINTENDED USE

Improper use of rigging frames and incorrect handling of this load-carrying equipment can pose a serious danger.
Never

- use rigging frames to exert diagonal force or tension on loads,
- use a crane to dislodge stuck or immovable loads,
- lift people,
- strike, knock or dent rigging frames,
- heat-treat or weld rigging frames,
- exceed the truss's maximum load-carrying capacity

Note that in addition to the above specifications, the operational safety regulations of VBG 9 (the German employers' liability insurance association accident prevention regulations) apply.

2 WARRANTY AND LIABILITY

HK AUDIO® cannot be held responsible for damages due to improper use or non-compliance with the safety specifications for setup and operation. All warranty and liability claims for personal injury and property damages are excluded if attributable to one or several of the following:

- non-compliance with operating manual instructions, voiding product liability and warranty claims
- unintended use of rigging frames
- non-compliance with operating manual instructions regarding transportation, storage, initial setup, operation, maintenance and repair of rigging frames
- unauthorized structural modifications performed on rigging frames
- unauthorized modification of the parameters indicated in the operating manual
- inadequate or improper repairs

3 IMPORTANT NOTES ON SAFETY

Original COHEDRA® rigging accessories have been certified as a complete and cohesive system by the safety standards authority TÜV. The directions for use of the COHEDRA® rigging system require that it be installed in accordance with the following specifications. Before you begin installation, ensure that the mounting points (for example, a chain hoist) on the stage roof or the venue's ceiling comply with BGV-C1 accident prevention regulations and that the safety standards authority TÜV has certified them for the full load (see table 1). Prior to every installation, inspect all components to ensure they are in good operating condition, taking particular care to confirm that all quick-release pins and hardware connectors are undamaged.

The principle requirement for safe handling and trouble-free operation of rigging frames is a thorough understanding of the basic notes on safety and the safety regulations.
This operating manual contains key rules on safe handling.

3.1 RESPONSIBILITIES OF THE OPERATOR

As the operator, you are legally bound to allow only those persons to work with rigging frames who are

- 16 years of age or older,
- physically and mentally able, familiar with the basic rules of industrial safety and accident prevention, and trained in the handling of rigging frames.

Be sure to regularly review and confirm personnel's safety awareness.
In addition, task personnel with specific responsibilities for setting up, putting into service, operating, maintaining, and repairing equipment. Ensure that personnel are trained to work with the rigging frame only under the supervision of a proficient and experienced technician. Ensure also that defects, flaws and other damage that could impede safety are repaired immediately.

3.2 STORAGE, MAINTENANCE, INSPECTION AND REPAIR OF COHEDRA® RIGGING HARDWARE

Storage, temporary and long-term
When not in use store the truss indoors in a safe place where it cannot be tipped over and is protect from exposure to the elements.

Inspections
§ 39, VBG 9 A of the German employers' liability insurance association accident prevention regulations requires that load-carrying equipment be inspected by a qualified expert and possible defects be eliminated prior to initial commissioning by the recipient.

§ 40, VBG 9 A requires that load-carrying equipment be inspected at least annually for cracks. When used in dynamic applications, equipment must be inspected for cracks every six months.

Maintenance
You are authorized to replace easily serviceable wearing or standard parts in accordance with the manufacturer's instructions. Use original parts for this purpose. If necessary, tighten screws and screwed connections.

Repair
In the event that parts of the load-carrying equipment have been deformed, it is up to the manufacturer to determine if they are repairable. Solely the manufacturer is authorized to perform welding and repair jobs on load-carrying equipment.

3.3 TECHNICAL SPECIFICATIONS OF THE COHEDRA® RIGGING HARDWARE

Load-carrying capacity of standard rigging frames: 800 kg
Test load: 3,200 kg
Ambient temperature when in operation:
min. -10° C, max. + 60° C

3.4 MAXIMUM PERMISSIBLE NUMBER OF FLOWN COHEDRA® MID/HIGH UNITS

- You may fly up to 32 mid/high range enclosures in a stacked array.
- You may fly up to 24 mid/high enclosures in a stacked array when using the standard rigging frame.
- If you want to fly up to 32 mid/high enclosures, you must use the high-load rigging frame! It is available on demand.

Warning: Flying more than 24 enclosures in a stacked array from the standard rigging frame voids the safety standards authority TÜV's certification!

Refer to table 1 to determine flown loads. The sum of the weights of COHEDRA® mid/high enclosures plus the weight of the rigging frames equals the total load.

Note: Ensure that you add the weights of chain hoists, motors, cables and further stops to determine total weight!

Quantity	Weight [kg]	Weight [lbs.]
1	30	66
2	60	132
3	90	198
4	120	264
5	150	330
6	180	396
7	210	462
8	240	528
9	270	594
10	300	660
11	330	726
12	360	792
13	390	858
14	420	924
15	450	990
16	480	1056
17	510	1122
18	540	1188
19	570	1254
20	600	1320
21	630	1386
22	660	1452
23	690	1518
24	720	1584
25	750	1650
26	780	1716
27	810	1782
28	840	1848
29	870	1914
30	900	1980
31	930	2046
32	960	2112
Top and bottom rigging frame with shackle: 30 kg/ 66 lbs.		

Table 1: Weight of mid/high enclosures

3.5 MAXIMUM NUMBER OF FLOWN COHEDRA® CDR 210 F SUBWOOFERS

The standard rigging frame can fly up to 20 vertically arrayed CDR 210 F Subs.
If you are using a combination of CDR 208 S/T cabinets and CDR 210 F Sub bins on one rigging frame, calculate the total load using both tables. Ensure the rigging frame's maximum permissible load is never exceeded.

Number	Weight [kg]	Weight [lbs.]
1	40	88
2	80	176
3	120	264
4	160	352
5	200	440
6	240	528
7	270	616
8	310	704
9	350	792
10	390	880
11	430	968
12	470	1056
13	510	1144
14	550	1232
15	590	1320
16	630	1408
17	670	1496
18	710	1584
19	750	1672
20	790	1760

Table 2: Weight of the CDR 210 F Sub

3.6 GROUND-STACKED MID/HIGH ENCLOSURES

Ensure that the (inverted) top rigging frame is placed securely on the ground or stage. Secure the mid/high stack to prevent slippage!

3.7 PICK POINTS FOR FLYING COHEDRA® MID/HIGH ENCLOSURES

Use only the top rigging frame's shackles to attach motors, chain hoists and straps. Insert them into the eyelets in the centre rail designed to accept shackles!

Never use the round pole on the top rigging frame to attach shackles or mount motors! This pole is used only for guiding and securing cables.
Use only the bottom rigging frame to curve the array.
Clear the area immediately below arrays of people before raising or lowering loads.
Lift and lower flown mid/high enclosures smoothly, avoiding abrupt stops or jerky motions.
Secure the flown mid/high array in place with straps so that it remains immovable, for example, despite gusts of wind. Use the eyelets in the bottom rigging frame to affix straps.

3.8 STRUCTURAL MODIFICATIONS OF COHEDRA® RIGGING HARDWARE

No structural modifications may be made without the manufacturer's permission. This also applies to welding work performed on supporting parts. Structural alterations require the manufacturer's written approval. Use original replacement and wearing parts only.

3.9 ORIGINAL HK AUDIO® ACCESSORIES

Use original HK AUDIO® parts only (see section 4)! The safety standards authority TÜV has not certified any other parts for use! Always install parts in accordance with these installation instructions! Compile and store all documents pertaining to the system in a safe place!

3.10 INITIATION AND OPERATION

§ 39, VBG 9 A of the German employers' liability insurance association accident prevention regulations requires that load-carrying equipment be inspected by a qualified expert and possible defects be eliminated prior to initial commissioning by the recipient.

§ 41 VBG 9a requires that load-carrying equipment be subjected to a non-routine inspection following damage, repair work and other incidents that can affect load-carrying capacity.



Figure 1: 12 COHEDRA® mid/high enclosures



Figure 2: Mid/high enclosure with integrated flight attachments



Figure 3: Top rigging frame



Figure 4: Shackles for attaching motors, straps



Figure 5: Bottom rigging frame



Figure 6: Lashing strap for curving the array



Figure 7: Quick-release pin

4 COMPONENTS OF THE COHEDRA® RIGGING HARDWARE

COHEDRA® rigging hardware consists of the following parts:

- a top rigging frame with three shackles for attaching motors, lashing straps or chain hoists. The top rigging frame also serves as the base for ground stacks.
- a bottom rigging frame for attaching a lashing strap, chain hoist or motor for curving the array
- a two-part lashing strap for curving arrays of up to eight COHEDRA® mid/high enclosures
- integrated attachments on the side and back for flying COHEDRA® mid/high enclosures
- four quick-release pins per mid/high enclosure for connecting enclosures to the rigging frames

5 DETERMINING THE CURVING ANGLE BETWEEN TWO COHEDRA® MID/HIGH ENCLOSURES

The curving angle between two enclosures is set by simply adjusting one pin. One person can easily carry out the entire process of curving cabinets.

The maximum adjustable angle depends on how the mid/high range enclosures are configured in a flown stacked array. Two different housing designs are available for optimizing the gap between two mid/high range enclosures, the straight variant CDR 208 S (S stands for straight) and the slanted variant CDR 208 T (T is short for trapezoidal). Both COHEDRA® mid/high enclosures (the CDR 208 T and the CDR 208 S) are labeled uniformly to provide information on the adjustable angle: The left side of the connector panel designates the angle if the top enclosure is a CDR 208 S. On the right is designated the angle if the top enclosure is a CDR 208 T (see Figure 8 a, b).
If two CDR 208 S enclosures are configured in a flown stacked array, your only option is 0°.
If one CDR 208 S and one CDR 208 T enclosure each are configured in a flown stacked array, you can opt for 0 °, 1.5°, 3 °, or 4.5 °.
If two CDR 208 T enclosures are configured in a flown stacked array, you can opt for 4.5°, 6°, 7.5° or 9 °. This variant is an excellent choice when you want to configure sharply curving down-fills.

The rigging equipment is designed so that the curving angle can still be adjusted when COHEDRA® mid/high arrays are flown (see Fig. 9).

How is this done?
The pin that determines the curving angle (the top pin on the mid/high unit) is merely a predefined stop for the flexible connector component when the entire COHEDRA® mid/high array is pulled together accordion-style and thereby adjusted using a lashing strap, chain hoist or motor attached at the back. If no force is exerted, the entire mid/high array is suspended at a 0° angle, meaning that the pin is easily repositioned!

Important notes on safety when curving the array with lashing straps and chain hoists: When tightening the lashing strap or using a chain hoist, ensure that just enough force is exerted to curve the array to the desired extent along the rear of the housings. Use a chain hoist with a maximum load of 250 kg (8 m in length). This also suffices for configurations with up to 24 Mid / High units. If possible, choose a pick-point for the chain hoist shackle near the top rigging frame's rear connector.

Do not use powerful chain hoists with low gear ratios (that is, a powerful force action and a long lashing strap)! A chain hoist that exerts too much force relieves the load on the rigging system's rear pick-point, which means the pick-point's force action is distributed unfavorably across the full length of the rigging frame. This can permanently warp the rigging frame, thereby voiding the operating permit

Never place or use motors between the rigging frames for this purpose! This will overload the top flight frame and impair operating safety!

Important note: If you first mount a CDR 208 S enclosure to the top rigging frame - that is, configure two CDR 208 S mid/high enclosures in a flown stacked array - you must insert the back pin into both the eyelet labeled 0° and through the connector component's slot (see Fig. 10)! Otherwise, the angle will be set incorrectly and you will not be able to curve the array as desired!
For every other configuration, do not insert the pin into the slot!

6 PREPARATIONS

The following section describes how to set up a basic mid/high array. Use the COHEDRA® CAPS software to select on the top rigging frame pick points for determining the angles between the mid/high enclosures.

Move the open case with the four mid/high enclosures in position.



Figure 8: The curvature between two COHEDRA® mid/high enclosures



Figure 9: Setting the curving angle on a flown array



Figure 10: Connector component attached o the top rigging frame for a 0 ° curving angle

D



Figure 11: Open case with four mid/high range enclosures



Figure 12 a



Figure 12 b



Figure 12 c



Figure 12 d



Figure 12 e



Figure 12 f

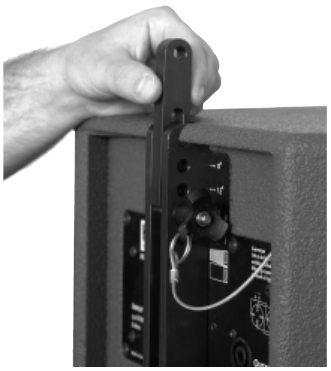


Figure 12 g

7 Mounting the Top Rigging Frame

The tasks described below require two people. Remove all three quick-release pins from their receptacles on the top rigging frame and the top pin on the back of the top mid/high range enclosure (preferably CDR 208 S). Set the top rigging frame on the topmost enclosure. First attach the two front connectors. Turn the connector component so that the rounded side of the component faces forward (see Fig. 12 a – g). Insert the pin of the top mid/high enclosure through the slot on the connector component and into the eyelet labeled 0°.



Figure 13: Mounting the top rigging frame



Figure 14: Mounting the main motor to the top rigging frame



Figure 15: Setting the curving angle between COHEDRA® mid/high enclosures

Now connect the back of the top rigging frame to the enclosure (see Fig. 13).

Important note: For this purpose, the pin must be inserted through the slot and into the 0 °s position! Always on the CDR 208 S. See Figure 10.

Attach to the top rigging frame the shackle destined to accept the motor hook (see Fig. 14).
Your choice of pick point depends on how sharply you aim to curve the COHEDRA® mid/high array.

Note: Use the third eyelet (from the front) to set the array to a curving angle of about 0°.
Check all pins on the top rigging frame to ensure they are firmly seated and attach the motor to the shackle.

Hoist the enclosures from the case using the motor and roll the case off to the side.
Set the pins on the back of the top four mid/high enclosures in accordance with the desired application and curving angle.

This is also a good time to connect the speaker cables to the four mid/high range enclosures, which will later be the top cabinets in your array. You can use the round pole on the top rigging frame to secure the cables.
Bear in mind that you must attach one of the shackles on the top rigging frame to the lashing strap, chain hoist or motor that will later pull in the back of the array to curve out its front face. Do this now.

Tip: If you intend to mount additional mid/high enclosures, it is recommended that you attach all the required speaker cables to the top rigging frame now because this task is made more difficult as the height of the array increases. Be sure to use cables of sufficient length!



Figure 16: Hoisting the top four COHEDRA® mid/high enclosures



Figure 17 a: Mounting additional mid/high enclosures



Figure 17 b



Figure 17 c

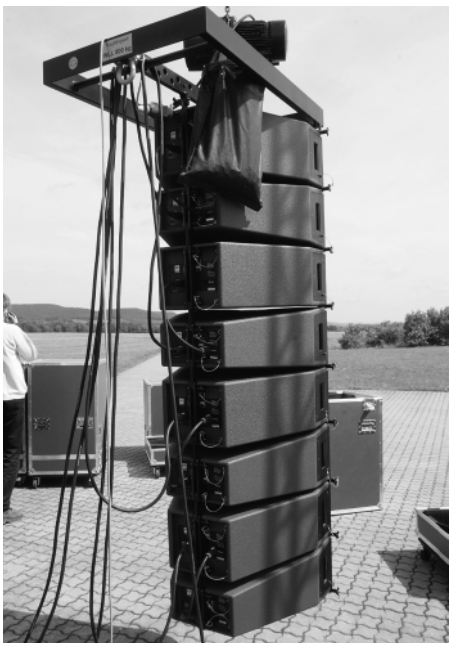


Figure 17 d

8 MOUNTING ADDITIONAL COHEDRA® MID/HIGH ENCLOSURES

Hoist the cabinets to a height that allows you to roll a second case with four mid/high range enclosures under the array. Remove both front pins from the lowest flown enclosure and the bottom pin on the back (see Fig. 16).
Tip: Insert the front pins into the carrying handles on the sides of the mid/high range enclosure. This ensures that they are out of the way when the bottom enclosures are placed in position.

Move the second case with four additional mid/high enclosures into position. Slowly hoist the top four cabinets until the two front connectors engage (see Fig. 17 a). Insert both front pins first, ensuring that they engage fully and securely. You may have to shift the two enclosures slightly to ease the pins into position (see Fig. 17 b). In order to attach the rear connector component, you must swivel it out of the rail so that the round end faces up and the slot faces down (see Fig. 12 a – g for details and Fig. 17 c)

Tip: Use the motor to slowly hoist the array, creating a gap of about 60 to 80 mm at the back between the two enclosures. This makes it easier to insert the pin into the top enclosure.

Hoist the COHEDRA® mid/high array with the eight enclosures just enough to remove it from the case.
Configure the pins on the back of the bottom four enclosures to achieve the desired curving angle.
Connect the remaining speaker cables.
Repeat the above procedure to configure even more mid/high enclosures in a flown stacked array.

9 ATTACHING THE BOTTOM RIGGING FRAME AND RAISING THE MID/HIGH ARRAY

Once all COHEDRA® mid/high enclosures have been assembled in the desired array, you must attach the bottom rigging frame to the lowest enclosure. To do this, remove all three pins from the lowest enclosure. First attach the front of the bottom rigging frame and secure it using the pins, and then insert the rear pin.

Now the enclosures are mounted, speaker cables are all connected, and the pins are inserted in the required configuration.
If you want to use the lashing strap to curve the COHEDRA® mid/high array, connect its hooks to the bottom rigging frame and, using a shackle, to the top rigging frame (see Figure 20). Tighten the strap until it exerts enough force to curve the array as desired.

The pin that determines the curving angle (the top pin on the mid/high unit) is merely a predefined stop for the flexible connector component when the entire COHEDRA® mid/high array is pulled together accordion-style and thereby adjusted using a lashing strap, chain hoist or motor attached at the back. If no force is exerted, the entire mid/high array is suspended at a 0° angle, meaning that the pin is easily repositioned!

Do not use powerful chain hoists with low gear ratios (that is, a powerful force action and a long lashing strap)! A chain hoist that exerts too much force relieves the load on the rigging system's rear pick-point, which means the pick-point's force action is distributed unfavorably across the full length of the rigging frame. This can permanently warp the rigging frame, thereby voiding the operating permit.

Important notes on safety when curving the array with lashing straps and chain hoists: When tightening the lashing strap or using a chain hoist, ensure that just enough force is exerted to curve the array to the desired extent along the rear of the housings. Use a chain hoist with a maximum load of 250 kg (8 m in length). This also suffices for configurations with up to 24 Mid / High units. If possible, choose a pick-point for the chain hoist shackle near the top rigging frame's rear connector.

Never place or use motors between the rigging frames for this purpose! This will overload the top flight frame and impair operating safety!



Figure 18: Mounting the bottom rigging frame



Figure 19: Attaching the lashing strap between the top and bottom rigging frames

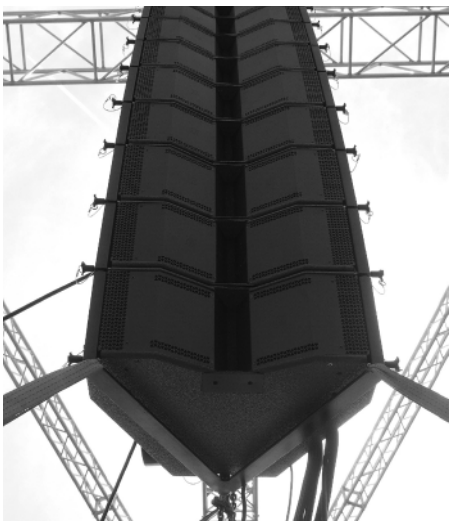


Figure 20: Hoisting the fully assembled COHEDRA® mid/high array



Figure 21: Groundstack with CDR 210 F Sub and CDR 208 S/T enclosures

10 GROUND STACKING

10.1 GROUND STACKING WITH THE STACK FRAME

The stack frame was developed especially for ground-stacking CDR 208 S/T and CDR 210 F Sub enclosures. If you are unable to fly the top units or bass bins, the stack frame provides the underpinning for setting up stacked mid/high arrays or a fullrange stacks comprised of CDR 210 F subwoofers and CDR 210 S/T mid/high units.
The stack frame is equipped with four extendible, height-adjustable feet. This lets you adjust the stack to suit the underlying surface. In addition, the feet are infinitely variable, allowing you tilt the entire stack forward or back to align the system to the audience. The stack frame is readily set up and stowed away in a case. Its removable feet facilitate handling and transport.

Technical data (preliminary):
Weight: approx. 30 kg / 66 lbs
Base dimensions (with feet fully extended):
approx. 200 cm x 160 cm
Dimensions (dismantled):
approx. 80 cm x 80 cm x 40 cm
Material: Steel w. black enamel coating

10.2 GROUND STACKING WITH THE RIGGING FRAME

This option is recommended for smaller (four mid/high units) configurations in venues that do not allow enclosures to be flown, or when you want to cover galleries, terraces or balconies.

Place the top rigging frame on the ground or stage without shackles so that the connector components for the mid/high enclosures face up. If necessary, place wooden wedges under the rigging frame to ensure a stable, secure and level position.

Remove all three pins from the rigging frame and mount the mid/high enclosures one after another. The procedure is the same as for a flown system, apart from the fact that enclosures are stacked upside down and, due to the weight of the enclosures, a lashing strap is not required for curving purposes.

Caution: Always secure ground stacks with a suitable lashing strap to prevent slippage!

11 SETTING UP SUBWOOFERS

11.1 SUB ARRAY

In a sub array, individual subwoofers are arranged side by side. This configuration creates a horizontal cylindrical wave that makes use of the floor contact. Space two CDR 210 Sub bins about 0.60 m apart. Spacing them at distances greater than 0.60 m, lowers the sub array's upper frequency limit. This can be advantageous when you are consciously aiming to thin out the 100-to-150 Hz frequency range.

Advantages:
A cylindrical wave loses just 3 dB over twice a given distance, while a spherical wave loses 6 dB, suffering twice the loss of effective sound pressure.
A cylindrical wave yields the most uniform low frequency diffusion (comb filtering is not a problem).

Disadvantages:
The bass floor array's vertical angle of projection is 0° in its near field. In practice, this means you must ensure that the signal is also projected to the targeted area on the horizontal plane (that is, to the right and left). To do this, you may have to add bass bins to the right and left of the array.
Alternatively, you can spread the cylindrical wave somewhat by delaying the outside subwoofers (for example, by using a DFC Sub only rack).



Figure 22: CDR 210 sub array



Figure 23: CDR 210 sub cluster

11.2 BASS CLUSTER/ STACKING

In the classic right/left stacked configuration, one half of the bass bins is arrayed to the right of the stage, the other to the left.

Advantages:
The stacked bass bin configuration depicted above is a conventional and widely accepted option.
It is very easy to deal with (short cables and walking distances).

Disadvantages:
Massive comb filtering effects sweep from right to left, creating peaks and valleys in frequency amplitude and typical low end drop-outs.

11.3 BASS CLUSTERS IN BLOCKS

If you want to deploy many bass bins, arraying them in blocks is a good option. Note that it is important to maintain varying distances between individual blocks.

Advantages:
Different frequencies are cancelled or boosted. The sum of the comb filters creates a relatively uniform soundscape. This setup's horizontal directivity is quite wide, as is typical for bass signals.

Disadvantages:
Though slight, comb filtering effects remain a problem. Cables and walking distances are longer than for right/left stacked configurations.



Figure 24: CDR 210 sub cluster in blocks



Figure 25: Flown CDR 210 F bass array next to a mid/high array

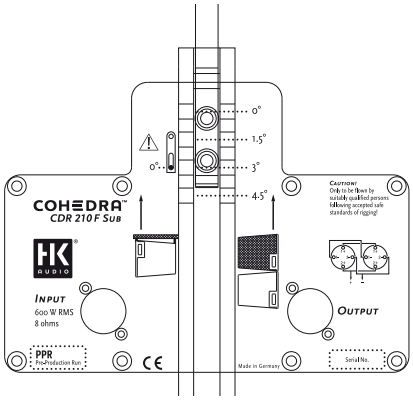


Figure 26: The CDR 210 F Sub's curving angle

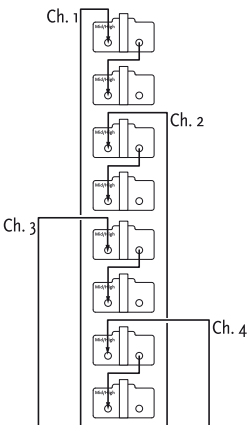


Figure 27: Pin assignment of channels 1-4

12. Flying CDR 210 F Subs

12.1 As an Independent Bass Array Using A Second Rigging Frame

Up to 20 CDR 210 F enclosures may be flown in a stacked array using the standard rigging frame. Please also read and heed the safety rules discussed in chapter D of the manual.
The procedure for setting up and mounting subwoofer arrays is the same as the procedure for CDR 208 T and CDR 208 S mid/high cabinets described in the chapter on rigging and curving COHEDRA® systems. Your choices of curving angles (or splay) between two flown CDR 210 F Sub cabinets are 0°, 1.5°, 3° and 4.5°.
The array's overall curving will be oriented on the mid/high array's curving. However, the bass array may not project beyond the front edge of the mid/high array to ensure the former does not negatively influence the latter's response.

Important note:
If you first mount a CDR 210 F Sub enclosure to the top rigging frame, you must insert the back pin into both the eyelet labeled 0° and through the connector component's slot (see Figure 26)! Otherwise, the angle will be set incorrectly and you will not be able to curve the array as desired! If you are configuring two CDR 210 F Sub enclosures in a stacked array and want the angle to be 0°, do not insert the connector component through the eyelet (see figure 26)!

12.2 In Combination with a Mid/High Array on One Rigging Frame

Flying the subwoofers and mid/high units together on one rigging frame can be a workable option, depending on the application. In these cases, the subwoofers should be mounted on top.
Mind the rigging frame's maximum permissible load. Be sure to check the system's overall weight; you'll find weights listed in the tables 1 and 2 in chapter D on rigging and curving the system.
The first cabinet to be mounted under the CDR 210 F Sub should be a CDR 208 S. Use the 0° option for this cabinet.

13. The SL 218 as a Bass Supplement

The SL 218 is well-suited for enhancing sub bass response of both flown and stacked subwoofers. It is arrayed in a center block or in line between CDR 210 blocks, depending on the given requirements and application scenario.

14. Operating the System

We recommend the following procedure to help prevent errors and troubleshoot problems quickly. The adverse affect of a mid/high cabinet dropping out or an incorrect connection can seriously degrade a line array's performance!

14.1 Connecting Speaker Cords or Multi-core Cables

Always ensure cables are laid clearly and orderly! You should be able to attribute enclosures to their connected power amp channel and/or amp rack at any time. This ensures flaws such as defective cords can be pinpointed and repaired swiftly.
Also ensure LSM multi core speaker cables (mid/high and sub adapters) are labeled appropriately, that is, from channel 1 to 4 (see the chapter on the PB 5 in the manual and figure 27).
For example, channel 1 drives the array's two top mid/high units, channel 2 the two units below to top pair, and so forth. An LSM mid/high adapter can serve to drive a total of eight mid/high units. If more than 8 cabinets are connected, they are addressed by an additional PB 5, and the channel 1-to-4 numbering system is repeated. See the chapter on the PB 5 in the manual to learn more about how to assign power amp channels to the PB 5's channels 1 to 4.
Follow the same systematic approach when connecting CDR 210 (F) Sub enclosures.

14.2 Activating the PR 8 and PR 16 Amp Racks

Ensure the VX 2400s' power switches are off and the gain knobs are turned all the way down. Check the PB 5's phase switches. They must all be set to +2 (or +3)! Once you have done this, switch on the PS 32's circuit breakers on the back of the amp racks. The DFCs and the PB 5 patch bays are now supplied with power. First select the appropriate filter for your set-up on all DFCs (making sure you select the same set on each!). If you are unsure of how the amp rack or DFC was used in the previous application (delays, EQ, etc.), as a precaution execute a hot reset on all DFCs and then select the filter set on the DFCs! Read the chapter on the DFC in the

manual to learn more about how to do this.
Before you can procedure further, you must first connect to the amp racks the DFCs' remote line and all of the system's audio cords.

14.3 CHECKING INDIVIDUAL MID/HIGH CABINETS

The best method of checking cabinets is to play a familiar song on a CD, routing the signal into the mixer and out via the master channel. Set the master level to a low-to-medium setting.

- Turn up the channel's gain knob. You will hear the signal rendered by the array's two top mid/high cabinets. The display of the DFC assigned to this pair should indicate an incoming signal level.

Important:
If you are located outside the high frequency signal's directivity radius, you will not be able to hear this signal! Your best bet is to perform this system check with a helper position a suitable distance from the array.

Note: If you can see the bottom of the mid/high unit as a plane surface, you are outside its directivity radius!

- Turn the channel 1 gain knob back down after hearing the signal!
- Follow the same procedure for all other power amp channels that you want to use.
  Be sure to turn the gain knob down after each successful test!

Note:
With this procedure, you are checking mid/high cabinets in descending order; that is, from the top to the bottom. A cabinet's height affects its directivity, so the lower the cabinets, the closer the listener should move in towards the array.

- Follow the same procedure for the subwoofers.
- Once you have checked all cabinets successfully, turn up all gain knobs, one after the other.
- Start with the channel 1 gain knob for the two top mid/high units, and then turn up the channel 2 gain knob, and so forth. With every additional channel that you activate, you should hear a boost in low midrange response. If not, this may be due to a phase inversion in the NF (or in extreme cases, in the speaker cords)! Also check the PB 5's phase switch again.
- Proceed in the same manner for the subwoofer channels.

14.4 CONFIGURING THE CONTROLLER NETWORK WITH THE AUDIO CONTROLLER SOFTWARE

Once you have performed these tests, you can configure the controller network. The type and size of the configuration of course depends on the given sound reinforcement task (PA left/right, center, outfills, etc.)
Read the chapter G about the DFC software in the manual to learn more about networking controllers, creating groups and setting delays and levels.

15. DISASSEMBLING AND REMOVING THE SYSTEM

As the saying goes: To disassemble the system, proceed in the reverse order of assembly.
These ten tips should make the job of dismantling the mid/high array easier:

1. Lower the array until the caster-equipped bottom of the mid/high case fits under it.
2. Engage the motor or chain hoist to relax the tension on the strap that is curving the array.
   Caution: The array may belly out towards the front!
3. Disconnect the four lower cabinets' cords.
4. Set these cabinets' curving pins to the maximum angle! This ensures that the array will not buckle quite as drastically when lowering and setting it on the bottom of the case. This also makes it easier to dismantle the four-cabinet block.
5. Remove the lower rigging frame.
6. Always insert the front pins into the rigging connector receptacles to ensure that they are not damaged or torn off when the array is lowered onto the case!
7. Adjust the angle of the mid/high case's bottom. Set it to 0° if the lower cabinet of the four-cabinet block is a CDR 208 S, and to 4.5° if it is a CDR 208 T.
8. Carefully lower the array into the case. First remove the rear pin connecting the two mid/high units. Then remove both front pins and place them in the recessed grips so they're out of your way and out of harm's way.
9. Raise the array slightly so that the lower four-bin block can be rolled away.
10. Do not leave the connector component of the rear rigging rail (which is now on the top cabinet of the four-bin block in the case) extended! Remove the pin that sets the curving angle, fold down the connector component, and insert the pin through the connector component and eyelet.

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RIGGING & CURVING THE COHEDRA® COMPACT SYSTEM

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Rigging COHEDRA® Compact Systems
Please read these instructions carefully before you begin setting up the system!

1 USE

1.1 INTENDED USE

Specifications for intended use include the following:
- When rigging enclosures, make sure that the load is centered directly under the suspension point on the rigging frame.
- The rigging frame may be tilted (not to be confused with curved!) no more than 10% (6°). Note that the specifications for intended use require you to read and heed all of the operating instructions and comply with inspection and maintenance requirements.

Any use other than specified is unintended.
The manufacturer shall not be liable for damages resulting from unintended use.

1.2 UNINTENDED USE

Improper use of rigging frames and incorrect handling of this load-carrying equipment can pose a serious danger. Never
- use rigging frames to exert diagonal force or tension on loads,
- use a crane to dislodge stuck or immovable loads,
- lift people,
- strike, knock or dent rigging frames,
- heat-treat or weld rigging frames,
- exceed the truss's maximum load-carrying capacity.

Note that in addition to the above specifications, the operational safety regulations of VBG 9 (accident prevention regulations of the German employers' liability insurance association) apply.

2 WARRANTY AND LIABILITY

HK AUDIO® shall not be held responsible for damages due to improper use or non-compliance with the safety specifications for setup and operation. All warranty and liability claims for personal injury and property damages are excluded if attributable to one or several of the following:
- non-compliance with operating manual instructions, voiding product liability and warranty claims
- unintended use of rigging frames
- non-compliance with operating manual instructions regarding transportation, storage, initial setup, operation, maintenance and repair of rigging frames
- unauthorized structural modifications performed on rigging frames
- unauthorized modification of the parameters indicated in the operating manual
- inadequate or improper repairs

IMPORTANT NOTES ON SAFETY

Original COHEDRA® rigging accessories have been certified as a complete and cohesive system by the safety standards authority TÜV. The COHEDRA® rigging system's provisions for use require that it be installed in accordance with the following specifications. Before you begin installation, ensure that the rigging points (for example, a chain hoist) on the stage roof or
the venue's ceiling comply with BGV-C1 accident prevention regulations and that the safety standards authority TÜV has certified them for the full load (see table 1). Prior to every installation, inspect all components to ensure they are in good operating condition, taking particular care to confirm that all quick-release pins and hardware connectors are undamaged.

The principle requirement for safe handling and trouble-free operation of rigging frames is a thorough understanding of fundamental operating safety and safety regulations.
This operating manual contains important instructions on the safe operation of rigging frames.



Figure 1: COHEDRA® Compact Mid/High case

2.1 RESPONSIBILITIES OF THE OPERATOR

As the operator, you are obligated to allow only those persons to work with rigging frames who are

- 16 years of age or older,
- physically and mentally able, familiar with the basic rules of industrial safety and accident prevention, and trained in the handling of rigging frames.

Be sure to regularly review and confirm personnel's working safety awareness.
In addition, task personnel with specific responsibilities for setting up, putting into service, operating, maintaining, and repairing equipment.
Ensure that personnel are trained to work with the rigging frame only under the supervision of a proficient and experienced technician. Ensure also that defects, flaws and other damage that could impede safety are repaired immediately.

2.2 STORAGE, MAINTENANCE, INSPECTION AND REPAIR OF COHEDRA® COMPACT RIGGING HARDWARE

Storage and safekeeping when not in use
When not in use store the rigging frame in a safe place where it cannot be tipped over and is protected from exposure to the elements.

Inspections
§ 39, VBG 9a of the German employers' liability insurance association's accident prevention regulations requires that load-carrying equipment be inspected by a qualified expert and possible defects be eliminated prior to initial commissioning by the recipient.

§ 40, VBG 9a requires that load-carrying equipment be inspected at least annually for cracks.
When used in dynamic applications, equipment must be inspected for cracks every six months.

Maintenance
You are authorized to replace easily serviceable wearing or standard parts in accordance with the manufacturer's instructions. Use original parts for this purpose.
Tighten screws and bolted connections whenever necessary.

Repair
In the event that parts of the load-carrying equipment have been deformed, it is up to the manufacturer to determine if they are repairable.
Solely the manufacturer is authorized to perform welding and repair jobs on load-carrying equipment.

2.3 TECHNICAL SPECIFICATIONS OF COHEDRA® COMPACT RIGGING HARDWARE

Load-carrying capacity of the rigging frame: 350 kg
Test load: 2,100 kg
Ambient temperature when in operation: min. –10° C, max. + 60° C

2.4 MAXIMUM PERMISSIBLE NUMBER OF FLOWN COHEDRA® COMPACT MID/HIGH UNITS

No more than 16 mid/high range enclosures may be flown in a stacked array.
- Up to 16 mid/high range enclosures may be flown in a stacked array with the standard rigging frame.
- No more than 6 mid/high range enclosures may be flown in a stacked array when using the lightweight rigging frame.
- No more than 6 mid/high range enclosures may be flown in a stacked array when using quick-release pins. In addition, be sure to mind the quick-release pins' maximum permissible load!

Warning:
Flying more than 16 enclosures in a stacked array voids the safety standards authority TÜV's certification!

Refer to table 1 to determine flown loads. The sum of the weights of COHEDRA® Compact mid/high enclosures plus the weight of the rigging frames equals the total load.

Note: Ensure that you add the weights of chain hoists, motors, cables and further stops to determine total weight!

Quantity	Weight [kg]	[lbs.]
1	18	40
2	36	79
3	54	119
4	72	158
5	90	198
6	108	238
7	126	277
8	144	317
9	162	356
10	180	396
11	198	436
12	216	475
13	234	515
14	252	554
15	270	594
16	288	634
Weight of the standard rigging frame with shackles: 10.5 kg/ 23.10 lbs.		

Table 1: Weights of COHEDRA® Compact mid/high enclosures

2.5 MAXIMUM PERMISSIBLE NUMBER OF FLOWN COHEDRA® COMPACT CDR 210 C SUBWOOFERS

- No more than six CDR 210 C subwoofers may be flown in stacked array with the standard rigging frame.

Warning: Flying more than six subwoofers in stacked array voids the safety standards authority TÜV's certification!

CDR 210 C subwoofers and CDR 108 C mid/high units may also be flown together on one rigging frame. Refer to table 2 to determine flown loads. The sum of the weights of CDR 210 C subwoofers and COHEDRA® Compact mid/high enclosures plus the weight of the rigging frames equals the total load.

Note: Ensure that you add the weights of chain hoists, motors, cables and further stops to determine total weight!

Quantity	Weight [kg]	[lbs.]
1	48	105.6
2	96	211.2
3	144	316.8
4	192	422.4
5	240	528
6	288	633.6

Weight of the standard rigging frame with shackles: 10.5 kg/ 23.10 lbs.

Table 2: Weights of COHEDRA® Compact CDR 210 C subwoofers

2.6 PICK POINTS FOR FLYING COHEDRA® COMPACT ENCLOSURES

Use only the top rigging frame's shackles to attach motors, chain hoists and straps. Shackles are inserted into the elongated holes in the center rail!
Clear the area below arrays immediately of people before raising or lowering loads.
Lift and lower flown mid/high enclosures smoothly, avoiding abrupt stops or jerky motions.
Secure the flown array with straps to prevent it from moving, for example, in the event of wind.

2.7 STRUCTURAL MODIFICATIONS OF COHEDRA® COMPACT RIGGING HARDWARE

No structural modifications may be made without the manufacturer's consent. This also applies to welding work performed on supporting parts. Structural alterations require the manufacturer's written approval. Use original replacement and wearing parts only.

2.8 ORIGINAL HK AUDIO®

ACCESSORIES

Use original HK AUDIO® parts only (see chapter 3)! The safety standards authority TÜV has not certified any other parts for use! Always install parts in accordance with these installation instructions! Compile and store all documents pertaining to the system in a safe place!

2.9 INITIATION AND OPERATION

§ 39, VBG 9a of the German employers' liability insurance association's accident prevention regulations requires that load-carrying equipment be inspected by a qualified expert and possible defects be eliminated prior to initial commissioning by the recipient.

§ 41 VBG 9a requires that load-carrying equipment be subjected to a non-routine inspection following damage, repair work and other incidents that can affect load-carrying capacity.



Figure 2: 16 COHEDRA® – CDR 108 C

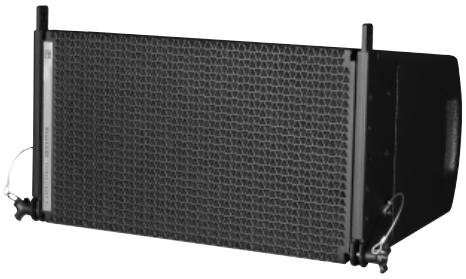


Figure 3: CDR 108 C with integrated rigging attachments



Figure 4: COHEDRA® Compact standard rigging frame



Figure 5: COHEDRA® Compact lightweight rigging frame



Figure 6: Optional quick-release pins for flying up to six CDR 108 C enclosures



Figure 7: Shackles for attaching motors, straps



Figure 8: Lashing strap for curving the array in compression mode



Figure 9: Quick-release pin

3 Components and Applications of COHEDRA® Compact Rigging Hardware

COHEDRA® Compact rigging hardware consists of the following parts:

- a standard rigging frame with two shackles for attaching motors, lashing straps or chain hoists. The rigging frame also serves as the base for ground stacks if the array is not stacked on CDR 210 C subwoofers.
- an optional lightweight rigging frame for flying up to eight CDR 108 C enclosures.
- side-mounted, recessed rigging points designed to accept optionally available quick-release pins for up to six CDR 108 C enclosures.
- an optional two-part lashing strap for curving the array in compression mode.
- integrated rigging points on the side and back for flying COHEDRA® Compact enclosures
- four quick-release pins per CDR 108 C for connecting the enclosure to rigging frames.

Important note on pins: Quick-release pins serve to connect rigging hardware and speaker enclosures, and their proper function must be tested and verified. The pins must always engage fully in the (fitted) hole. Under no circumstances may these pins release on their own when subjected to tractional forces. The nib in the center of the pinhead must always be depressed to insert pins; it releases the ball detents in front. Once the pin engages in the hole, the nib must glide back to its initial position.

3.1 Flying Enclosures Using Quick-release Pins

Small Applications

For small applications (up to six CDR 108 C), you may use two quick-release pins instead of a rigging frame. These are inserted into the top enclosure's designated side holes. The holes accept 10-mm pins (see Fig. 6. Be sure to mind the quick-release pins' permissible load as well as the manufacturer's safety guidelines!

Setting Up a Horizontal Array
You can configure up to three CDR 108 C enclosures in a horizontal array using quick-release pins. Connect three CDR 108 C enclosures and set the splay between the enclosures for fixed mode and in accordance with the given requirements. To learn more about this, read the chapter Determining the Splay Between Two CDR 108 C Enclosures. To do this, you will need two quick-release pins with 10-mm uptake and adequate load-carrying capacity. Mount these to the outermost enclosures, where they will serve as fixing points for flying the rig (see Fig. 10).

3.2 Flying Arrays with Lightweight Rigging Frames

As an alternative to the standard rigging frame that flies up to sixteen CDR 108 C enclosures, you can opt to use the lightweight rigging frame designed to accommodate up to six CDR 108 Cs. The rigging procedure is the same as for the standard rigging frame. However, the lightweight rigging frame may be adjusted to the 0° position only on the rear rigging connector!

4 Determining the Splay Between Two CDR 108 C Enclosures

You have two options for setting the splay between CDR 108 C enclosures - compression mode and fixed mode. In compression mode, the angle is easily adjusted after the array has been flown. This requires a lashing-strap or chain hoist. In fixed mode, the angle is determined during setup and the flown array cannot be adjusted later. This option does not require a lashing-strap or chain hoist. Compression mode is recommended for setups comprising 12 to 16 mid/high enclosures; fixed mode for smaller configurations.

4.1 Compression Mode

Determine the splay between two enclosures by adjusting a single pin (Set Angle). One person can easily perform the entire process of curving arrays.

The following angles may be adjusted between two CDR 108 C enclosures: 0°, 1.5°, 3°, 4.5°, 6°, 7.5° and 9°.

The rigging equipment is designed so that the splay can be adjusted when COHEDRA® Compact arrays have been lifted.

How is this done?
The pin that determines the splay (Set Angle) is merely a predefined stop for the flexible connector component when the entire COHEDRA® Compact array is compressed accordion-style at the back and thereby adjusted using a lashing strap or chain hoist.

When no force is exerted, the entire mid/high array is suspended at 0°, meaning that the pin (Set Angle) is easily repositioned (see Fig. 11)!

Important note: The pin labeled Link connects individual CDR 108 C cabinets. Ensure this pin is inserted, otherwise the enclosures will not be connected to each other and may swing forward!

Preparations
The following section describes how to set up an array in compression mode. Use COHEDRA® CAPS to select rigging frame pick points for determining the angles between CDR 108 C enclosures.

Move the open case with the CDR 108 C enclosures in position. Remove the top cover.

Mounting the Rigging Frame
The tasks described below require two people. Remove the quick-release pins from the rigging frame and the two pins on the back of the top CDR 108 C enclosure. Set the rigging frame on the enclosure. First attach the two front connectors. Turn the rigging frame's connector component down and slide it into the rear rigging connector.

Important:
The standard rigging frame's connector component is longer than that of mid/high cabinets. This means that you can also set ascending angles, for example, for covering balconies, terraces, etc. Bear in mind that a 0° angle between rigging frames and the first 1 CDR 08 C enclosure is set using the hole labeled 9° on the mid/high unit (see Table 3)! To mount the rigging frame, always employ the fixed mode option as follows:

Insert the first pin through the hole labeled 9° on the enclosure and attach the connector component by inserting the second pin through the slot into the hole labeled 6° (see Fig. 13).

Attach to the top rigging frame the shackle destined to accept the motor hook (see Fig. 14). Your choice of pick point depends on how sharply you aim to curve the array later.



Figure 10: Horizontal array comprising three CDR 108 Cs

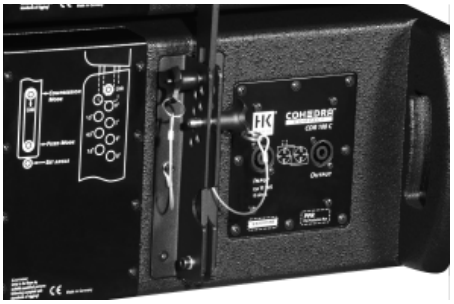


Figure 11: CDR 108 C set angle in compression mode: 4.5°



Figure 12: Open case with four CDR 108 C enclosures

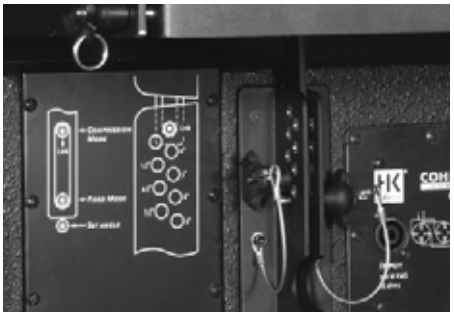


Figure 13: Rigging frame set to 0°



Figure 14: Setting an interim angle



Figure 15: Mounting the standard rigging frame



Figure 16: Setting the splay to curve a CDR 108 C array



Figure 17: Hoisting the top four COHEDRA® Compact Enclosures



Figure 18 a: Rigging additional CDR 108 C enclosures

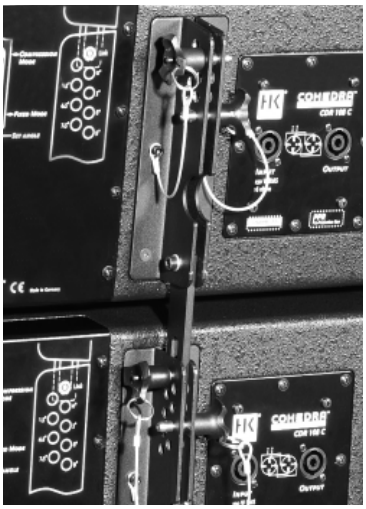


Figure 18 b



Figure 18 c

Note: Depending on application, you may not be able to select a pick point with a shackle. In this case, use two shackles and a suitable O ring as shown in Figure 14.

Check all pins on the top rigging frame to ensure they are firmly seated and attach the motor to the shackle.

Important: Ensure the motor's chain bag hangs freely and does not rest on the rigging frame!

Remove the two front pins of the lowest enclosure and fold down its connector component. Now you can rig the second two-cabinet block. Curve the four CDR 108 C enclosures as desired for the given application by setting the pins on the back accordingly (see chapter 3.1). Determine the desired angle using the pin labeled Set Angle.

This is also a good time to connect the speaker cords to the four enclosures that will later be at the top of the array. Bear in mind that you must attach one of the shackles on the rigging frame to the lashing strap or chain hoist that will later serve to pull back the ends of the array to curve out its front face. Do this now.

Tip: If you intend to rig additional CDR 108 C enclosures, it is recommended that you attach all the required speaker cords to the top rigging frame now because this task is made more difficult as the height of the array increases. Be sure to use cords of sufficient length!

Rigging Additional COHEDRA® Compact Enclosures

Hoist the mid/ high cabinets to a height that allows you to roll a second case holding four CDR 108 C enclosures under the array. Remove the two front pins from the lowest flown enclosure.

Move the second case with four additional CDR 108 C enclosures into position. Slowly lower the top four cabinets until the two front connectors engage. Insert the two front pins first, ensuring that they engage fully and securely (see Fig.e 18 a). You may have to shift the two enclosures slightly to ease the pins into position. In order to attach the rear connector component, you must swivel it out of the rail so that the round end faces up and the slot faces down (see Fig. 18 b). To connect the two blocks, insert the pin through the connector's elongated hole and through the hole labeled Link.

Hoist the COHEDRA® Compact array with the eight enclosures just high enough to remove it from the case.

Insert the pins on the back of the bottom four enclosures' Set Angle holes to achieve the desired curving angle. Connect the remaining speaker cords. Repeat the above procedure to configure even more CDR 108 enclosures in a flown stacked array.

Raising the System
The enclosures are rigged, speaker cords are all connected, and the pins are set in the required configuration. If you want to use the lashing strap to curve the COHEDRA® Compact array, connect one of its hooks to the rigging frame. Using a shackle (an 8-mm bolt), attach the hook on the other end to the bottom bin (best to the connector component).
Tighten the strap until it exerts enough force to curve the array as desired.

Once you have hoisted the COHEDRA® Compact array, secure it against gusts of wind or accidental twisting using two lashing straps or ropes.

4.2 Fixed Mode

To determine the splay between two enclosures in fixed mode, you must insert one pin (Set Angle) and fix the connector component in place with the second pin. To fix the selected angle, insert the pin into the neighboring hole labeled Link above the selected angle (Set Angle). This fixes the connector component in place so that it is immobile in all directions (See Fig. 20).

This option gives you the same splay options between two CDR 108 C enclosures to choose from – that is, angles of 0°, 1.5°, 3°, 4.5°, 6°, 7.5° and 9°.

To set up the system, follow the same procedure described for compression mode. Often when arrays are sharply curved it becomes difficult to rig additional blocks. In this event, you must mount enclosures separately from below.



Figure 19: Attaching the lashing strap



Figure 19: Example fixed mode application with 4.5° angle

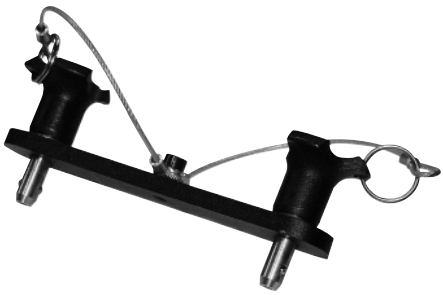


Figure 21: CDR 210 C Rigging Set

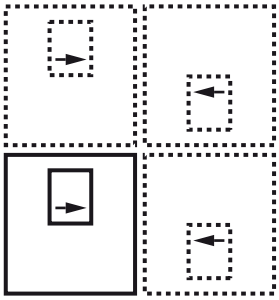


Figure 22: Setting up CDR 210 C subwoofers in a cluster

5 FLYING CDR 210 C SUBWOOFERS

5.1 COMPONENTS

The following components are required to fly CDR 210 C subwoofers:

- a standard rigging frame.
- the pick points on the side panels of COHEDRA® Compact CDR 210 C subwoofers
- the CDR 210 C Rigging Set consisting of four connector components and eight pins

5.2 AS AN INDEPENDENT BASS ARRAY ON A SECOND RIGGING FRAME

The standard rigging frame is certified to fly up to six CDR 210 Cs in stacked array. Read and heed also the safety regulations in chapter C of the manual.

Rigging

Set the standard rigging frame on the CDR 210 C subwoofer with the rubber feet facing down. Remove the four pins on the rigging frame. Attach the four (optional) connector components between the rigging frame and the CDR 210 C using the pins. Attach the shackles for the motor to the rigging frame. Attach the motor to the shackle and lift the subwoofer. Now you can rig additional CDR 210 C bins below this subwoofer. To do this, you need four connector components and eight pins for each subwoofer. (=1Set)

5.3 IN COMBINATION WITH CDR 108 C MID/HIGH

Configuring subwoofers and mid/high units together in a single array can be a viable option, depending on application. Subwoofers must be rigged on top of the flown array for this application.
Mind the rigging frame's maximum permissible load. Before you begin, add up the individual components' weights to determine total system weight. Refer to tables 1 and 2 for weight specifications.

6 CONFIGURING CDR 210 C SUBWOOFERS IN CLUSTERS

CDR 210 C enclosures have been optimized for setting up clusters comprising four subwoofers. When configuring a cluster, set up the bins so that the bass reflex apertures point toward each other. This ensures the various subwoofers' low-frequency signals couple for maximum sonic effect. To this end, set one row of speakers bottom side up (see Fig. 22). The housings are equipped with feet on the bottom and top panels. Refer to the labels on the connector panel for details.

7 GROUND-STACKING

This option is recommended for smaller venues, for example, in which enclosures cannot be flown, or when you want to align the array to cover galleries, terraces or balconies. You can configure stacks with or without CDR 210 C subwoofers, as the given application may require. In both cases, you must use a standard rigging frame as the base for the mid/high cabinets.

7.1 WITHOUT SUBWOOFERS

Set the standard rigging frame, without shackles and with the rubber feet facing down, on the ground, bass bins or stage so that the rigging frame's center connector component for the CDR 108 C enclosures faces up.

Remove the front pins from the rigging frame and mount the CDR 108 C enclosures upside down. Proceed as you would to rig a flown system, except that you do not need a lashing strap to curve the array. The enclosures' weight enables the array to be curved. Maximum stability is achieved in fixed mode.

Note:
You can shift the mid/high stack's center of gravity inwards to make it more stable. Use the two holes on the sides of the rigging frame to do this. They are located about 70 mm inwards, measured from the rear edge (see Fig. 24 a, b).

What's more, you can adjust the rigging frame's center connector component on the lowest CDR 108 C enclosure to tilt the stack 9° downwards. To do this, use the set angles in fixed mode! The table below indicates which angle between the rigging frame and the first mid/high unit will give you the desired down-tilt:

Desired down-tilt	Label on the CDR 108 C
0° (horizontal)	9°
1.5°	7.5°
3°	6°
4.5°	4.5°
6°	3°
7.5°	1.5°
9° (maximum)	0°

Table 3: Angle between the rigging frame and the first mid/high unit

Caution:
Always secure ground stacks with a suitable lashing strap to prevent slippage!

7.2 WITH CDR 210 C SUBWOOFERS

Depending on application, use two or three CDR 210 C subwoofers as the base of the stack. Stack the desired number of subwoofers and then mount the standard rigging frame using four connector elements by following the procedure described in section 7.1 for stacking mid/high cabinets.

Important note:
When configuring ground stacks comprised of three CDR 210 Cs and four to six CDR 108 Cs, subwoofers must be linked using connector elements!



Figure 23: Groundstack with flying frame

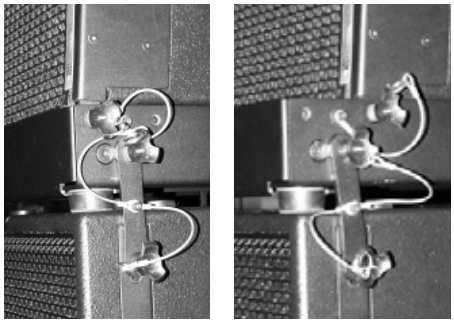


Figure 24 a): normal pin position, b): shifted pin position



Figure 25: Groundstack with CDR 210 C subwoofer

8 OPERATING THE SYSTEM

We recommend the following procedure to help prevent errors and troubleshoot problems quickly. The adverse effect of a mid/high cabinet dropping out or an incorrect connection can seriously degrade a line array's performance!

8.1 CONNECTING SPEAKER CORDS

Always ensure cables are laid out clearly and orderly! You should be able to attribute enclosures to their connected power amp channel and/or amp rack at any time. This ensures flaws such as defective cords can be pinpointed and repaired swiftly.

Example setup using a PB 5:
Channel 1 drives the array's four (two or three) top mid/high units, while channel 2 drives the four units below that, and so forth. Thus, one HK AUDIO® LS cable can serve to drive a total of four mid/high units per channel.
If more cabinets are connected, they are addressed by an additional PB 5, and the channel 1-to-4 numbering system is repeated. See the chapter on the PB 5 in the manual to learn more about how to assign power amp channels to the PB 5's channels 1 to 4.

Take the same systematic approach when connecting CDR 210 C subwoofers.

8.2 ACTIVATING AMP RACKS PR 8 AND PR 16

Ensure the VX 2400s' power switches are off and the gain knobs are turned all the way down. Check the Phase switches on the PB 5s or PB 2s. They must all be set to +2 (or +3)! Once you have done this, switch on the PS 32 circuit breakers on the back of the amp racks. The DFCs and the PB 5 patch bays are now supplied with power. First select the appropriate filter for your setup on all DFCs (making sure you select the same set on each!). If you are unsure of how the amp rack or DFC was used in the previous application (delays, EQ, etc. settings), as a precaution carry out a hot reset on all DFCs and then select the filter set on the DFCs! Read the chapter on the DFC in the manual to learn more about how to do this.
Before you can continue, you must first connect to the amp racks the DFCs' remote line and all of the system's audio cords.

8.3 CHECKING INDIVIDUAL MID/HIGH ENCLOSURES

The best method of checking cabinets is to play a familiar song on a CD, routing the signal into the mixer and out via the master channel. Set the master level to a low-to-medium setting.

- Turn up channel 1's gain knob. You will hear the signal rendered by the array's four top mid/high cabinets. The display of the DFC assigned to this pair should indicate incoming signal levels.
  Important note: If you are located outside the high frequency signal's directivity radius, you will not be able to hear this signal! This system check is best performed with a helper positioned a suitable distance from the array.
  The rule of thumb is, if you can see the bottom of the mid/high unit as a plane surface, you are outside its directivity radius!
- Turn the channel 1 gain knob back down after hearing the signal!
- Follow the same procedure for all other power amp channels that you want to use. Be sure to turn the gain knob down after each successful test!

Note: With this procedure, you are checking mid/high cabinets in descending order; that is, from top to bottom. A cabinet's height affects its directivity, so the lower the cabinets, the closer the listener should move in towards the array.

- Follow the same procedure for the subwoofers.
- Once you have checked all cabinets successfully, turn up all gain knobs, one after the other.
- Start with the channel 1 gain knob for the top mid/high units, and then turn up the channel 2 gain knob, and so forth. With every additional channel that you activate, you should hear a boost in low midrange response. If not, this may be due to a phase inversion in the NF (or in extreme cases, in the speaker cords)! Also check the PB 5's or PB 2's Phase switch again.
- Proceed in the same manner for the subwoofer channels.

8.4 CONFIGURING THE CONTROLLER NETWORK USING AUDIO CONTROLLER SOFTWARE

Once you have performed these tests, you can configure the controller network. The type and size of the configuration of course depends on the given sound reinforcement task (PA left/right, center, out-fills, etc.).
Read the chapter on DFC software in the manual to learn more about networking controllers, creating groups and setting delays and levels.

9 TEARING DOWN AND TRANSPORTING THE SYSTEM

As the somewhat clichéd but certainly true adage goes: To disassemble the system, proceed in the reverse order of assembly.

These tips should make the task of tearing down the mid/high array easier:

1 Lower the array until the bottom of the mid/high case fits under it.
2 Engage the motor or chain hoist to relax the tension on the strap that is curving the array.
Caution: The array may belly out towards the front!
3 Disconnect at least the four lower cabinets' cords.
4 Set the Set Angle pins that are determining the array's curving to 0°! This way the array will not buckle when lowering and setting it on the bottom of the case. This also makes it easier to dismantle the four-cabinet block.
5 Always insert the front pins into the holes on the rigging connector to ensure they are not damaged or torn off when the array is lowered onto the case!
6 Carefully lower the array into the case. First remove the rear Link pin connecting the two mid/high units. Then remove the two front pins. Raise the array slightly so that the lower four-bin block can be rolled away.

CHAPTER E

SETUP WITH CAPS

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1 INTRODUCTION

CAPS (Cohedra Acoustic Prediction Software) providesthe tools and support you need to plan and configure HK AUDIO® COHEDRA® line arrays. To this end, it features many useful functions and handlesintuitively. Despite its ease of use, please take thetime to read this manual and learn to make themost of all its features so you can achieve the best possible audio results every time you deploy a COHEDRA® system.

1.1 ACOUSTIC SIMULATION FOR LINE ARRAYS

An acoustic simulation serves to predict expectedaudio results. With its capability of forecasting howwell a proposed sound reinforcement solution willwork in practice, it is very helpful in masteringsound reinforcement challenges. Best of all, it letsyou perfect the sound system before you actually setit up: The simulation helps detect errors beforehand;sparing you the considerable extra effort it takes tocorrect flaws after the system is up. For this reason, acoustic simulations have become a standard toolfor fixed installations and are used in many projects.

Traditionally, acoustic simulations have been employedless frequently for mobile sound reinforcement, andthen primarily for larger projects. This is changing withthe arrival of line arrays in the sound reinforcementarena. Figures 1 and 2 illustrate the reason for this.

Figure 1 depicts a simulation of direct sound propagation using an HK AUDIO® RT 112 F enclosure as a source with spherical reflectivity. Although at 25°,this enclosure's vertical angle of radiation is quitesmall, it throws sound energy a considerable distanceacross a relatively large field of the audience area. A minor change in the enclosure's vertical angle (3°)would not have a major impact in changing levels within the audience area.

Figure 2, in turn, depicts a simulation of direct sound propagation using a COHEDRA® CDR 208 enclosure as a source with spherical reflectivity. Because the radiated sound wave does not expand much vertically, the enclosure throws sound energyacross a narrowly defined field of the audience area.A minor change in the enclosure's vertical anglewould shift this very narrowly defined field so thatlisteners are no longer supplied with sound energy. Sound energy may also be directed towards walls, which produces undesirable reflections.

Hence, achieving a good audio result with a line array requires very careful configuration and alignment. To help you determine the best possibleconfiguration and alignment of the COHEDRA® Line Array before you set up or install it, HK AUDIO® offers the CAPS software and a DLL for the simulationprogram EASE 4.0. EASE 4.0 takes into account thegiven acoustical conditions to calculate all relevantacoustical parameters such as direct and overallsound levels, delay times, clarity, speech intelligibility, and so forth, as well as to create auralizations. EASE 4.0 is commonly used to plan COHEDRA® system configurations for fixed installations and larger mobile sound reinforcement projects.

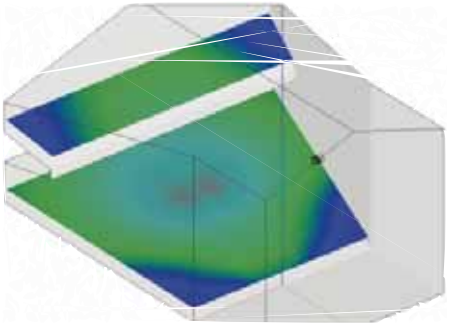


Figure 1: Simulation of a RT 112 F's directivity

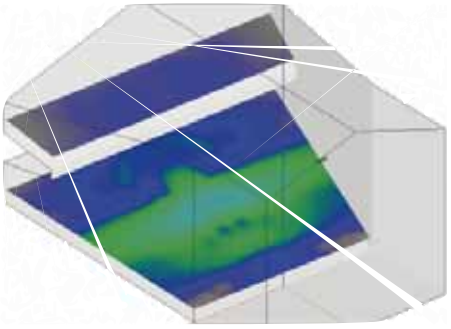


Figure 2: Simulation of a CDR 208's directivity

ACOUSTIC SIMULATION FOR COHEDRA®

CAPS	EASE DLL
Runs on all Win xx platforms	Dynamic Link Library plug-in for EASE 4.0
2D cut model	3D volume model
Direct sound calculation	Calculation of all simulations: direct sound, ALCons, RaSTI, ray tracing, auralization
Application: Day-to-day use when touring	Application: Precision simulations for fixed installations
Data import	

1.2 REMARKS ON SPL CALCULATION IN CAPS

For simulation purposes, HK AUDIO® COHEDRA® CAPS and EASE DLL (Version 1.0) use a point source model that factors the acoustical phase into the equation. This mathematical model provides a good approximation of a line array's cylindrical source up to about 4 kHz. However, the deviations from actual readings increase markedly above this frequency. This causes HF interference to appear in the simulation that does not occur in reality!

To adequately approximate reality, you should always select an average over three octaves for frequencies above 4 kHz.

When determining absolute SPL levels, always use a broadband average; that is, the average of all calculable frequencies. The reason for this is because there may be some deviation in the indication of thirds.

Absolute SPL levels are indicated differently in CAPS and the EASE-DLL:

1.2.1 CAPS

When Continuous is selected, CAPS computes the sound pressure level attained at the controller's input using an **EIA-426-B**-compliant signal at +6 dBu. Similar to pink noise, the **EIA-426-B** signal's spectrum is the averaged result of many different musical compositions. This input level roughly corresponds to the limiters' threshold so that these values are indeed continuous, meaning that they are attainable over a sustained period using a dense signal.

Of course, patching higher levels into the controller's input yields higher output levels. The Peak calculation option serves this purpose. The top units are supplied with the maximal permissible load without taking compression effects and limiters into account. Accordingly, these values are attainable for relatively brief periods only.

1.2.2 EASE DLL

SPL calculation in EASE has traditionally been somewhat different, as it always operates under the assumption of band-averaged energy distribution. For this reason, you should only lend credence to broadband-averaged SPL values; otherwise, the simulated signals' high-frequency range will be overemphasized in comparison to actual signals.

Initial SPL values calculated using an EASE DLL are always peak values! To obtain realistic continuous levels, the SPL values of all frequencies must be reduced by at least -6 dB in the Edit Loudspeaker menu!

The following applies to every simulation in general:
Computed SPL values can be only reproduced precisely using the appropriate test signals. In live musical applications, differences occur naturally as a result of the different spectra and crest factors. However, computed values may certainly be considered conservative, and their accuracy has been verified in countless analyses.

1.3 THE PURPOSE OF CAPS

In contrast to EASE 4.0 DLL, CAPS is employed for mobile sound reinforcement applications that allow little time for a complex simulation. It calculates a COHEDRA® configuration's sound dispersion across audience areas, whereby the room's acoustical influences are not taken into account. CAPS lets you determine the best configuration and alignment for a sound reinforcement application in a virtual simulation; that is, without having to map the room's complexities and without setting up, testing and adjusting the system until you find the optimum solution. To this end, CAPS offers tools that:

- Calculate and view broadband direct sound dispersion at normal and peak levels in up to three audience areas
- Calculate and view sound dispersion in bandwidths ranging from a third of an octave to three octaves in steps of thirds in up to three audience areas
- Fine-tune the COHEDRA® configuration using predetermined sound dispersion specifications
- Calculate the A-weighted direct sound pressure level at the FOH location
- Prepare rigging plans
- Calculate the delay between COHEDRA® line arrays and ground-stacked subwoofers and subwoofer arrays

Note!
Bear in mind that precisely measuring a room's geometrical specs (particularly the audience areas) and carefully planning the COHEDRA® configuration using CAPS will always take less time than determining the best possible configuration by trial and error. Oftentimes, DXF data – or at least scale diagrams of halls – are available on venues' websites. These sources can provide all the information required for a simulation.

2 INSTALLING AND LAUNCHING CAPS

2.1 SYSTEM REQUIREMENTS

A Windows computer with 600 MHz or higher processor, 128 MB RAM, Win 98, Win NT, Win 2000, or Win XP OS

2.2 INSTALLATION

Place the CD-ROM containing CAPS into your computer's disk drive. View the CD-ROM's contents, for example, via the Windows Desktop or Windows Explorer. To begin installing CAPS, double-click the CAPS_Setup.exe icon using the left mouse button. An Installation Assistant appears; it will help you install CAPS properly. First indicate the folder to which you want to load CAPS.
The Installation Assistant offers to create the folder C:\Programs\HK AUDIO\CAPS for this purpose. If you agree, click the Next button. If you want to install CAPS to another folder, click the Browse button, select the desired folder, and then click the Next button.

The CAPS Installation Assistant installs and copies the requisite files to the selected folder. It will let you know when the installation process has been completed. Click the Finish button to quit the Installation Assistant.

2.3 SOFTWARE FILES

CAPS comprises files named CAPS.exe, cdr208.xhn, RCG32.dll, Mscomctl.ocx and Tabctl32.ocx. CAPS. exe is the application file. CAPS is launched by double-clicking the relevant icon. The cdr208.xhn file contains COHEDRA® speaker data; this information is required to calculate levels and directivity. RCG32.dll, Mscomctl.ocx and Tabctl32.ocx are program libraries, or they contain ActiveX control features required by the application.

Caution:
Never edit the content of or remove files because CAPS will no longer run if you do.



Figure 3: Dialog "Select System"



Figure 4: File menu



Figure 5: Tools menu

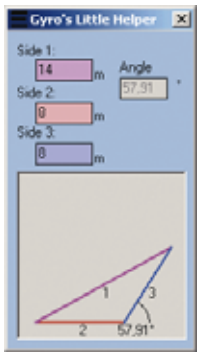


Figure 6: Gyro's Little Helper



Figure 7: Options menu

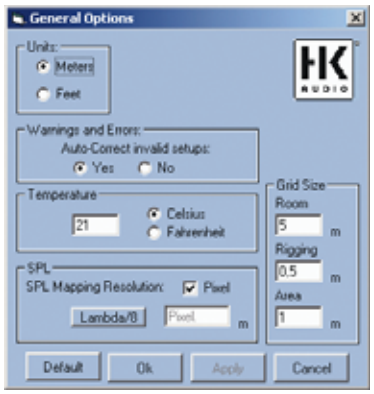


Figure 8: General Options

3 Launching CAPS

During installation, the Installation Assistant creates links called CAPS on the desktop of your computer and in START > PROGRAMS > HK AUDIO > CAPS. Click these links to start CAPS. After launching the program, the user interface appears on your screen with a menu bar and the default Location panel.

The CAPS interface offers tabs providing access to the Location, Setup, Rigging and Sub Array panels. They accept your data and execute the program's function. In the upper region of the screen, you'll find a menu bar offering the menus File, Tools, Options und Help.

3.1 Menu File

- Use the menu option New to create a new COHEDRA® sound reinforcement project. If you have not saved the project you are currently working on, a dialog appears asking you if you really want to create a new project. If you confirm, your current project will be overwritten.
- Use the menu option Open to load a previously created and stored project. A window opens when you select this menu option. Select the project's name (*.lad) and, possibly, its folder in this window. If you have not saved the project you are currently working on, a dialog appears asking you if you really want to create a new project. If you confirm, your current project will be overwritten.
- Use the menu option Save to store the project you are currently working on. If you have not named the project, a window opens prompting you to enter a name for the project.
- Use the menu option Save As to save the project you are currently working on under the name designated here.
- Use the menu option Create Print Version to create a printable rigging plan in RTF format. A window opens when you select this menu option. Enter a name and, possibly, a folder for the new file that you want to create. Once this is done, click the Save button to create and view the RTF file with the rigging plan.
- Use the menu option Exit to quit CAPS. If you have not saved the project you are currently working on, a dialog appears asking you if you really want to exit CAPS. If you quit CAPS without saving the project, its data will be deleted.

3.2 Tools Menu

Use the menu option Gyro's Little Helper to open a utility that calculates the inclination of audience areas. It's rarely feasible to directly measure the height of the last row in inclining audience areas. Instead, measure the distance from the reference point to the beginning of the inclining audience area (Side 2), the distance from the reference point to the last row of the inclining audience area (Side 1), and the length of the inclining audience area (Side 3). If you enter the values you have measured to the program, it calculates and indicates the audience area's inclination. In CAPS, you can then enter this inclination angle for the given audience area (see the chapter "Entering Audience Areas" to learn more about this).

3.3 Options Menu

- Use the menu option Display Font to determine the typeset employed in CAPS. A window opens when you select this menu option. Select the desired settings in it.
- Use the menu option General Options to open a window that lets you determine basic settings for the calculations and displays used in CAPS (cf. figure 7: General Options). The Unit box serves to determine if lengths are indicated in meters or feet. Use Warnings and Errors to determine if CAPS automatically corrects invalid configurations. The Temperature box lets you enter the ambient temperature as well as the unit measurement, Centigrade or Fahrenheit. CAPS uses the indicated temperature to compute the velocity of sound and thus the delay times of signals rendered by the COHEDRA® system. The SPL box lets you select the spatial resolution employed for sound level calculations; in other words, the distance between two neighboring points in front of the COHEDRA® array at which the sound level is calculated. Though a coarse resolution requires less computing time than a fine resolution, it may yield less accurate views, depending on the frequency. You can enter the resolution directly in meters or click the Lambda/8 button to select a frequency-dependent resolution that serves to accurately compute different sound waves' overlap. Furthermore, you can choose the Pixel option to define your screen resolution as the resolution used for calculations. The Grid Size box lets you determine the size of the grid used to represent the room, rigging and audience area for sound level calculations. Click the Default button to select defaults for all boxes. Click Apply to confirm the settings; click Ok to close the General Options window. Click Cancel to close the General Options window without confirming your settings.

3.4 HELP MENU

Use the menu option About to open a window providing general information on CAPS, the version number, and your computer system.

3.5 LOCATION PANEL

Open the Location panel to begin creating a new project. In box 1, enter the room measurements (depth and height), the FOH location, and the coordinates of the reference point from which you will measure the audience areas' coordinates. In box 2, enter the number and coordinates of audience areas you have measured. Data entered for the room and the audience areas are represented in a side view with a superimposed grid. In box 3, you may enter general project-related data such as the project name, author and comments. This information will then appear on all other panels.

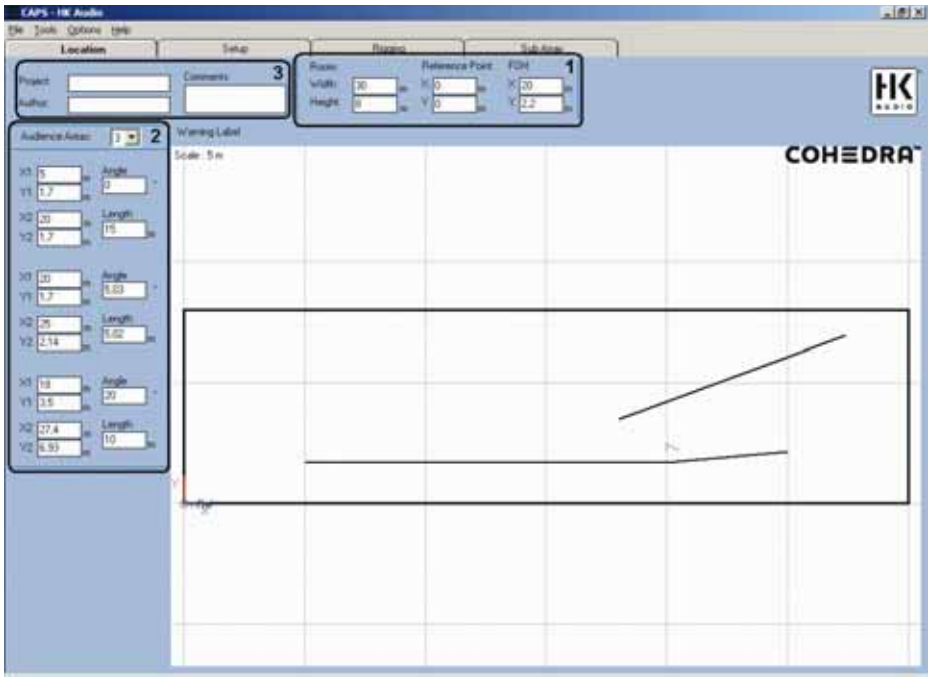


Figure 9: The Location panel

3.6 SETUP PANEL

The Setup panel lets you create and test your configuration. First you must determine if you want CAPS to compute the continuous sound level, peak sound level or the sound level of an individual frequency band within the audience areas. In box 2, enter the position of the array and how many and/or which components it consists of. In box 3, adjust the vertical angle of the entire array as well as the angles between individual components until you achieve optimum results. You can view sound level envelopes in the individual audience areas using the diagram in box 4. To this end, click the desired audience area using the left mouse button. In box 5, you can indicate the position of subwoofers and then see the delay between the subwoofer and COHEDRA® mid/high array depicted in a side view. Click Calculate to compute the COHEDRA® array's sound level envelope in the audience areas and view a color view thereof. Use the Optimize button to open a panel providing an optimization function. When selected, it fine-tunes the configuration automatically.

Note:
The optimization function is a fine-tuning tool rather than a full-fledged auto setup option that configures your system for you. It does not detect or correct major setup errors!

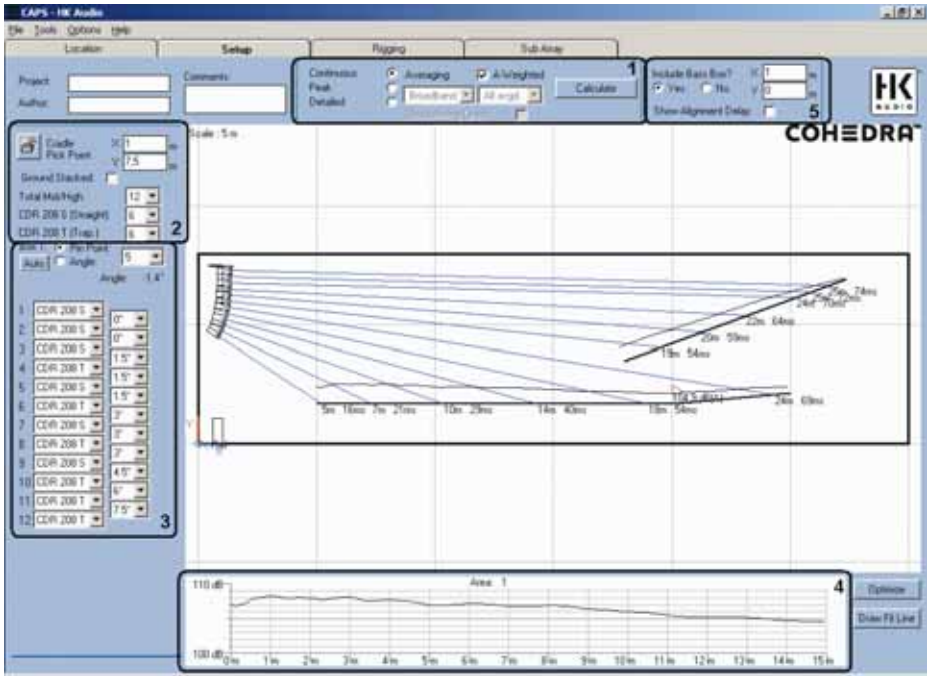


Figure 10: The Setup panel

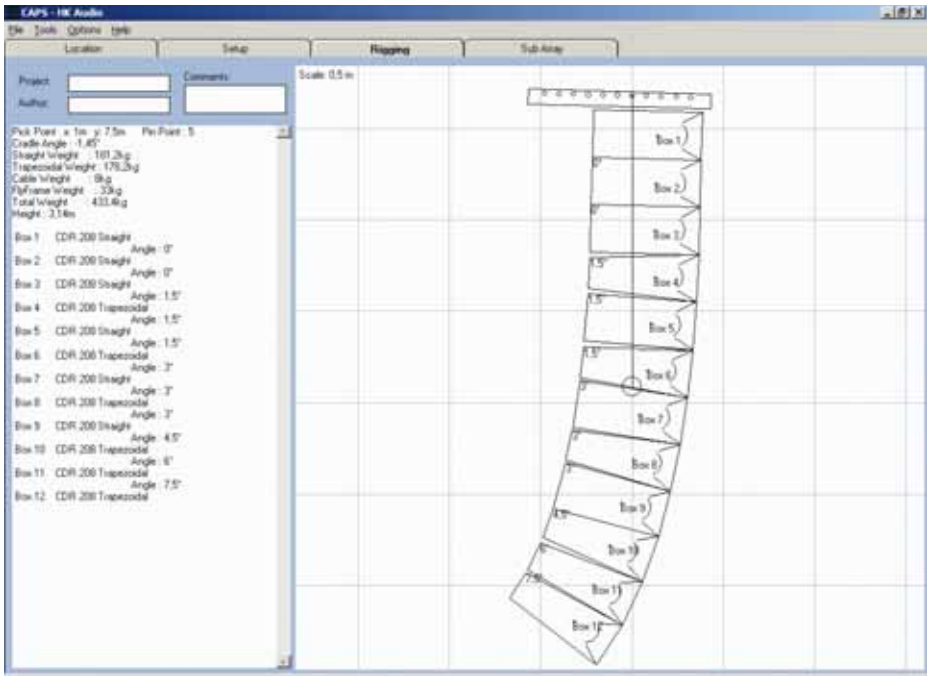


Figure 11: The Rigging panel

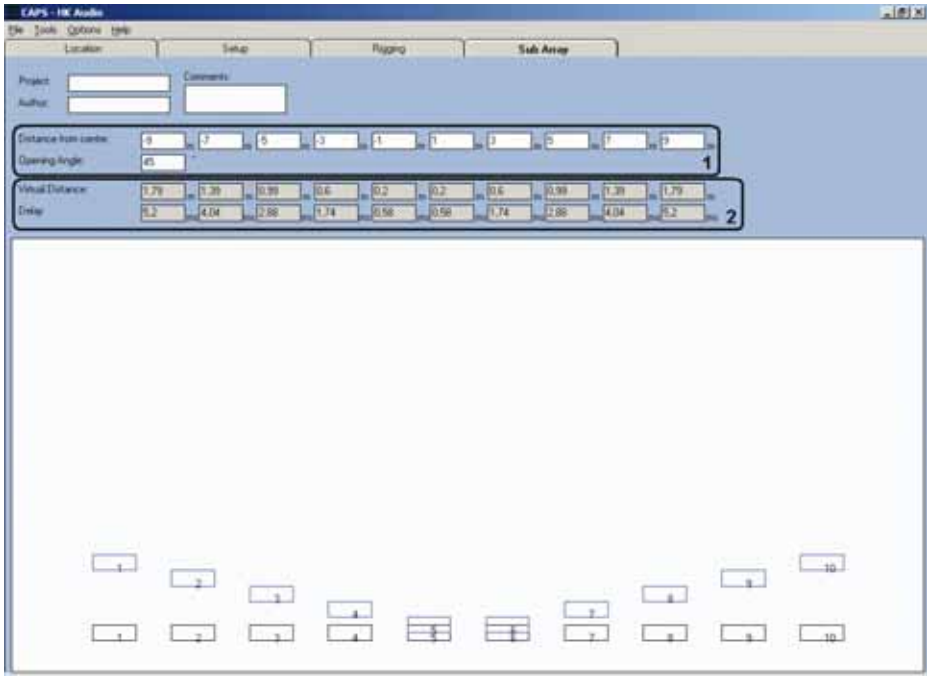


Figure 12: The Sub Array panel

3.7 RIGGING PANEL

The left screen area of the Rigging panel contains the current COHEDRA® configuration's mechanical data. This includes information on the pick-point as well as the height and weight of the COHEDRA® array; that is, the composite of the CDR 208 S, CDR 208 T, the flight frame and the speaker cords' individual weights. In addition, it indicates for every enclosure the model name and the vertical angle to the neighboring enclosure. Adjust rigging fixtures to this angle when setting the system up. The right region of the screen shows a side view of the current array with a superimposed grid. This view indicates the angles between two neighboring enclosures and the pick-point on the flight frame. Adjust rigging fixtures to this angle and use this pick-point when setting the system up.

3.8 SUB ARRAY PANEL

Use the Sub Array panel to configure horizontal subwoofer arrays. It can calculate up to ten subwoofers or subwoofer blocks. If a subwoofer block consists of several subwoofers, be sure to stack these.
In box 1, indicate the distances between the individual subwoofer blocks using a virtual median, and then indicate desired curvature for the entire subwoofer array. CAPS uses your input to compute a virtual subwoofer array that satisfies your curvature requirements. Box 2 shows for every subwoofer block the distance between every virtual subwoofer block and its real-world counterpart, as well as the delay time that you must select as a result of this. The lower screen area depicts a top view of the subwoofer array featuring the real subwoofer blocks (black) and the virtual subwoofer blocks (blue)

4 CREATING A NEW PROJECT

To create a new project, first launch CAPS or, if CAPS is running, select the menu option New from the File menu.

4.1 ENTERING PROJECT DATA

When creating new projects, make a habit of entering project data first to ensure the project is easily identified later. To enter project data after launching CAPS, open the Location panel, if it is not already on your screen. Type a meaningful name into the Project box, your name into the Author box, and brief remarks that will help you identify the project later into the Comments box. For example, if you want to simulate different variants of the same sound reinforcement project in CAPS, type in a comment describing the individual variant's unique features.

4.2 ENTERING ROOM DATA

Under Room, type the given room's width into the Width box, and its height into the Height box. This information is used solely to represent the room's dimensions in the side view provided in the Location and Setup panels; it has no influence on acoustical calculations. For outdoor sound reinforcement applications, enter the depth of the event grounds to the Width box and a height greater than the projected height of the flown COHEDRA® array (possibly the height of the tiers).

Under Reference Point indicate in the X and Y boxes the respective X and Y coordinates of a reference point. You must later measure from this reference point individual audience areas' distances and dimensions, as well as the position of the COHEDRA® array. As a rule, the reference point is located at the left bottom corner.

In the X and Y boxes under FOH, indicate the X and Y coordinates of the FOH location. You will later see indicated here the calculated A-weighted sound pressure levels achieved by the givenconfiguration at the FOH location.

4.3 ENTERING AUDIENCE AREAS

Click the Audience Areas box to open a list from which you can select the number of audience areas (up to 3). Then enter the coordinates for each audience area. You have several mapping options. The first is to type for the given audience area the first row's X and Y coordinates into the X1 and Y1 boxes, and the last row's X and Y coordinates into the X2 and Y2 boxes. This option is a good choice when coordinates are derived from diagrams rather than being measured on site.

If you are compelled to map distances and dimensions on site, measuring the height of the last row of inclining audience areas is rarely a workable option. In this case, measure the distance from the reference point to the first row of the given audience area, and enter these X and Y coordinates into the X1 and Y1 boxes for this audience area. Select the menu option Gyro's Little Helper from the Tool menu and also enter the X1 value into the Side 2 box. Measure the distance from the reference point to the last row of the audience area and enter this value into the Side 1 box. Now all you have to do is measure the length of the audience area from the first to the last row and enter this value into the Side 3 box. Then you will see indicated in the Angles box the audience area's inclination. Enter this value into the given audience area's Angles box on the Location panel. Type the length of the audience area (the value you entered into the Side 3 box in Gyro's Little Helper) into the Length box for the given audience area. This completes the procedure for mapping an inclining audience area.

Note!
Measure all X and Y coordinates used to map audience areas from the reference point indicated in the Reference Point box.

5 CREATING A COHEDRA® CONFIGURATION FOR A PROJECT

To create a COHEDRA® configuration for a project, go to the Setup panel after entering project data, room data and audience areas.

5.1 DEFINING THE SIMULATION'S BANDWIDTH

Before you begin setting up a COHEDRA® configuration, click Continuous at the top center of your screen to select a continuous sound level simulation. This is the threshold level – the highest level attained by the COHEDRA® system without triggering the DFC's peak limiters. The readout automatically changes from Averaging to Broadband when you select Continuous because continuous sound level simulations always use a broadband signal with a spectrum similar to pink noise. Click A-Weighted to select the A evaluation option for the sound level simulation.

5.2 ENTERING COHEDRA® ARRAY SPECIFICATIONS

Select Cradle Pick Point and type the x coordinates into the X box and the projected height of the pick point for the COHEDRA® array in the Y box. Both values are measured from the predetermined reference point.

Note:
As a rule, the greater the height (altitude) of the COHEDRA® array, the more uniform sound dispersion will be.

If under exceptional circumstances you are unable to fly the COHEDRA® array and are compelled to set it up on the ground, select this option by clicking Ground Stacked. When selected, a check-mark appears in the box next to Ground Stacked and the COHEDRA® array presented in the side view is flipped so that the flight frame is on the bottom. In this case, enter the height of flight frame that is now below the COHEDRA® array into the Y box under Cradle Pick Point.

In the Total Mid/High box, select the number of enclosures that you want to employ in your configuration. The premise in CAPS is that CDR 208 S and CDR 208 T enclosures are distributed equally. On the one hand, the COHEDRA® array produces a higher sound level with a greater number of COHEDRA® enclosures. On the other, a certain number of COHEDRA® enclosures is necessary to achieve the required vertical angle of radiation and sufficient spread in the near field.

This means that for some projects, you may require more COHEDRA® enclosures than are strictly necessary to achieve the desired sound level.

In the side view, you'll now see a view of the room with the audience areas and a COHEDRA® array consisting of the number of enclosures that you have determined. Note that lines run from every enclosure (main axis); these tools are there to help you align speakers. Values appear at the point where an aiming line meets an audience area. They indicate the distance from the respective point to the given enclosure in meters, and the given delay in milliseconds.

In Box 1 at the left edge of the screen, click Angles and enter the vertical angle of the top enclosure to the neighboring enclosure so that it is aimed toward the rearmost row of the rearmost or uppermost audience area. This is done to prevent undesirable reflections from bouncing off the back wall. Or you can click Auto under Box 1 to have CAPS automatically adjust this angle for you. The angle of the top enclosure and its alignment remains unchanged for all further settings. This also applies to settings that change the array's focal point.

You have another option alongside entering the angle directly: Click Pin Point to the right of Box 1 to determine the vertical angle of the top enclosure by entering the pick-point on the flight frame. When you have determined a pick-point using this method, it remains unchanged for all further settings, although this does change the alignment of the top enclosure when the array's focal point is changed.

5.3 ALIGNING COHEDRA® ARRAY ENCLOSURES MANUALLY

At the left edge of the screen, you'll see listed individual enclosure's data. The list is numbered in descending order from the flight frame down. In the selection box to the right of each enclosure number, you can determine if you want to employ a CDR 208 S or a CDR 208 T at this position in the array. Ensure flown CDR 210 F Sub bass bins are always positioned above mid/high units. On the right are selection boxes that let you determine the vertical angle between two neighboring enclosures. The setting options for this angle depend on the type of neighboring enclosures:

Upper enclosure	Lower enclosure	Possible angles
CDR 208 S	CDR 208 S	0°
CDR 208 S	CDR 208 T	0°, 1.5°, 3°, 4.5°
CDR 208 T	CDR 208 S	0°, 1.5°, 3°, 4.5°
CDR 208 T	CDR 208 T	4.5°, 6°, 7.5°, 9°
CDR 210 F Sub	CDR 208 S	0°, 1.5°
CDR 210 F Sub	CDR 208 T	3°, 4.5°, 6°

In the side view, click the audience area in which you want to begin aligning the COHEDRA® array's enclosures. As a rule, you'll start with the uppermost or rearmost audience area. A view of the sound level envelope in this audience area appears in the diagram at the bottom of the screen.

Now align the enclosures you have selected to cover this audience area by adjusting the vertical angles between the individual enclosures.
Use the aiming lines running from each enclosure to the audience as alignment tools. An accurately aligned COHEDRA® array achieves very uniform sound dispersion within an audience area, with very little level drop-off between the first and last audience row.

To this end, the density of aiming lines running to the audience area should increase as distance increases. Accordingly, the greater the altitude of two neighboring enclosures in the array, the smaller the angle between the two should become. However, do not aim for totally uniform sound dispersion between the first and last rows because audiences expect levels to drop-off somewhat at greater distances from the stage. Follow the same procedures to align the enclosures of the COHEDRA® array to the other audience areas.

When aligning the array, you may find that you need more enclosures to attain the desired sound level within an audience area. If possible, increase the number of enclosures to cover this audience area. If not, your only remaining option is to align enclosures so that they achieve the best possible rather than ideal results.

Once you have aligned enclosures, click the button with the open lock icon to ensure the configured COHEDRA® array cannot be changed. The lock on the button closes, and the COHEDRA® array can no longer be edited. To unlock the configuration, simply click the button again so that the lock opens.

5.4 ALIGNING ENCLOSURES USING THE OPTIMIZATION FUNCTION

The higher the frequency, the more pronounced the directivity of a COHEDRA® array. Therefore, your best bet is to select a frequency of 5,000 hertz with a bandwidth of three octaves before executing the optimization function. Then click the audience area for which you want to optimize the enclosure alignment. Click the Draw Fit Line button. Draw a line representing the desired sound level envelope in the diagram at the lower edge of the screen. To do this, place the mouse pointer at the desired starting point. Press and hold the left mouse button. Drag the mouse pointer to the desired end point and release the left mouse button.

Click the Optimize button to open a window for the optimization function. In the Optimization Settings box you can select various settings for the optimization function. When Area Speakers only is activated, CAPS optimizes the alignment of enclosures that you have manually aimed at the given audience areas. Otherwise, CAPS optimizes the alignment of all enclosures in the array in order to achieve the desired dispersion in the given audience area. This setting is not a viable option if you have finished aligning enclosures to an audience area and want to align other enclosures of the COHEDRA® array to a second audience area.

When Neighboring angles only is selected, CAPS uses for optimization purposes only the next higher and next lower angles alongside your manually selected angle between two enclosures. For example, the manually determined angle between two CDR 208 T enclosures is 6°. In this case, the optimization function will only allow for angles of 4.5 ° and 7.5°! Otherwise, CAPS optimizes the alignment using all possible angles between two neighboring enclosures. If you have achieved a good result by aligning enclosures manually, and you just want to fine-tune it using the optimization function, ensure this option is enabled. If you want the optimization function
to align enclosures for you, deactivate Neighboring angles only.

In the Number of Points box, enter the number of points in the audience area at which the sound level

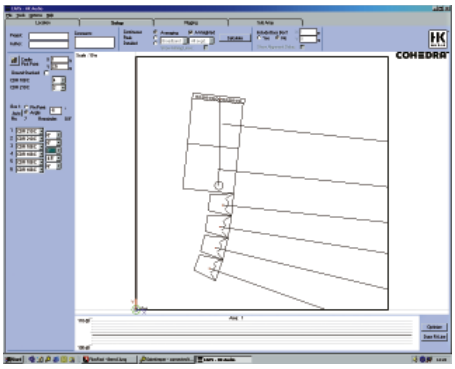


Fig. 13: Configuring flown subwoofers

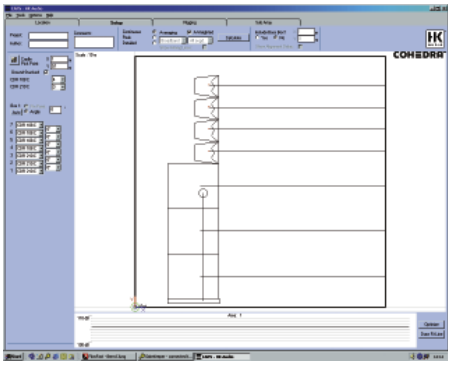


Fig. 14: Example ground stack

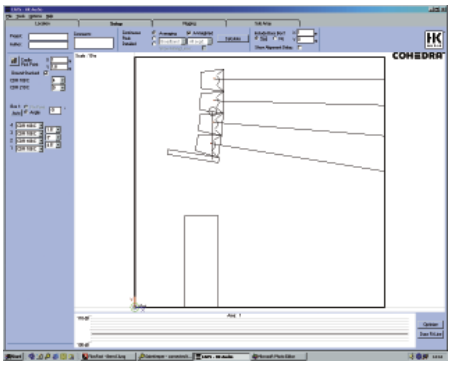


Fig. 15: Example of down-tilt simulation for a ground stack

is computed during the optimization procedure. The default value is 200 points.

Note:
Deactivating Area Speakers only and Neighboring angles only increases the number of COHEDRA® configurations to be analyzed during the optimization process. This prolongs computing time, as does selecting a greater number of calculation points!

When Fit to line is selected in the Measure box, the array's alignment is optimized to fit the envelope that you defined by drawing in the red line. Conversely, if Smooth Area is selected, the array's alignment is optimized to ensure uniform, smoothed dispersion within the given audience area.

The Fit line box indicates the starting point X1 and the end point X2 of the envelope that you defined by drawing in the red line. Delta dB indicates the difference in sound level between the starting and end points. In the box above the Begin Calculation button, you'll first see indicated the number of the audience area for which the alignment is being optimized, and then the number of configurations to be analyzed in this optimization process.

Click the Begin Calculation button to initiate the optimization process. Throughout you'll see indicated in the display above the button the number of tested configurations, the progress so far in percentage values, the best optimization value so far, and the number of configurations that have achieved this value. In the box at the right of the optimization window, you'll see a view of the configuration currently being analyzed in the optimization procedure. Deactivate the Show Setup option located above this box to hide the configurations view. If you want to temporarily halt the optimization process, click the Pause button. Click Continue Calc. to resume the optimization process.

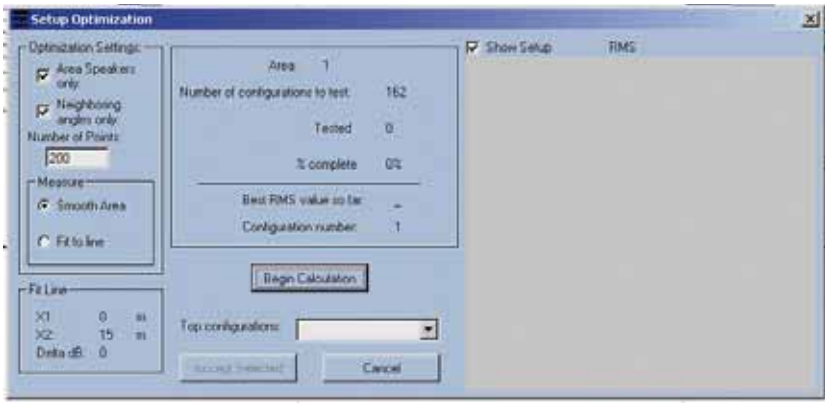


Figure 16: Setup optimization

Once the optimization process has been concluded, the Top configurations selection box shows the three configurations that deliver the best optimization results, as well as the original configuration; that is, your manually configured array. You may select these configurations successively in the Top configurations box in order to compare them. Each selected configuration is shown in the view on the right of the optimization window. You'll see the selected configuration's alignment in the side view shown on the Setup panel. You'll also see that the diagram at the lower edge of this panel continues to show the sound level achieved in the given audience area using this configuration.

After you have selected one of the configurations in the optimization window, click the Accept Selected button to accept this configuration for the given project. Otherwise, click Cancel to close the optimization window and retain your initial configuration.

When you have finished aligning enclosures, click on the button with the open lock to secure the configured array against changes. The lock on this button closes. To unlock the configuration, simply click the button again so that the lock opens.

5.5 Viewing the Sound Level Envelope

Once enclosures have been aligned, you can click Continuous at the top center of the screen to view the continuous level within the audience area in a diagram at the lower edge of the screen. Click the other audience areas in the side view to see their sound level envelopes. To view the peak sound level within the audience area, click Peak at the top center of the screen. Like the continuous sound level simulation, the peak simulation also uses a broadband signal covering the entire frequency range.

Click Detailed at the top center of the screen to obtain a view of relative sound dispersion with an adjustable frequency and adjustable bandwidth for the currently selected audience area. In the selection box on the right of Peak, you can enter the desired bandwidth from a third of an octave, one octave, three octaves or broadband. In the selection box on the right of the bandwidth setting, you can choose the desired frequency within a range of 100 hertz to 12,500 hertz in steps of thirds.

Note:
You can use a bandwidth of a third of an octave or one octave to view narrow-band spatial interference.

However, a bandwidth of three octaves comes closer to the reality of a sound reinforcement system's broadband response. In the high frequency range above 4,000 Hz, select a bandwidth of three octaves because at these high frequencies, simulated results using narrow bandwidths differ markedly from actual results in the real world.

Click A-Weighted to activate/deactivate the A evaluation option for the simulation.

5.6 VIEWING THE DISPERSION PATTERN

To view the COHEDRA® array's dispersion pattern at continuous or peak levels, select Continuous or Peak on the Setup panel at the top center of your screen. Activate the A evaluation for the sound level by clicking A-Weighted. Then click the Calculate button. A window showing the progress of the calculation operation appears while CAPS computes. Then the COHEDRA® array's dispersion pattern is shown in a color side view. At the lower edge of the side view, you'll see a legend indicating the assignments of colors to sound level values. Click Show Aiming Lines to also view the aiming lines running from the individual enclosures to the audience areas.

To view the COHEDRA® array's dispersion pattern in a specific frequency band, select Detailed at the top center of the screen, and the desired bandwidth and its center frequency in the two selection boxes on the right.

Note:
You can use a bandwidth of a third of an octave or one octave to view narrow-band spatial interference. However, a bandwidth of three octaves comes closer to the reality of a sound reinforcement system's broadband response. In the high frequency range above 4,000 Hz, set a bandwidth of three octaves because at these high frequencies, simulated results using narrow bandwidths differ markedly from actual results in the real world.

Click A-Weighted to deactivate the A evaluation option for the sound level simulation. Then click the Calculate Band button to compute the dispersion pattern of the array in the selected frequency band or click Calculate All to compute the dispersion pattern in all frequency bands. A window showing the progress of the calculation operation appears while CAPS computes. Then the COHEDRA® array's dispersion pattern is shown in a color side view. At the lower edge of the side view, you'll see a legend indicating the assignments of colors to sound level values. Click Show Aiming Lines to also view the aiming lines running from the individual enclosures to the audience areas.

If you clicked Calculate Band to compute the array's dispersion pattern in the selected frequency band only and then select another frequency band, CAPS calculates and indicates the new band's dispersion pattern. On the other hand, if you clicked Calculate All to compute the dispersion pattern of all frequency bands and then select another frequency band, CAPS indicates the new frequency's dispersion pattern without having to calculate it first.

Note:
If you have not locked the configuration to prevent further editing, CAPS does this automatically when computing the dispersion pattern. The lock on the given button closes and the button is engaged. To unlock the configuration, simply click the button again so that the lock opens and the button is disengaged.

5.7 VIEWING DELAY TIMES BETWEEN MID/HIGH ARRAYS AND STACKED SUBWOOFERS

Click Yes in the Include Bass Box field at the upper right of the Setup panel. A subwoofer appears in the side view; it can also represent several subwoofers for multi unit configurations. At the right of Include Bass Box, type the x coordinates into the X box and type into the Y box the stacked subwoofer's height measured from the reference point. The side view of the subwoofer shifts accordingly. Then activate Show Alignment Delay. The side view indicates the delay between the mid/high array and the subwoofer at the points where the individual enclosures' aiming lines meet an audience area. Negative values mean that subwoofer signals arrive earlier; positive values mean that the mid/high array's signals get there first.

In some cases, the difference in delays must be compensated via a delay function (Low Delay or Mid+High delay on the DFC Software Controller) to ensure mid/high and subwoofer signals arrive simultaneously at the first rows of the front audience area. Do not compensate for delay in projects with inclining audience areas because the subwoofer signal will arrive much later than the mid/high signal at the top rows of the inclining audience area.
The improvement at the front rows comes at the cost of signal degradation at the top rows. In these cases, it is preferable to fly the bass bins.

6 CREATING A RIGGING PLAN

Go to the Rigging panel to view the COHEDRA® array's rigging plan. Select the menu option Create Print Version from the File menu. A window appears. Enter into this window the folder and name of the RTF file in which you want to store the rigging plan and click the Save button. CAPS generates an RTF file with the rigging plan and opens it using your computer's designated word processing program for RTF files.

If necessary, edit data in the given word processing program to create a layout suitable for the pages you want to print. Then you can print the rigging plan using the word processing program's standard printing function.

7 CREATING HORIZONTAL SUBWOOFER ARRAYS

Subwoofers may be set up in vertical or horizontal arrays. Vertical subwoofer arrays are beneficial in that – depending on the length of the array – they focus sound energy quite tightly on the vertical plane. This yields greater throw distances without exciting the venue's ceiling. Their drawback is that vertical subwoofer arrays positioned at the right and left of stage generate interference on the horizontal plane. A horizontal subwoofer configuration arrayed across the full width of the venue's grounds does not generate interference. Bear in mind that the distance between two neighboring subwoofers in the array must be less than half the wavelength of the highest frequency radiated by the subwoofer array.

A horizontal subwoofer array focuses sound energy quite tightly on the horizontal plane. This means that in the near field, it radiates a horizontal cylindrical wave with a dispersion angle of nearly 0°.

And that, in turn, means that sound energy does not reach listeners located in front of the subwoofer array but outside the horizontal cylindrical wave's sound field. For this reason, it is usually necessary to adapt the horizontal subwoofer array's horizontal angle of radiation to suit the given sound reinforcement situation. This is achieved by positioning the subwoofers accordingly or adjusting an appropriate delay setting for every subwoofer (block).

Go to the Sub Array panel to create a horizontal subwoofer array. A subwoofer block can comprise an individual subwoofer or a vertically arrayed block of subwoofers. Type into the boxes at the right of Distance from center the individual subwoofer blocks' distances measured from the system's center line of symmetry.

Note:
In order to prevent horizontal interference, the distance between two neighboring subwoofer blocks may not be greater than half the wavelength of the subwoofer array's upper limiting frequency.

Example:
Upper limiting frequency 100 Hz: Lamda half of 100 Hz = 170 cm
Enter into the Opening Angle box the subwoofer array's desired horizontal angle of radiation.
The screen shows a top view of the real subwoofer blocks (black) and the virtual subwoofer blocks' (blue) setups as required to implement the selected angle of radiation. In the boxes to the right of Virtual Distance you'll see indicated the distances between the respective real subwoofer block and its virtual counterpart. In the boxes to the right of Delay you'll see indicated for each subwoofer block the delay time required to implement the virtual array in the real world. Enter these delay times to the DFC's Low Delays for the respective subwoofer blocks.

Chapter F

COHEDRA® Controlling Concept

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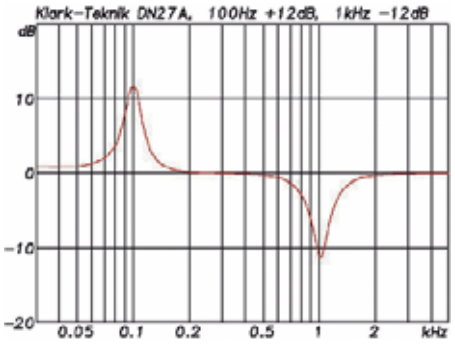


Figure 1: Equalization at 100 Hz and 1 kHz

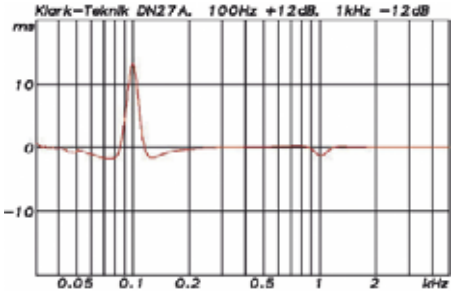


Figure 2: Resultant group time of IIR filter processing

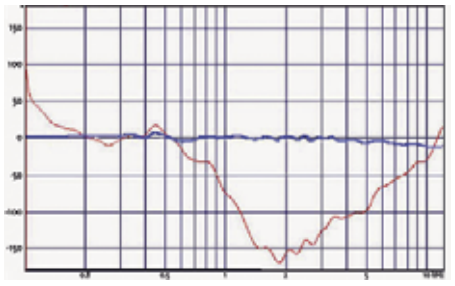


Figure 3: Phase characteristic with and without phase equalization

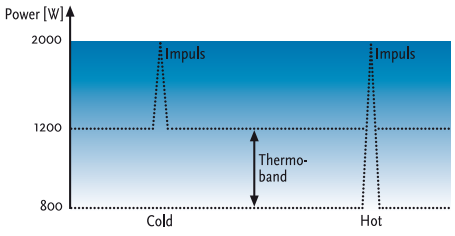


Figure 4: The Overshoot Limiter's mode of operation

1 THE COHEDRA® CONTROLLER CONCEPT

The performance of a conventional controller is confined to providing:
- crossover functions
- equalization
- time alignment
- limiting functions protecting against power amp and speaker overloading

Current digital controllers compute frequency equalization using IIR filters, which are however unable to equalize phases. At present, some line arrays use purely mechanical time alignment for high frequency drivers, but not for midrange woofers.
An example of filtering using an IIR controller or analog EQ follows:

When equalizing frequency response as shown in the example above, the 100 Hz frequency suffers a delay of 13.1 ms in comparison to the first overtone at 200 Hz! (see Fig. 2). If this frequency is rendered by an 18" woofer, delay time increases again before the signal reaches the ear! This means the fundamental and its overtone are no longer in sync, causing dynamic distortion that degrades the sonic image's natural homogeneous sound.

To ensure natural response, the speaker system must be processed with phase and time alignment as well as real phase equalization.

The functions of the HK AUDIO® Digital Field Controller (DFC) go far beyond those of a standard controller:

1.1 FREQUENCY AND PHASE EQUALIZATION USING FIR FILTER TECHNOLOGY

FIR filter technology lets you equalize a sound systems' phase and frequency response of (loudspeakers and power amp!) separately. Unlike IIR filters, FIR filters do not consist of a specific number of separately computed filter elements. Instead, they contain a complete sampled copy of the function required for equalization.
The entire filter is recomputed every time a filter setting is modified.
The DFC's controller concept is geared specifically to avoid unsatisfactory group time results of conventional digital controllers using IIR filter technology such as shown in the above example.

1.2 3-WAY VIRTUAL CROSSOVER

The crossover splits the input signal into three frequency bands. The selected filter equalizes the entire sound system's frequency and phase response. This includes all components following the DFC in the signal chain such as amps, passive crossovers, and speakers.

1.3 THE DFC LIMITER IN COMBINATION WITH THE VX 2400

RMS/ Peak Limiter and Thermo Limiter
The DFC is equipped with temperature and RMS limiters for all three frequency bands. These forward-looking features anticipate the amount of power routed to the amp's outputs. In the event of impending electrical, mechanical or thermal overload, they cut output power to allowable levels for the connected speaker systems.

Overshoot Limiter
The VX 2400 power amp can produce intermittent peak output levels ranging up to 2,000 W per channel. For this reason, the overshoot limiter also takes the duration of an impending overload into account alongside its amplitude. This ensures that the DFC limiters exert little or no influence on the amplitude and duration of brief percussive impulses with high amplitude but very brief durations. This, in turn, clearly extends the sound system's useful dynamic range. Beyond that, the rendered audio signal retains its natural characteristics despite the use of limiters.

1.4 SPECIFIC SPEAKER FILTERS

The DFC features an extendible database archiving functions for equalization, phase correction, and limiting different HK AUDIO® speakers and sound reinforcement systems in combination with the VX 2400 power amp (see the chapter entitled Controllers and Controller Software).

Chapter G

Controller and Controller software

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Figure 1: DFC front view

1 DIGITAL FIELD CONTROLLER (DFC)

Courtesy of its virtual crossover, the Digital Field Controller lets you operate COHEDRA® and all other biamped sound reinforcement systems of the HK AUDIO® Concert Sound Series as you would active three-way sound reinforcement systems.

This is possible because the DFC splits the input signal into three frequency bands – the low, middle and high ranges. It then equalizes, limits, and performs similar functions separately for each frequency band. After processing the incoming signal, the DFC blends the middle and high frequency bands to create a composite signal, thereby delivering the midrange/high frequency signal required to drive biamped systems.

This means that even though one power amp channel drives a mid/high unit via a passive crossover and using a single speaker cable, you can set levels and delay times separately for the cabinet's midrange woofers and high frequency drivers, as well as use virtual functions to invert phases and mute signals.

The Digital Field Controller designed for use in the Amp Rack. It implements in digital format all the functions required to control HK AUDIO® sound reinforcement systems composed of speakers and the VX 2400 amp. The DFC features FIR filters enabling comprehensive frequency and phase response correction. Used in combination with the specially developed PC control software and Remote Interface, you have a logical and amazingly convenient control system readily available. It handles intuitively, enabling you to master even the most daunting sound reinforcement challenges with ease. Its hallmark features include specially developed filter sets preprogrammed to EQ varying system and stacking configurations of HK AUDIO® Concert Sound systems in combination with VX 2400 power amps.
The DFC features the following functionality:
- PA Remote Management
- System Equalization
- Phase Correction
- Peak / RMS, Temperature and Overshoot Limiter
- EQ
- Delay.

The DFC is equipped with an analog input and a digital AES/EBU input for patching in signals.
The DFC's analog input is electronically balanced. Input impedance is 15 k-ohms. Input sensitivity is 0 dBV (equals 1 V RMS); the maximum permissible input level is 24 dBV. An electronic filter serves to protect the device against HF interference.

FIR filter technology
FIR filter technology lets you correct the phase and equalize the frequency response of HK AUDIO® sound systems independently. Unlike IIR filters, FIR filters do not consist of a specific number of separately computed filter elements. Instead, they contain a complete sampled copy of the function required for equalization. The entire filter is recomputed every time a filter setting is modified.

The DFC features an extendible database archiving functions for equalization, phase correction, and power handling capacity specifications of different HK AUDIO® speakers and sound reinforcement systems. You can load new filters programmed for specific cabinets and speaker configurations into the DFC's memory using HK AUDIO® Controller PC software (see chapter 2.15).

Frequency and phase equalization
The crossover splits the input signal into three frequency bands. The selected filter equalizes the entire sound system's frequency and phase response. This includes all components following the DFC in the signal chain – amps, passive crossovers, speaker chassis, and speaker housings.

Limiters
The DFC is equipped with temperature and RMS limiters for all three frequency bands. They feature forward-looking algorithms that anticipate the amount of power routed to the amp's outputs. In the event of impending electrical, mechanical or thermal overload, they cut the output to allowable



Figure 2: Rear view of the DFC

The VX 2400 power amp can produce intermittent peak output levels up to 2,000 watts per channel. For this reason, the overshoot limiter also takes the duration of an impending overload into account alongside its amplitude. This ensures that the DFC limiters exert little or no influence on the amplitude and duration of brief percussive impulses with high amplitude but very short durations. This, in turn, clearly extends the sound system's useful dynamic range. Beyond that, the rendered audio signal retains its natural characteristics despite the use of limiters.

Note that the DFC's overshoot limiter only works when the VX 2400 power amp's limiter is switched off. It limits the VX 2400's output to 1200 W per channel.

1.1 Connections

230 V/50 - 60 Hz mains power supply. The DFC's mains plug is a three-pole non-heating equipment connector with a ground contact. Do not connect the device using anything other than a three-pole connector with a ground contact. The mains outlet must also be equipped with a ground contact. Never use damaged cables, plugs, or sockets.

Analog audio input FULLRANGE In
Connect signal sources with an analog output to this three-pin female XLR socket.
Pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

Digital signal port DIGITAL In / DIGITAL Out
Connect signal sources with a digital AES/EBU output to this three-pin female XLR socket. The input signal can be patched through via the parallel circuit's three-pin male XLR port.
Pin assignments are:
pin 1 = ground, pins 2 and 3 = signal.

Analog audio output LF Out
This port carries the low frequency output signal in 3-way or 2-way configurations. It is a male three-pin XLR port.
Pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

Analog audio output MF Out
This port carries the midrange signal in 3-way configurations. It is a male three-pin XLR port.
Pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).
This port is disabled when HK AUDIO® systems are biamped!

Analog audio output HF Out
This port carries the high range signal in 3-way configurations, the mid-/high range signal in 2-way configurations, and the fullrange signal in passive configurations (e.g. when using Solo filter sets for the HK AUDIO® fullrange cabinets VT 112 II F or VT 115 X). It is a male three-pin XLR port.
Pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

Midi In / Midi Out connector for remote monitoring and control
Located on the front panel of the DFC, this port serves to transmit remote control and monitoring data via a looped circuit. Midi In is a three-pin female XLR port, Midi Out a three-pin female XLR port.
Pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = power circuit.

REMOTE control connector
This port serves to control the HK AUDIO® PB 4 Patchbay and to provide power to the COHEDRA® PB 5 Patchbay.

1.2 DISPLAY AND CONTROL FEATURES

Limiter LEDs (red)
- Available for each frequency band (HF, MF, LF)
- LED lights up when the Peak Limiter activates in response to an overload.
- LED also lights up when the temperature limiter of the given frequency band is active even if it is not receiving an incoming signal.

Input Level LEDs (8 LEDs: green/yellow/red)
Green: Input level within a range of -24 to 0 dBV
Yellow: Input level within a range of +6 to +12 dBV
Red: Input level higher than +18 dBV

LCD display
- 2 x 16 characters
- In normal operating mode, it indicates the controller number and selected filter.
- When a menu is accessed, it shows the options and editable parameters.

Menu button
- Accesses and exits the main menu.
- Selects individual values in windows offering several variable values.

Enter button
- Accesses windows for editing main menu parameters.
- Confirms entries and edited values.

+ and - buttons
- Navigate to the next or previous option.
- Edit parameters in the editing window.

Reset button
- Reboots the DFC so that all settings are maintained.
- For further reset functions, see the section Reset Functions.

Ground switch
On: Grounds the signal to the DFC chassis.
Lift: Severs the connection between the signal and the DFC's ground. This can eliminate humming caused by ground loops.

1.3 BASIC SETTINGS

Loading stored settings
To load previously programmed and stored DFC settings, press the Menu button to go to the main menu and press the + and - buttons to select the Load Setup window (press - twice). Access the appropriate editing window by pressing the Enter button and press the + and - buttons to select a stored DFC setting from memory slots 1 to 10. Press Enter to load it to the DFC and return to the main menu.

Changing the controller number
The controller number is factory-set to Controller no 1, which is also the default after a hot reset. HK AUDIO® DFC PC Software can be used to assign numbers to DFCs automatically in the sequence in which they are looped, or the controller number can be set manually on the DFC.

To do this, press Menu to access the main menu and the + and - buttons to select the window for the option Controller No. (press + eight times). Press Enter to access the editing window and use the + and - buttons to select a controller number from 1 to 32 for this DFC. Confirm your selection and return to the main menu by pressing Enter.

Selecting the filter for connected speaker(s)
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option Speaker Type (press – seven times). Press Enter to access the Speaker Change editing window and use the + and - buttons to select one of the DFC's dedicated speaker filters. Confirm your selection and return to the main menu by pressing Enter.

Selecting the audio input
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option Audio Input (press – four times). Press Enter to access the editing window and use the + and - buttons to select from among the one analog and three digital options.

Selecting Analog configures the DFC to accept an analog signal. AES/EBU format is in stereo, so you have three channels to choose from for patching in digital signals. Digital Left routes the left channel of the digital signal to the DFC, Digital Right sends the right channel. When you select Digital L+R, the digital left and right channels are blended internally to create a composite signal. Confirm the selected option and return to the main menu by pressing Enter.

Selecting a Controller/Rack Mode
This function is only available in combination with the PB4, which is used exclusively for HK AUDIO® R-Series configurations.

Setting master levels
Press the Menu button to go to the main menu. Volume is the first option offered in the main menu, so the window for this option appears immediately in the DFC display. Press Enter to access the Master Volume editing window and use the + and - buttons to adjust the DFC's master level in 0.5 dB steps within a range of -40 dB to dB +6.
Confirm the adjusted level and return to the main menu by pressing Enter.

Setting low frequency levels
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option LoGain (press + once). Press Enter to access the Volume Low editing window and use the + and - buttons to select the DFC's low frequency output level in 0.5 dB steps within a range of -40 dB to +6 dB. Settings lower than -40 dB mute the DFC's low frequency output signal. Confirm the adjusted level and return to the main menu by pressing Enter.

Setting midrange frequency levels
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option MiGain (press + twice). Press Enter to access the Volume Mid editing window and use the + and - buttons to select the DFC's midrange frequency output level in 0.5 dB steps within a range of -40 dB to +6 dB. Settings lower than -40 dB mute the DFC's low frequency output signal. Confirm the adjusted level and return to the main menu by pressing Enter.

Setting high frequency levels
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option HiGain (press + three times). Press Enter to access the Volume High editing window and use the + and - buttons to select the DFC's high frequency output level in 0.5 dB steps within a range of -40 dB to +6 dB. Settings lower than -40 dB mute the DFC's high frequency output signal. Confirm the adjusted level and return to the main menu by pressing Enter.

1.4 Setting Delay Times

Selecting the delay display mode
The DFC can indicate delay settings in milliseconds (ms) or meters (m). To select the desired delay display mode, press the Menu button to go to the main menu and the + and - buttons to go to the window for the option Delay Base (press - eight times). Press Enter to access the Delay Display editing window and use the + and - buttons to select ms (delay indicated in milliseconds) or m (delay indicated in meters). Confirm the selected mode and return to the main menu by pressing Enter.

The DFC offers both master and frequency band delays. The master delay aligns delay lines to the main sound reinforcement system. Frequency band delays align speakers within a system, for example when subwoofers are stacked on the ground and tops are flown overhead. This is called time alignment.

Note: When biamping HK AUDIO® systems, always ensure midrange and high frequency delay times are identical, otherwise the different delays in the passive high/midrange unit will cause phase problems.

Setting master delay time
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option Delay (press + four times). Press Enter to access the Master Delay editing window and use the + and - buttons to select the DFC's master delay within a range of 0 ms to 1999.39 ms (equals 679.81 meters). Confirm the selected delay time and return to the main menu by pressing Enter.

Setting low frequency delay time
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option LoDel (press + five times). Press Enter to access the Low Delay editing window and use the + and - buttons to select the DFC's low frequency delay time within a range of 0 ms to 92.15 ms (equals 31.33 meters). Confirm the selected delay time and return to the main menu by pressing Enter.

Setting midrange frequency delay time
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option MiDel (press + six times). Press Enter to access the Mid Delay editing window and use the + and - buttons to select the DFC's midrange frequency delay time within a range of 0 ms to 92.15 ms (equals 31.33 meters). Confirm the selected delay time and return to the main menu by pressing Enter.

Setting high frequency delay time
Press the Menu button to go to the main menu and the + and - buttons to select the window for the option HiDel (press + seven times). Press Enter to access the High Delay editing window and use the + and - buttons to select the DFC's midrange frequency delay time within a range of 0 ms to 92.15 ms (equals 31.33 meters). Confirm the selected delay time and return to the main menu by pressing Enter.

1.5 Adjusting the Equalizer

The DFC features an onboard equalizer offering 28 frequency bands. It lets you adjust the sound system to suit the acoustics of the given venue.
To set the equalizer, press the Menu button to go to the main menu and use the + and - buttons to go to the window for the option Equalizer Setup (press - five times). Press the Enter button to access the first of the two equalizer editing windows. In this window, the + and - buttons serve to switch the equalizer ON and OFF) when the cursor is set to the first cursor position and to adjust the equalizer's level via Volume when the cursor is set to the second position. Use the Menu button to reposition the cursor.

Press the Enter button when the first equalizer editing window is shown in the display to access the second equalizer editing window. In this window, you can select the frequency band when the cursor is set to the first cursor position and then boost it (by up to 15 dB) or cut it (down by 15 dB) when the cursor is set to the second position. Use the Menu button to reposition the cursor. Once you have adjusted the equalizer, press Enter to return to the main menu.

1.6 Storing Settings

To store the settings you have made on the DFC, press the Menu button to go to the main menu and use the + and - buttons to go to the window for the option Store Setup (press – once). Press Enter to access the editing window and use the + and - buttons to select one of the memory slots from 1 to 10.
Press Enter to store the DFC settings in the selected memory slot and return to the main menu.

1.7 Disabling Buttons on the DFC

The DFC offers a key lock option that safeguards it against tampering and accidental activation of functions. To disable these buttons, press the Menu button to go to the main menu and use the + and - buttons to go to the window for the option Lock Keys (press – three times). First press Enter to access the editing window, then use the + button to select Yes, and confirm by pressing Enter. The following message appears in the window: Are you sure? Confirm by pressing the + button twice + (Yes).
A counter appears in the editing window. Use the + and - buttons to set it to the indicated value of 23. Press Enter to activate the DFC's key lock.

Enabling buttons on the DFC
When the key lock is active and you press the Menu button, a prompt appears telling you to press Enter to deactivate the key lock. After pressing Enter, the editing window of the option Lock Keys appears. First, use the - button to select No, then confirm via the Enter button.
The following message appears in the window: Are you sure? Confirm by pressing the + button twice + (Yes). A counter appears in the editing window. Use the + and - buttons to set it to the indicated value of 23. Press Enter to deactivate the DFC's key lock mechanism.

1.8 Reset, Hot Reset and Master Reset Functions

Reset
Pressing the Reset button once reboots the DFC. The process takes about 10 seconds. All adjustments made before the reset are retained.

Hot reset
A hot reset restores the DFC's factory settings. All your settings are deleted, but the filter database is retained. To initiate a hot reset, press and hold the Menu and Enter buttons simultaneously, then press the Reset button. The DFC initiates a hot reset when you release the Reset button. The following message appears in the display: Hot Reset!!!! – Release Keys!!!!. After a hot reset (which takes about 15 seconds) the Speaker Type option's Speaker Change editing window appears in the display.
As described in section 6.3, select a filter for the speakers that you want to address. Once you have done this, the DFC is ready to operate.

Master reset

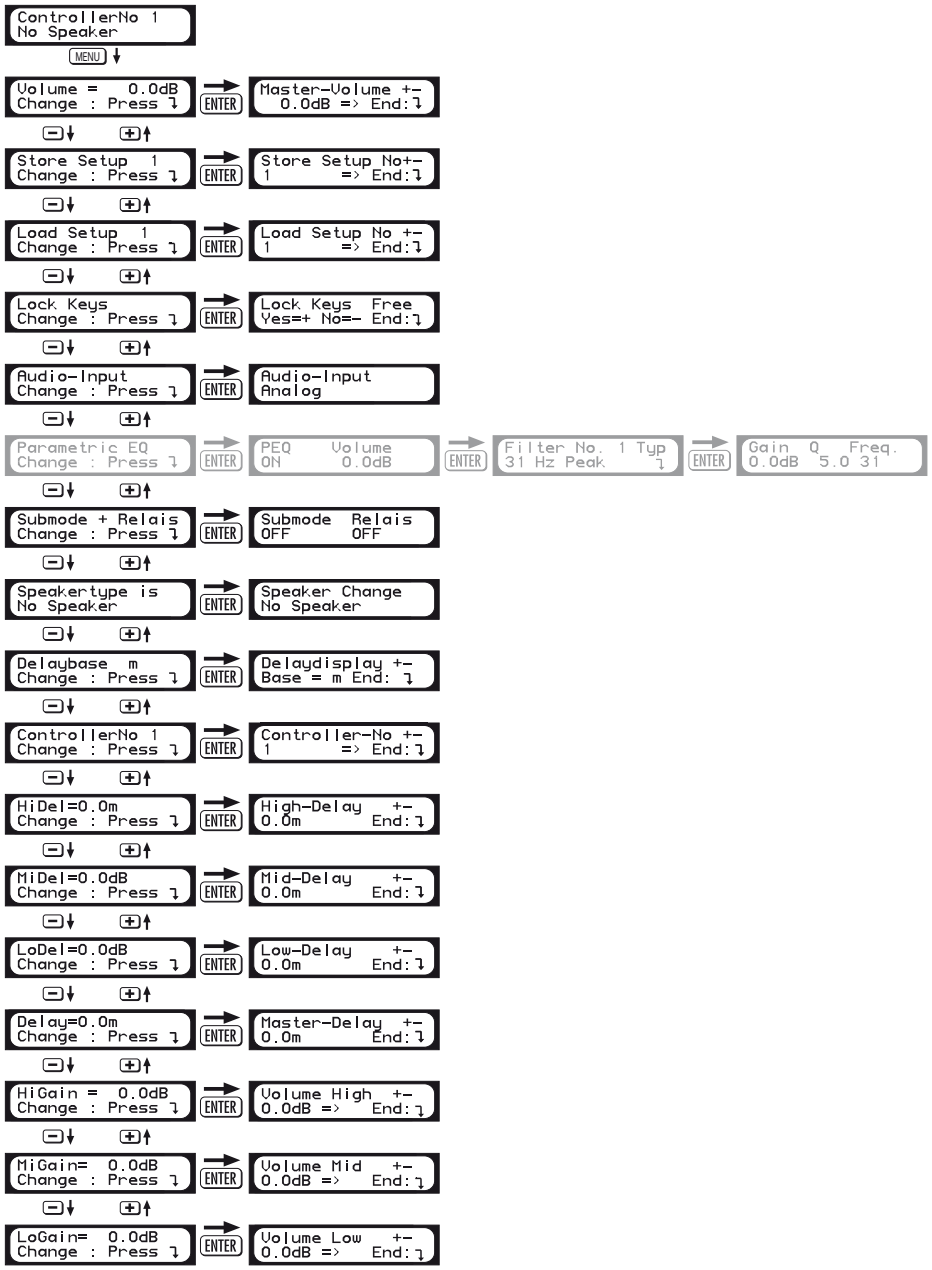
A master reset restores the DFC's factory settings and deletes its filter database. Because new filters can only be uploaded to the DFC via a connected PC and the Audio Controller Software, the master reset option is only available when the DFC is connected to a PC via Midi loop and PC/Midi interface and the HK AUDIO® Audio Controller software has been launched.

The DFC will not operate without the speaker filters. For this reason, the master reset option is password-protected and may only be activated by HK AUDIO® service staff.

1.9 Remote Control and Remote Monitoring

The DFC's Midi port lets you control and monitor up to 32 DFCs remotely using a PC. The DFC connects to the PC via a special HK AUDIO® interface. To this end, all DFCs are connected in a loop starting at the dongle's Midi Out port (from the dongle's Midi Out to the first DFC's Midi In, from the first DFC's Midi Out to the second DFC's Midi In, and so forth until the final DFC's Midi Out is connected to the dongle's Midi In). The dongle connects to the PC via a serial interface (COM, RS 232). You can monitor the DFC's temperature and peak limiter status and view and edit all of the DFC's variable parameters using HK AUDIO® Audio Controller PC Software.
In addition, the HK AUDIO® DFC PC Software offers convenient options for handling several DFCs at the same time by grouping them, as well as for creating for even very complex sound reinforcement systems. This lets you switch configurations swiftly and easily (see also the chapter Audio Controller Software).

1.10 Overview of the DFC's Menu Functions



1.11 TECHNICAL DATA

Analog Input
Input: 3-pin XLR female
Pin assign: 1 = ground, 2 = signal(+), 3 =signal(-)
Input impedance: 15 k-ohms
Input level (nominal / maximal): 0 dBV / + 24 dBV

Digital Input
Input: 3-pin XLR female
Pin assign: 1 = ground, 2 and 3 = Signal
Input impedance/sensitivity: 250 ohms / 200 mV
Data format / sampling rate: AES-EBU / 44.1 kHz

Analog output
Output: 3-pin XLR male
Pin assign: 1 = ground, 2 = signal (+), 3 = signal (-)
Output impedance: 47 ohms
Output level (maximal): + 10 dBV

Digital output
Output: 3-pin XLR male
Pin assign: 1 = ground, 2 and 3 = Signal
Output impedance: 110 ohms
Max. output level: 5 V
Data format / sampling rate: AES-EBU / 44.1 kHz

Mains
Mains voltage connector:
3-pole non-heating equipment connector
Mains voltage: 230 V to 253 V
Mains frequency: 50 - 60 Hz
Power consumption: 17 VA

Remotes / Midi
Midi In port: 3-pin XLR female
Pin assign: 1 = ground, 2 = (+), 3 = power circuit
Midi Out port: 3-pin XLR male
Pin assign: 1 = ground, 2 = (+), 3 = power circuit
Remote port: 9-pin D-Sub for connecting a PB4 or PB5

A/D–D/A Converter
THD, input voltage: -83 dB
Input analog: +21 dBV, 1 kHz
Output analog: +21 dBV
THD, frequency: -87 dB
Input analog: 0 dBV, 50 Hz to 20 kHz
Output analog: 0 dBV
Frequency response: 10 Hz to 20 kHz (± 2 dB)
Input analog: 0dBV
Output analog: 0 dBV
Dynamic range: -128 dB (unweighted; 10 Hz to 20 kHz)
Output: analog, +10 dBV
A/D converter resolution: 24 bits
D/A converter resolution: 20 bits
Ambient temperature range: -10° C to +60° C

Weight: 3 kg (6.6 lbs)
Dimensions (B x H x T): 48.2 cm x 4.4 cm x 22.7 cm (19" x 1 7/8" x 9")

2 AUDIO CONTROLLER SOFTWARE VERSION 3.01

DFC Software Version 3.01 lets you control and monitor up to 32 HK AUDIO® Digital Field Controllers (DFCs) remotely using a PC (or notebook) and the HK AUDIO® PC interface. This makes it easy to handle even very large PAs and complex sound systems using very little equipment. And that goes for fixed as well as for mobile sound systems.

DFC Software 3.01 handles intuitively and offers many useful functions and application options, all of which are described in this manual. Please take the time to read it so that you can make the most of the possibilities afforded by the Digital Field Controller in combination with DFC Software 3.01.

System requirements

- 100 MHz Pentium processor (200 MHz recommended)
- 16 RAM MB, 32 MB recommended
- 1 MB free hard disk space for the application
- 100 MB free hard disk space for the filters and filter descriptions
- Mouse
- At least 800x 600 resolution, 16 bits color, 4 MB graphic RAM recommended
- Free serial interface (COM port) of USB interface with COM adapter
- Operating systems: Windows 95/98, NT 4.0, Win XP

2.1 INSTALLING SOFTWARE

Make sure an EPROM with an operating system version Feb 21, 2001 or higher is installed in the DFCs. The installed version appears in the display for a few seconds after you switch the DFC on. Older operating system versions do not support and implement all the functions offered by the DFC Software 3.01.
If you find that your DFCs run an older system, get in touch with HK AUDIO® directly at:
dfcupgrade@hkaudio.com
or fax +49 (0) to 6851 905215.

If you are running an older version of the DFC Software on your PC, delete it before installing DFC Software 3.01.

To install the software, insert the CD-ROM in the disk drive and copy the folder named DFC Software 3_01 to the PC. You can use the Windows Desktop or Windows Explorer to do this. Once you have copied the file, remove the CD-ROM from the disk drive and open the folder named DFC Software 3_01 on the PC.

Important note: Once you have done this, be sure to deactivate write protection for the files HK.Ini, BLK.Ini, and SUB.Ini (right-click File / Properties / disable Write-protected.) Not until write protection is deactivated will DFC Software 3.01 be ready to run!

2.2 DFC SOFTWARE FILES

DFC Software comprises the files Audio Controller 3_01, BLK.DEF, BLK.Ini, HK.Ini, and SUB.Ini, as well as the Speakers folder. It also offers the Audio Controller Demo file, which serves practice and demonstration purposes. When you open this file, all functions such as the Info window are operative without a connected Digital Field Controller.

Note: The demo version cannot be connected to DFCs or used to control them in real-time.

Audio Controller File 3_01
This is the DFC Software's application file. Double-click the icon using the left mouse button to launch the software.

BLK.DEF, BLK.Ini, HK.Ini, and SUB.Ini files
DFC Software settings are stored in these configuration files.
Before launching the DFC Software for the first time, be sure to deactivate write protection for the files HK.Ini, BLK.Ini, and SUB.Ini (right mouse click on File / Property / disable Write-protected); see section 2.1).

Speakers folder
This folder serves to store filter data (*.BLK files) and descriptions (*.HKI files) of each filter. DFC Software accesses this file when you want to download filters to the DFC, upload filters to a PC, or view the properties of a filter.

2.3 CONNECTING HARDWARE / THE PC INTERFACE

The PC interface establishes a data link between a PC and up to 32 DFCs. Its power is supplied by the included PSA 0812 power unit (12 ~, 200 mA), which plugs into the PSA 0812 POWER SUPPLY connector on the PC interface. The Power On LED lights up (red) to indicate incoming operating voltage.

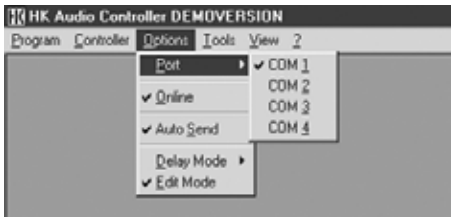


Figure 3: Selecting the serial interface

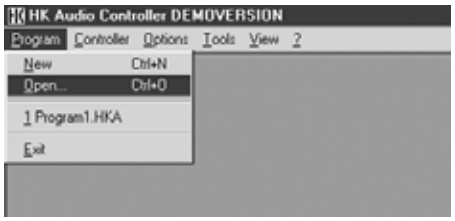


Figure 4: Loading stored programs



Figure 5: Loading and setting controller values

Connect the PC interface to the serial port of the PC (COM port) using the included serial connector cable (9-pin Sub-D male/female). If your computer lacks a COM interface, use a COM-port-to-USB-adapter. Please consult your computer to learn how to configure this connection.

DFCs are connected in a loop starting at the PC interface's Midi Out port (from the PC interface's Midi Out to the first DFC's Midi In, from the first DFC's Midi Out to the second DFC's Midi In and so forth until the final DFC's Midi Out is connected to the PC interface's Midi In). Use balanced microphone cables (XLR male / XLR female) to connect the components. The distance between the PC interface and the first DFC may range up to 300 meters. Every DFC amplifies the data signal before routing it out. The DFCs must be looped because they not only receive data, but also send acknowledging messages and data back to the PC.

Important note: The Midi In and Midi Out ports of the DFCs and the DFC interfaces do not comply with the MIDI standard and are incompatible with other devices!

2.4 LAUNCHING DFC SOFTWARE

Launch the DFC Software by double-clicking the Audio Controller 3_01 icon using the left mouse button. If the PC and PC interface are connected properly, a window will pop up; it reads Please wait...Updating current configuration. Once this is done, the software is ready to run.
The user interface consists of the Menu bar containing the individual menus, the Status bar, the Peak Limiter window, and the Editing Panel.

Note: If there is a problem with the Midi loop or the loop has not been closed, a window pops up indicating the following message: Midi-Loop open! No data transfer possible. Change to offline mode? If you opt to switch to offline mode, the display reads: Warning! While working in offline mode the display shows wrong controller values. The reason for this is that the PC and DFCs are not connected. Check the Midi loop and re-launch the DFC Software.

If there is a problem with the serial link between the PC and PC interface or the wrong COM port has been entered to the DFC Software, the following window pops up: No dongle connected to the serial port. Only Edit Mode will be possible. If the cable is defective, replace it.

Selecting the serial interface
See figure 3. The option Port in the Options menu lets you define the correct PC serial interface for the PC interface (for example, COM 1). Once you have selected the correct interface, DFC Software ready to run. To load the current looped DFC configuration to the software, first activate the option Online in the Options menu (see section 2.5) by clicking it using the left mouse button, and then select the option Update current configuration in the Controller menu (see section 2.5).

Loading stored programs
See figure 4. To load DFC programs created and stored in previous sessions, select the option Open in the Program menu. A window pops up with a prompt asking you for the program name and possibly the program file. Select the desired program and click the Open button. The program is loaded to the DFC Software.

Note: Programs generated in an earlier DFC Software version (Version 2.1 or lower) cannot be loaded to DFC Software 3.01.

Creating new programs
See figure 5. To create new DFC programs, select the option New in the Program menu. A window pops up suggesting that you load the settings on the currently connected DFCs as the basis for the new program (Load Controller Values).

In this window, you also have the option of starting the new program with preset defaults (zero values) that are loaded to the DFCs when the DFC Software is launched (Set Default Values). The actual user panel appears once you have selected an option and confirmed it with OK.

2.5 MENU BAR

See figure 6. The Menu is located in the upper area of the screen and includes the Program, Controller, Group, Options, Tools, View, and Window menus, as well as the Info menu providing access to the DFC Software's individual functions.

Program menu

- The option New initiates a new DFC program.
- The Load option loads a stored program. When this option is selected, a window pops up with a prompt asking you for the program name and possibly the program folder.
- The option Save saves (to a clipboard) the program that you are currently working with. If you have not assigned a name to it, a window pops up prompting you to name the program.
- The option Save As saves an edited program. A window pops up prompting you to name the program.
- The option Delete closes the current program in the DFC Software. When this option is selected, a window pops up with a prompt asking you if you want to save the program before exiting it.
- The option Copy copies the current program into a clipboard.
- The option Insert inserts a program contained in the clipboard into a Program window.
- The option Exit closes the DFC Software. When this option is selected, a window pops up with a prompt asking you if you really want to quit the DFC Software. If programs have not been saved, a window pops up asking you if you want to save them.

Controller menu

See figure 7.

- The option Update current configuration loads the current DFC loop configuration into the DFC. This tells the application which DFC network you want to control and monitor. This function is executed automatically when the DFC Software is activated, if the PC and DFCs are connected properly and the correct serial interface has been selected.
- The option Load Controller Values to PC loads the DFC's current settings for level, delay, frequency response, and so forth into the DFC Software. When this option is selected, the following message appears: Warning! Loading controller values will overwrite program. Associations of controllers and groups will be lost. This function can be executed automatically when creating a new program using the option New in the Program menu, if the Online option in the Options menu is activated.

Group menu

See figure 8.

- The option Add creates a new DFC group that you can assign individual DFCs to.
- The option Delete deletes the selected group. An additional warning message does not appear when this option is selected.
- When activated, the option Lock precludes DFC group assignments from being changed. New groups may be added but DFCs cannot be assigned to these groups. Groups may also be deleted even if DFCs are assigned to them.

Options menu

See figure 9.

- The Online option switches back and forth between online and offline mode. When online mode is selected, a checkmark appears next to the option. In offline mode, the PC and DFCs are not connected, meaning that any adjustments you make do not affect the connected DFCs and the DFC status cannot be monitored. For this reason, the following message appears when offline mode is activated: Warning! While working in offline mode the display shows wrong controller values.
- When selected (a checkmark appears next to the option), the option Auto Send sends modifications immediately to the connected DFCs. If Auto Send is deactivated, you must first click the OK button in the given window every time you want to send new settings. This option can serve as an additional safeguard against accidental editing.
- The option Delay Mode accesses a submenu that lets you determine if delays are indicated in meters, milliseconds, or feet.
- The option Edit Mode activates its namesake. In edit mode, all 32 controller views are always displayed in the user interface's Editing Panel. This is where you can configure DFCs and create groups. You can also adjust DFC parameters such as level, delay and equalizer settings in edit mode. With the exception of selecting a filter for speakers, this lets you create programs without having DFCs connected.

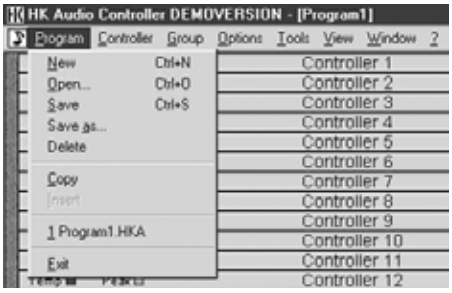


Figure 6: Program menu

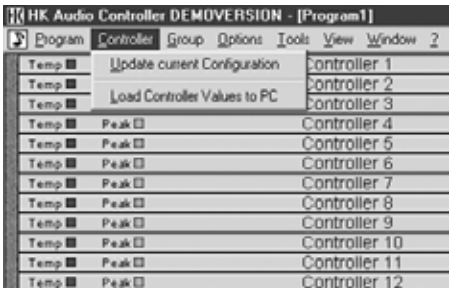


Figure 7: Controller menu

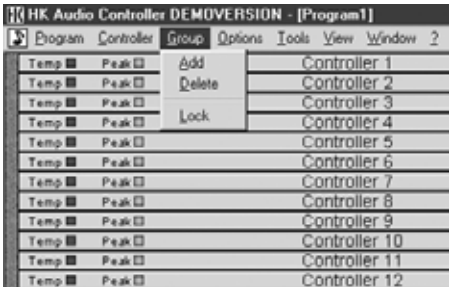


Figure 8: Group menu

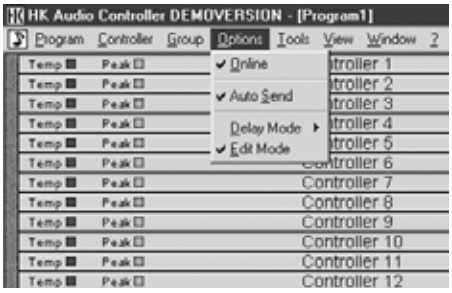


Figure 9: Options menu

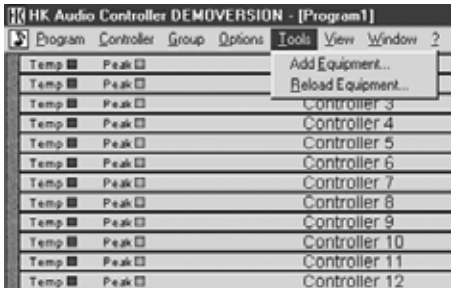


Figure 10: Tools menu

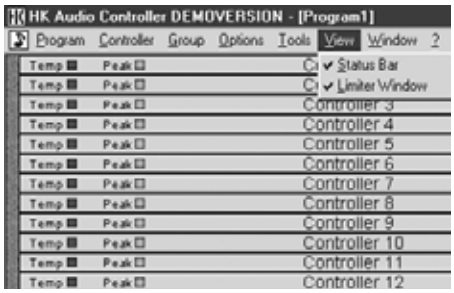


Figure 11: View menu



Figure 12: Window menu

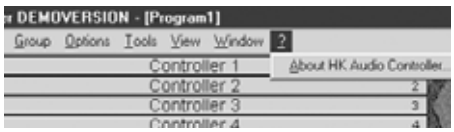


Figure 13: Help menu (?)

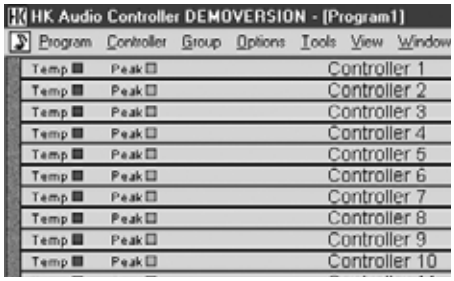


Figure 14: DFC Controller Software Editing Panel

Figure 15: Peak Limiter window



Tools menu
See figure 10.
- The option Add Equipment loads new speaker filters to the connected DFCs (see section 2.15).
- The option Reload Equipment loads and stores speaker filters from the connected DFCs to the PC.

View menu
See figure 11.
Select the option Status Bar (a checkmark appears next to the option) if you want the Status bar to be displayed.
Select the option Limiter Window (a checkmark appears next to the option) if you want the Peak Limiter window to be displayed. Once activated, it remains on-screen even if you go to another program on the PC/laptop.

Window menu
See figure 12.
- The option Cascade cascades (arranges front to back in staggered formation) all program windows appearing on the screen.
- The option Tile arranges all program windows appearing on the screen side by side or stacks them one on top of the other.
- The option Arrange Icons displays all program windows appearing on the screen in the form of little symbols called icons. The program windows must first be reduced to the size of an icon by clicking the Minimize button.

The Window menu also lists the names of all currently opened programs. Access the desired program by clicking its name.

Info menu (?)
See figure 13.
The option About HK AUDIO® Controller displays information on the software, version and copyright.

Status bar
The Status bar is located at the lower edge of the screen. It principally indicates the progress of activated functions. When the program is not executing a function, the display reads Ready. If you activate one of the menus in the Menu bar by clicking it using the left mouse button and point the cursor
to individual options, the Status bar shows a description of the given option's function (Help).

Controller Number and Limiter displays
See figure 14. The Editing Panel shows a graphical view of the individual controllers. In edit mode, the Editing Panel always displays all 32 potential Controller views. If you are not working in edit mode (and the connection between the PC and the DFCs is up and running), it shows only the controllers connected to the PC.

DFC Controller Software Editing Panel
See Figure 14.
Temperature and Peak Limiter indicators appear on the left side of the controller views. These are subdivided into the DFC's three output frequency bands (Bass, Mid, High). The upper area of each limiter box indicates the high frequency band, the center area the middle frequency band, and the bottom area the low frequency band. When deactivated, the Temperature Limiter indicator appears in blue and the Peak Limiter display in green for all frequency bands. When activated, the given frequency band indicator's color changes to red.

The respective controller number (1 to 32) appears on the right side of the Controller views. The name of the DFC assigned the given controller number appears roughly at the center. The factory default is Controller 1 to max. Controller 32. However, you may enter other names as you see fit; for reasons of clarity, you will find that this makes sense in practice (see section 2.6. Changing the Controller Name).

Peak Limiter window
See figure 15. The Peak Limiter window always shows the peak limiters for all 32 possible DFCs. When selected (a checkmark appears next to the option Limiter Window in the View menu), it remains visible in the foreground of the screen. This lets you continuously monitor the status of the DFCs' peak limiters even when working with other programs.

Like the Controller views, the Limiter view is divided into boxes for the low frequency band, middle frequency band, and high frequency band. In normal operating mode, the color of the Peak Limiter indicator is green. When DFC's peak limiter activates, the indicator for the given frequency band turns red.

The Peak Limiter window can only be activated (View menu > Limiter window) when the DFC Software is in online mode (a checkmark appears next to the Online option in the Options menu).

2.6 ADJUSTING CONTROLLER PARAMETERS

See figure 16. Double-clicking a Controller view opens a window (Adjustment for Controller) that lets you set and edit controller parameters.

Changing the controller name
The controller name is factory set to Controller 1 to max. Controller 32. For reasons of clarity - particularly when working with complex sound reinforcement systems and several DFCs – we recommend that you assign meaningful names to the connected controllers (for example, something along the lines of Longthrow left, Delay right, Sublow, etc.).

Click Name to delete the given controller name and enter a new controller name.

Selecting the filter for connected speaker(s)
Click Speaker using the left mouse button to open a selection box listing all speaker filters offered for the selected DFC. Click the desired filter using the left mouse button to select it.

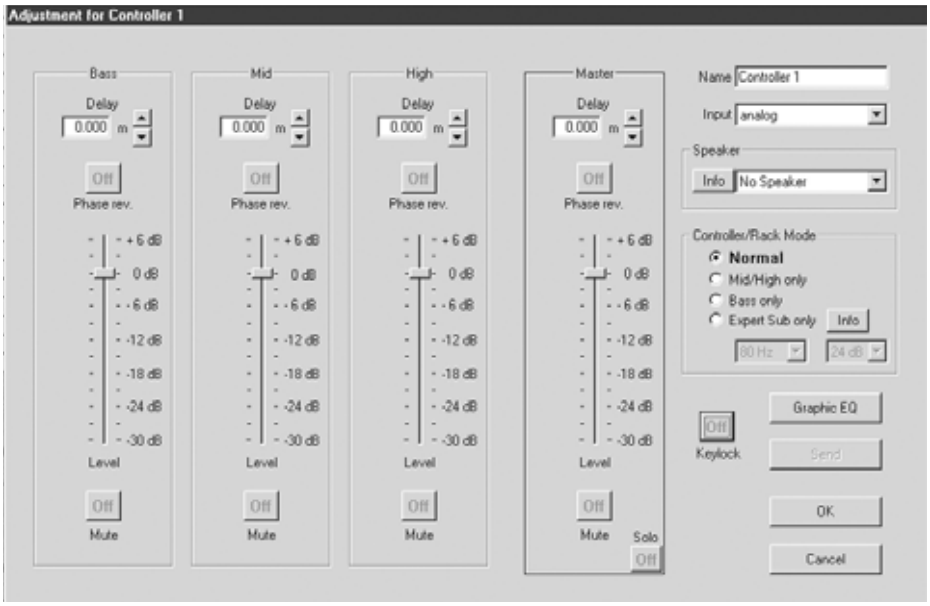


Figure 16 a: Adjustment for Controller window

Viewing filter properties
Click the Info button in the Speaker panel to open a window showing the properties of the selected filter and associated speakers.
These properties include:
- filter name
- filter latency
- required speakers and power amps
- list of speakers with picture and details
- frequency response of the speakers when driven by the DFC

Click the Close button located at the upper right edge of the Info window to close it.

Note in the event that you trouble viewing properties:
In order to view a given filter's properties, this filter's Info file (*.HKI) must be stored in the DFC Software's Speaker folder. If the DFC Software is unable to locate this file, a window pops up indicating the following message: Speaker connection info for ... not available!

2.7 SELECTING THE AUDIO INPUT

The DFC accepts both analog and digital audio signals (sampling rate = 44.1 kHz), so you must select the desired input and/or channel for incoming audio signals. Click Input to open a box listing one analog and three digital options.

Select Analog to configure the given DFC to accept an analog audio signal. The digital circuit is stereo, so you have three channels that accept digital audio signals to choose from. Digital Left routes the left channel of the digital signal to the given DFC, Digital Right sends the right channel. When you select Digital L+R, the digital left and right channels are blended internally to create a composite signal.

Click the desired option using the left mouse button to select it.

2.8 SELECTING A CONTROLLER/ RACK MODE

Controller/Rack Display Mode offers four options for operating the DFC in combination with the HK AUDIO® PB 4 Patchbay. Click the desired mode to select it.

Note: This function is only available when using the PB4 in combination with HK AUDIO® R-Series!

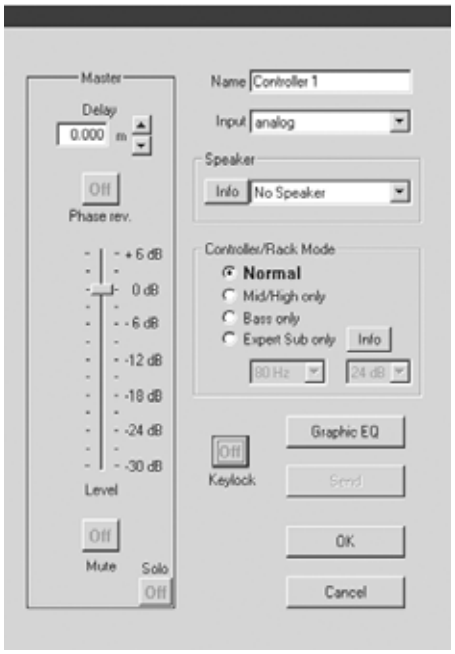


Figure 16 b: Master channel

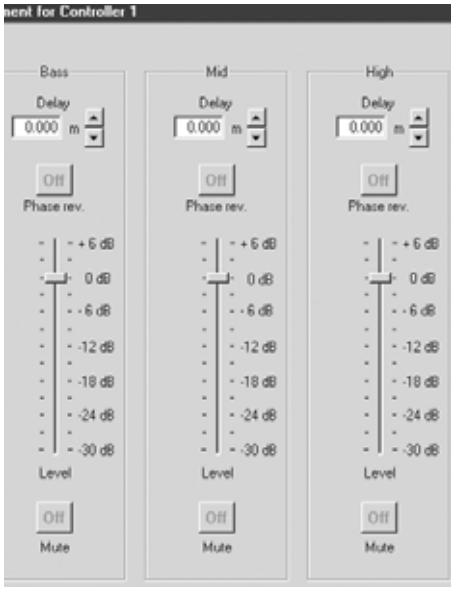


Abbildung 16 c: Bass, Mid and High channel

2.9 Activating the Key Lock on the DFC

The key lock safeguards the DFC against tampering and accidental activation of functions. Activate it by clicking the Keylock button. The lettering of the Keylock On button turns red to indicate the key locking mechanism is activated. Deactivate the key lock by clicking the Keylock button again. The Keylock button reads Off and turns grey.

2.10 Adjusting Master Channel Strip Settings

The master channel strip (appropriately labeled Master) lets you adjust settings such as level, delay, and so forth for the entire DFC. These settings apply to all frequency bands of outgoing signals. (see Fig. 16 a).

Master channel level
The virtual Level fader in the master channel strip determines the level of the entire DFC. To adjust the level, click the virtual fader's knob using the left mouse button, hold the button down, and drag the mouse up or down. Once you have dragged the virtual fader to the desired position, release the left mouse button.

Master channel delay
Click the Delay display in the master channel strip to set the delay for the entire DFC. Once you have clicked the display, you can delete the given delay setting and type in a new setting. The two buttons located next to the Delay display give you another option for setting delay time. Click one of them to step through delay times in predefined increments. Depending on the selected delay mode (as defined by the Delay Mode option in the Options menu), delay settings are indicated in milliseconds, meters or feet. The delay display appears in red to indicate delay settings other than zero.

Reversing the master channel's phase
Click the Phase rev. button in the master channel strip to reverse the phase of the entire DFC. When phase reversal is activated, the lettering on the Phase rev. button changes from Off to On and its color from grey to red. To deactivate phase reversal, click the Phase rev. button again.

Mute and solo
Click the Mute button in the master channel strip to mute the entire DFC. When mute is activated, the lettering on the Mute button changes from Off to On and its color from grey to red. To deactivate mute, click the Mute button again.

Click the Solo button in the master channel strip to mute all connected DFCs with the exception of the given DFC (Solo-In-Place function). When solo is activated, the lettering on the Solo button changes from Off to On and its color from grey to red.
To deactivate solo, click the Solo button again.

Note: If you attempt to close the Adjustment for Controller window while solo is activated, the following message appears: Attention!!! Solo still activated. You will not be able to close the window.

2.11 Adjusting the Bass, Mid and High Channels

See figure 16 b. The three channel strips Bass, Mid and High let you determine level, delay and other settings for the given frequency bands before routing signals from the DFC to connected speakers.
This lets you handle biamped systems as (virtual) active three-way systems.

Adjusting levels
The virtual fader Level in the Bass, Mid and High channel strips determines the level of each frequency band for the given DFC.
To adjust the level, click the virtual fader's knob using the left mouse button, hold the button down, and drag the mouse up or down. Once you have dragged the virtual fader to the desired position, release the left mouse button.

Adjusting delay time
You can set a delay time of up to 100 ms for each frequency band (Bass, Mid and High channel strips) of the given DFC via the Delay display in the respective channel strip. This serves to align clusters and compensate for discrepancies in response time caused by the given stacked configuration, for example, to align subwoofers stacked on the ground with tops flown overhead.

Important note: Ensure midrange and high frequency delay times are identical; otherwise you will encounter alignment problems within a single speaker cabinet.
Once you have clicked the display, you can delete the given delay settings and type in new values.

The two buttons located next to the Delay display give you another option for setting delay time.
Click one of them to step through delay times in predefined increments.

Depending on the selected delay mode (as defined by the Delay Mode option in the Options menu), delay settings are indicated in milliseconds, meters or feet. The delay display appears in red to indicate delay settings other than zero.

Reversing phase
Click the Phase rev. button in the Bass, Mid and High channel strips to reverse the phase of the entire DFC. When phase reversal is activated, the lettering on the Phase rev. button changes from Off to On and its color from grey to red. To deactivate phase reversal, click the Phase rev. button again.

Mute
Click the Mute button Bass, Mid and High channel strips to mute the respective frequency on the selected DFC. When mute is activated, the lettering on the Mute button changes from Off to On and its color from grey to red. To deactivate mute, click the Mute button again.

2.12 GRAPHIC EQ

See figure 17. Click the Graphic EQ button in the Adjustment for Controller window to open another window offering a graphical view of a 28-band equalizer. Use it to adjust the frequency response of the speakers addressed by the DFC to suit the given venue's acoustics.

Adjusting frequencies
Use the graphic EQ's virtual faders to adjust the given DFC's frequency response. The control range for each frequency band is -18 dB to dB +12.
To adjust the graphic EQ, click the knob of the desired frequency band's virtual fader, hold the button down, and drag the mouse up or down. When you click the fader, its color changes to blue and the color of its knob to red. Once you have dragged the virtual fader to the desired position, release the mouse button.

You can also adjust frequency response settings using the computer keyboard's cursor keys as well as the Pos 1 and End key. The Q and P cursor keys serve to select a fader, the R and S cursor keys to move it. Pressing the Pos 1 key selects the fader for the frequency band at around 31.5 Hz and pressing the End key selects the fader for the 16-kHz frequency band.

Adjusting gain settings
Click one of the two buttons in the Gain display to adjust the graphic EQ for the given DFC.
This is done in 0.5 dB steps within a range of -12 dB to dB +12.

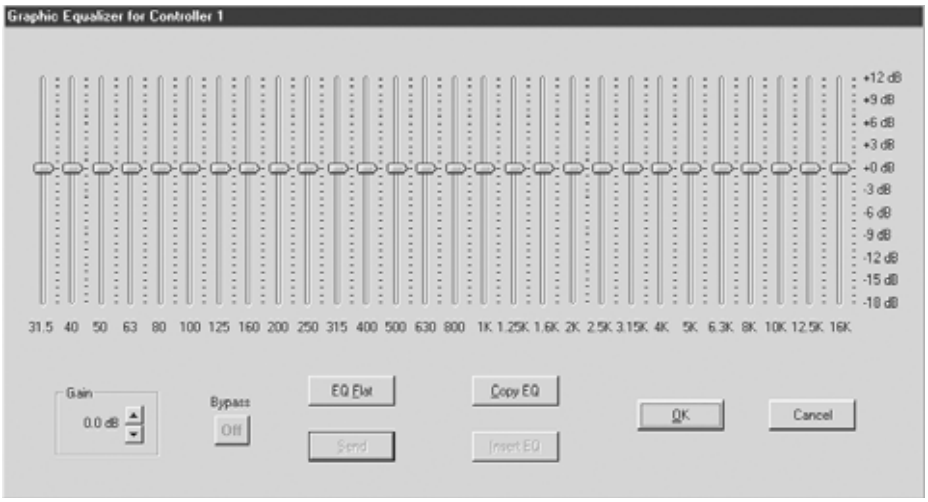


Figure 17: The 28-band Graphic EQ's control panel

Bypass and EQ Flat
Click the Bypass button to remove the graphic EQ from the signal path (for example, to make A/B comparisons of a processed / unprocessed audio signal). When activated, the lettering of the Bypass button changes from Off to On and its color from grey to red.

The EQ Flat button resets all of the graphic EQ's virtual faders as well as the gain settings to a value of 0 dB. When you click EQ Flat, a window appears asking you if you really want to reset the graphic EQ.

Copy EQ and Insert EQ
Copy EQ and Insert EQ make it very easy to load one graphic EQ setup to another graphic EQ.
To do this, click the Copy button of the graphic EQ whose settings you want to transfer. Then activate the graphic EQ to which want to copy the settings. This can be the EQ of another or DFC group.
The copied setup is loaded to this graphic EQ when you click the Insert button.

Copy EQ and Insert EQ comprise the graphic EQ frequency and gain settings.

Send in the Graphic EQ window
Click the Send button to send the graphic EQ settings to the given DFC and activate them there. This is not necessary if the option Auto Send in the Options menu has been activated, because then all edited settings are immediately sent to the DFCs. The Send button is shaded grey when the option Auto Send is activated because there is no need to click it.

Exit the graphic EQ via the OK (your settings are retained) or Cancel button (your settings are deleted).

Send in the Adjustment for Controller window

Click the Send button to send the settings adjusted in the Adjustment for Controller window to the given DFC and activate them there. This is not necessary if the option Auto Send in the Options menu has been activated, because then all edited settings are immediately sent to the DFCs.
The Send button is shaded grey when the option Auto Send is activated because there is no need to click it.

Exit the Adjustment for Controller window via the OK button (your settings are retained) or the Cancel button (your settings are deleted).

2.13 FORMING GROUPS

The option of forming groups is very convenient, making it much easier to work with DFCs and the DFC Software, particularly when facing challenging sound reinforcement applications and using complex systems. To this end, individual DFCs are assigned to one group or several groups. All adjustments made to a given group affect all DFCs assigned to that group.

Assigning DFCs to specific groups

DFCs are usually assigned to a group when the group is initially created. To do this, select the option Add in the Group menu. The newly defined group appears in the Editing Panel at the right of the user interface's right. The group name is initially set to the factory default Group 1 to max. Group 32.

You must select a group before you can assign DFCs to it. Do this by clicking the Group button using the left mouse button. When selected, the color of the Group button changes to red. Then click the DFCs that you want to assign to the selected group using the right mouse button. The color of the selected DFCs changes to green. To revoke a DFC's group assignment, click it again using the right mouse button. Its color changes back to grey. When a group is selected (via a single click using the left mouse button), the color of the Group button changes to red and the color of the given DFCs to green. If a DFC assigned to a group is selected (via a single click using the left mouse button), its color changes to red and the color of its group to green.

Setting group parameters

Double-clicking a Group button opens a window (Group Settings window) that lets you set and edit group parameters.

Changing group names

The group name is initially factory-set to Group 1 to max. Group 32. For reasons of clarity, we recommend that you assign meaningful names to groups (for example, something along the lines of Longthrow all, Delay, Sublow, etc.).

Click Name to delete the given group name and enter a new group name. When two or several DFC are combined into a group, you can make the same adjustment for all DFCs within the group that you can for an individual controller, only that these settings apply to all controllers in the group (see section 2.10).

Specifically, these are:

- Master channel strip setting
- Master channel level
- Master channel delay
- Master channel phase reversal
- Mute and solo functions
- Bass, Mid and High channel settings
- Group level settings
- Group delay settings
- Group phase reversal
- Group mute
- Group Graphic EQ
- Group frequency adjustments
- Group gain settings
- EQ copy and EQ insert functions
- Send function

2.14 WORKING WITH SEVERAL PROGRAMS

The DFC Software lets you open several programs with different DFC settings in dedicated Program windows. You have several options for viewing these simultaneously on the user panel.

You can click the desired Program window to activate it and send its settings to the connected DFCs. This is a simple, swift, and convenient option for switching back and forth among the different configurations of even very complex sound reinforcement systems.

Creating several programs
You can create new programs, copy and edit stored programs, or simply open a stored program. To begin creating a new program, select the option New in the Program menu (see 2.5). Stored programs are loaded using the option Load in the Program menu as described in section 5.2.

The options Copy and Insert in the Program menu load one program's setup to another. To do this, select the option Copy in the program whose settings you want to copy. Then go to the program to which you want to copy the settings by clicking its window, or create a new program via the option New in the Program menu. In this program, select the Insert option in the Program menu. It loads the copied settings into the selected program.

Arranging Program windows
Once you have created, edited, or opened several programs in different windows, you can arrange these windows in a variety of ways on the user panel. To do this, use the options Cascade, Tile, and Arrange Icons in the Window menu

The option Cascade cascades (arranges front to back in staggered formation) the program windows. The option Tile arranges programs side by side or stacks them one on top of the other in windows of the same size. The option Arrange Icons arranges all program windows in the desired order once they have been minimized to the size of icons.

Activating programs
Activate an open program by clicking its Program window. As soon as a program is activated, its settings are transmitted to the connected DFCs.

The Window menu offers another option for activating a program. In the bottom half of this window, you will find listed the names of all open programs. Activate the desired program by clicking its listed program name.

2.15 LOADING NEW FILTERS INTO DFCS

At HK AUDIO®, we constantly strive to develop speaker filters for numerous application scenarios and configurations of HK AUDIO® speakers and power amps. You can get these on CD-ROM or download them from out website www.hkaudio.com. The DFC Software lets you load these new filters to the DFCs that you have at your disposal. Once loaded to a DFC, filters can also be activated directly at the DFC without using the DFC Software.

Vice versa, it is also possible to copy filters to a PC from the DFCs. This is a handy option when you want to load filters from one DFC to other DFCs.

Important note: In order to load filters to DFCs, they must be accessible in the DFC Software's Speakers folder. If, for example, you received them on CD-ROM, you must first copy them to this file. To load new filter sets to DFCs, select the option Add Equipment in the Tools menu. This opens a new window called Add Equipment.

Selecting filters for loading
See figure 18. In the Add Equipment window, you must first select in the Speakers folder the filters that you want to load to the DFC(s). The buttons used to do this are called Append, Insert, Remove, and Remove all. The Selection list shows the filter sets selected for uploading to the DFC.

Important note: All filters designated in the Selection list are loaded to the DFC even if these are already stored in the DFC. The newly loaded filters of the same name do not overwrite the filters stored in the DFC; instead, these names are listed twice!

Click the Append button to open a window listing all filters offered in the Speakers folder. Select one or several filters and confirm via the Open button. This appends the Selection list, adding the selected filters at its end.
You can also use the Insert button to do this. It inserts filters from the Speakers folder to a selected position in the Selection list. This comes in handy when you want to do things like insert a R-2x2 Stack mid2 filter between R-2x2 Stack mid1 and R-2x2 Stack mid3 filters listed in the Selection.

The Remove button deletes filters currently designated for loading in the Selection list. Click Remove all to delete all filters designated for loading in the Selection list.

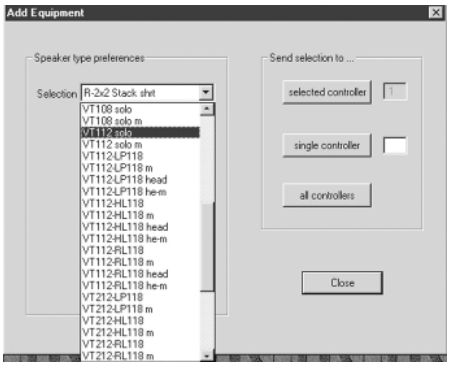


Figure 18: The Add Equipment window



Figure 19: The Reload Equipment window

Important note: The BLK.DEF file contains all filter sets in the sequence recommended by HK AUDIO® and available at the time of the DFC Software 3.01 release. If you want to reload all of these filters to a DFC after a master reset, you have another option – alongside using the Append and Insert buttons– for creating a filter Selection list:

1. Open the file named BLK.DEF in an editor (for example, Windows Editor)
2. Store the opened BLK.DEF file under the name BLK.Inl. This new file overwrites the existing BLK. Inl file.

The Selection list now offers the filters contained in the BLK.DEF file.

Downloading filters to DFCs
Use the Selected Controller, Single Controller, or All Controllers buttons in the Add Equipment window to load filters designated for loading in the Selection list to the DFC(s).
The Selected Controller button sends the filters in the Selection list that is currently activated in the user interface's Editing Panel (marked red) to the DFC. The controller number of this DFC appears in the display at the right of the Selected Controller button.

The Single Controller button also sends the filters in the Selection list to an individual DFC. Select the desired DFC by entering its controller number to the display at the right of the Single Controller button.

The All Controllers button sends the filters in the Selection list to all connected DFCs.

Once filters have been transferred, close the Add Equipment window by clicking the Close button. The Selection list is retained.

Note: The BLK.Inl file's write protection must be deactivated for the Selection list to be retained. Otherwise, an error message appears because the Selection list cannot be stored.

Uploading filters to a PC
To copy a filter from a DFC into the DFC Software's Speakers folder, first select the DFC from which you want to upload the filter to the PC.
Once you have selected the DFC (it is marked red), go to the Tools menu and select the option Reload Equipment, which opens the Reload Equipment window.

See figure 19. The Reload Equipment window offers a box called Speaker Type; select the filter that you want to upload to the PC from the filters contained in the DFC. Click the Reload Filter button to copy the filter to the PC. Once it has been uploaded, you can select and send another filter or quit the Reload Equipment window via the OK button.

Note: Though the Reload Equipment function sends files containing filter data (*.BLK), it does not send files containing filter descriptions (*.HKI). If the Speakers folder does not contain the file describing a given filter (*.HKI), you will not be able to view its properties.

Chapter H

COHEDRA® Power Racks

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Figure 1: COHEDRA® Power Rack 16, front view



Figure 2: COHEDRA® Power Rack 16, rear view

COHEDRA® POWER RACKS

COHEDRA® Power Racks are preconfigured and preinstalled accableing to the VDE standard and designed to drive COHEDRA® Mid/ High cabinets and CDR 210 Sub subwoofers.

1 COHEDRA® POWER RACK 16

Depending on the PB 5's rack configuration, you can connect up to eight Mid/ High cabinets and eight CDR 210 Sub subwoofers to one COHEDRA® Power Rack 16. Alternatively, the Power Rack can also drive either 16 Mid/High cabinets or 16 subwoofers.

1.1 COMPONENTS

The COHEDRA® Power Rack 16 comprises:

No.	Device / Component	Description found in
4x	VX 2400 Power Amps	Chapter I
2x	Digital Field Controllers (DFC)	Chapter G
2x	PB5 Patchbays	Chapter H
1x	PS 32 Power Supply	Section 6
1x	FU4 Fan Unit	Section 5

2 COHEDRA® POWER RACK 8

Depending on the PB 5's rack configuration, you can connect up to four Mid/ High cabinets and four CDR 210 Sub subwoofers to one COHEDRA® Power Rack 16. Alternatively, the Power Rack can also drive either eight Mid/High cabinets or eight subwoofers.

2.1 COMPONENTS

The COHEDRA® Power Rack 8 comprises:

No.	Device / Component found in	Description
2x	VX 2400 Power Amps	Chapter I
1x	Digital Field Controller (DFC)	Chapter G
1x	PB5 Patchbay	Chapter H
1x	PS 32 Power Supply	Section 6

3 Design and Construction

The shock-mount rack housings are made of plywood. Four castors, each with a diameter of 100 mm and two with brakes, are located on the front rack lid. The two lids are designed so that the front lid does not fit the back of the rack and vice versa.
This ensures the Power Rack's center of gravity is low when it is rolled on its castors, minimizing the likelihood of the rack tipping and falling over.

The rack is equipped with rails on the front and back. The various devices attach to these rails via their 19" front panels. Two additional rails inside the rack accept VX 2400 power amps' rear supporting brackets.

Eight recessed, folding metal handles are located on the side panels of the Power Rack for easy handling, transport and set-up. Two additional grips are located on the back rack lid.

3.1 Dimensions and Weights

PR 8 (lying):
Width: 60 cm (23 5/8")
Height: 38.5 cm (15 3/16") (depth, when standing on casters)
Depth: 95 cm (37 3/8") (height, when standing on casters)
Weight: approx. 65 kg (143 lbs.)

PR 16 (lying):
Width: 60 cm (23 5/8")
Height: 65.5 cm (25 3/4") (depth, when standing on casters)
Depth: 95 cm (37 3/8") (height, when standing on casters)
Weight: approx. 125 kg (275 lbs.)

4 Displays and Control Features

Front

Device	Display or control feature
DFC	Menu, Enter, +, -, Reset Buttons
	LED indicators Limiter (red) and Input Level (green/yellow/red)
	LCD display
VX 2400	Mains power switch
	Circuit breaker
	Channel A, Channel B volume knobs
	LED indicators Mains (green), Protect (red), Signal (green), Clip (red)

Back

Device	Display or control feature
PB5	Polarity switch
	Ground switch
	Mid/ High Sub switch
PS 32	L1, L2, L3 circuit breakers
	L1, L2, L3 phase indicators (green)

5 FU4 Fan Unit (with COHEDRA® Power Rack 16 only)

The Fan Unit contains four axial fans installed in a 19", 6 HU metal housing. It is designed to draw hot air out of the Power Rack.
The Fan Unit's mains cable is a three-wire cable with a grounded plug.

The FU4 is furnished with a fuse that cuts the unit's power supply in case of malfunction. The fuse is easily accessible without having to remove the unit from the rack.

Note: Do not remove or replace fuses when the unit is powered up. Be sure to pull the ventilator unit's mains plug before inserting a new fuse!



Figure 3: 1 COHEDRA® Power Rack 8, front view



Figure 4: COHEDRA® Power Rack 8, rear view



Figure 5: PS 32 Power Supply

6 PS 32 POWER SUPPLY

The PS 32 is a Power Supply designed for use in professional audio and lighting system racks.
It distributes a three-phase 32 A CEEKON connector to individual grounding type power outlets.
The PS 32 is equipped with a 32 A CEE male plug with a 1.5 m rubber-insulated cable that connects to a three-phase power supply. Three-phase electrical current is routed through via a parallel 32 A CEE female socket.

6.1 CONNECTIONS

Equipped with three 16 A grounding type power outlets for each phase, the PS 32 distributes power to various devices. One three-core socket is located on the front panel and two on the rear panel for each phase. This convenient configuration makes it easy to plug devices installed in a rack or cabinet into the PS 32's rear panel and external devices into its front panel.

6.2 L1, L2, L3 CIRCUIT BREAKERS AND PHASE INDICATORS

One C 16 circuit breaker for each phase protects against excess current (overload). In the event of an overload, it cuts the overloaded phase's power supply off. The PS 32 is a equipped with a monitoring lamp (green) for each phase. It lights up to indicate that a live load is connected and that a neutral conductor is available.

6.3 NEUTRAL CONDUCTOR CHECK

1. Connect the PS 32 to a 32 A CEE house mains outlet. Switch circuit breaker 1 on. If the check lamp does not light up, the circuit lacks a phase or a neutral conductor. Switch circuit breaker 1 off and repeat the procedure for circuit breaker 2. If the check lamp also fails to light up, the problem may be the same. Repeat the procedure again for circuit breaker 3.

2. Switch circuit breakers 1 and 2 on at the same time. Circuit breaker 3 remains off. If the L1 and L2 check lamps light up when both circuit breakers are switched on but do not indicate voltage when they're switched on separately, this is a sure sign that the circuit lacks a neutral conductor.

Do not operate HK AUDIO® sound systems' electronic equipment (amps, controllers, and electrical accessories) if the power supply lacks a zero or neutral conductor. If you come across an outlet lacking a neutral conductor, have a qualified electrician check and repair it.

Note: The PS 32 is not equipped with a current operated circuit breaker. Therefore, make sure your system's main power supply is equipped with a suitable circuit breaker.

Chapter 1

Power Amp VX 2400

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Figure 1: VX 2400 front view

VX 2400

The VX 2400 is a dual channel power amplifier featuring integrated protective and monitoring circuits and the associated display and control features. The signal inputs of the VX 2400 are electronically balanced. Input impedance is 20 k-ohms balanced or 10 k-ohms unbalanced. Input sensitivity amounts to 1.4 RMS. Both inputs are provided with filters to protect against stray HF pickup.

Each of the VX 2400's two channels produces 1200 watts RMS of continuous power at an impedance of 4 ohms, and 750 watts RMS continuous power at 8 ohms. In the event of transient impulses (for example, percussive signals) at an impedance of 4 ohms, the amp can develop peak output levels ranging up to 2,000 watts per channel depending on the duration of the spike.

The VX 2400 accepts 230 V mains voltage and 50 to 60 Hz line frequency. In accordance with the VDE 0860 and IEC 60065 norms, the power amp will continue operating soundly at voltage fluctuations ranging up to 10%. The VX 2400's circuit breaker trips when the incoming mains voltage exceeds the permissible limit. The VX 2400's power consumption according to IEC 60065 is 1800 watts.

The power consumption specification is an average value; actual power consumption can intermittently peak at 4,000 watts. Make sure ample voltage is available. Particularly when operating the power amp near or at full power, always ensure the fan and ventilation ducts remain uncovered and unobstructed, ensuring sufficient ventilation and cooling.

1 PROTECTIVE CIRCUITS

The VX 2400 is equipped with circuits protecting it against DC voltage at the output, excess current (short circuits), and thermal overload (overheating). The Protect LED lights up when a protective circuit activates (see chapter 4). When a protective circuit shuts the amp down, it switches back on automatically as soon as the problem has been eliminated. Failure to do this indicates that there is an internal defect. In this case, have a qualified service technician examine the VX 2400.

2 LIMITER

The VX 2400 features an intelligent circuit that limits the level of the input signal according to the amount and duration of overload. This extends the power amp's useful dynamic range considerably.

Important note:
If you use the HK AUDIO® Digital Field Controller (DFC) in combination with the VX 2400, be sure to switch the VX 2400's limiters off. Otherwise, the DFC's Overshoot limiter will not work. Also, be sure to switch the VX 2400' limiter off when using the HK AUDIO® AC22 Controller (for example, for monitoring purposes).

3 FAN

A temperature controlled, DC-powered fan cools the VX 2400. It draws fresh air from the front, sucking it through a dust filter and expelling the warm air through the back vents.

Important note:
Check the dust filter regularly and clean when necessary. If the dust filter is clogged with dirt, the amp will not be cooled sufficiently.



Figure 2: Ports on the VX 2400's rear panel

4 Displays and Control Features

4.1 Mains Switch

0: Power amp off
1: Power amp on

4.2 LED Indicators

LED indicator - Mains (green)

- Lights up continuously when the power amp is switched on and is receiving mains voltage (power amp is ready for operation).
- Extinguishes when the mains voltage is cut or the amp is switched off.

LED indicator - Protect (red)

- Lights up continuously when the power amp is overheated and the protective circuit has activated.
- Flashes at three-second intervals when the connected speakers' impedance is too low (or in case of a short circuit) and the protective circuit has activated.

LED indicator - Signal (green)

- One for each channel
- Lights up when an audio input signal with a level of at least - 16 dBV is patched into the power amp's input.

LED indicator - Clip (red)

- Lights up to indicate that the amp has run out of headroom and is exceeding its nominal power output rating.

Turn the power amp down if the CLIP LED indicator illuminates continuously. Note that it may flash occasionally when the amp is used in setups with HK AUDIO® Digital Field Controllers. This is attributable to the tolerance of some LEDs and the fact that the DFC's limiter makes full use of the amp's available output power.

4.3 Channel A, Channel B Gain Knobs

Twist these knobs to adjust the levels if the two power amp channels. Both Gain knobs are detent potentiometers scaled in dB increments. Twist the Channel A gain knob to adjust the level for the speaker connected to Output A; twist the Channel B gain knob to adjust the level for the speaker connected to Output B.

4.4 Circuit Breaker

The circuit breaker is on the VX 2400's front panel (on older models, it is on the back panel). It cuts the VX 2400's power supply in the event of a malfunction. Unlike fuses, a circuit breaker that has tripped can simply be switched back on again after the problem has been remedied. This is convenient because you don't have to worry about keeping a supply of replacement fuses at hand.

Important note: Do not power the VX 2400 up using the circuit breaker. Switch the VX 2400 mains switch off before resetting the circuit breaker; otherwise, you may destroy it.

4.5 Mode Selector Switch

Mono mode:
The two inputs are connected in a parallel circuit, that is, a single input signal is routed to both power amp channels. The output signals of both channels are identical.
In mono mode (Mode selector switch is set to Mono), patch the signal into the XLR port or jack of channel A (Input A) or B (Input B). Connect speakers to Output A and Output B using the Speakon ports or binding posts. The overall impedance of connected speakers may not be lower than 4 ohms per power amp channel!

Stereo mode:
The power amp operates in dual-channel mode (that is, using two independent channels).
In stereo mode (Mode selector switch is set to Stereo), patch the signal into both channels' Input A or Input B XLR ports or jacks. Connect speakers to both power amp channels via Output A and Output B using the Speakon ports or speaker binding posts.
The overall impedance of connected speakers may not be lower than 4 ohms per power amp channel.

Bridge mode:
The two channels are bridged to create a high-performance, single-channel power amp.
In bridge mode (Mode selector switch is set to Bridge), feed the signal in via the XLR port or jack of channel A (Input A) or B (Input B). Connect speakers to the Output A Speakon port with the pin assignments pin 1+ / pin 2+, or to the two red binding posts. Polarity is critical. Double-check to ensure the polarity matches the polarity indicated the labels on the speaker binding posts. The overall impedance of connected speakers may not be lower than 8 ohms. Twist the Channel A gain knob to adjust the level.

Biamp mode:
In biamp mode (Mode selector switch is set to Stereo), connect an active crossover or controller to the power amp's front end and drive high/mid range enclosures and subwoofers using a four-wire speaker cord. Patch the signal for the high/mid range enclosure via the Input A XLR port or jack and the subwoofer signal via the Input B XLR port or jack.

Connect the first speaker to Speakon Output A (Output A + B) and daisy-chain the remaining speakers. The overall impedance of connected high/mid range enclosures and subwoofers may not be lower than 4 ohms each. Twist the Channel A gain knob to set the level for Channel A (mid/ high range enclosure); twist the Channel B gain knob to set the level for Channel B (subwoofer).

Important note:
The mode setting and the configuration of signal routing cables must always match. If you operate VX 2400 power amps in combination with a DFC, make sure your set their Mode selector switches to Stereo.

4.6 LIMITER SWITCH

On: Activates internal limiters
Off: Deactivates internal limiters

4.7 GROUND SWITCH

On: Couples the audio signal's ground to the power amp's ground.
Lift: Severs the audio signal's ground from the power amp's ground to eliminate humming caused by ground loops.

5 CONNECTORS

5.1 MAINS

The VX 2400's mains plug is a three-pole non-heating equipment connector with a ground contact. Do not connect the device to a power supply using anything other than a three-pole connector with a ground contact. The mains outlet must also be equipped with a ground contact. Never use damaged cables, plugs, or sockets.

5.2 SIGNAL INPUT A, INPUT B

Each input channel of the VX 2400 is equipped with one female XLR port and one 6.35 mm (1/4") stereo jack; the two are connected via a parallel circuit.
The XLR port's pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).
The jack's pin assignments are:
sleeve = ground, ring = signal (-), tip = signal (+).
A mono 1/4" plug bridges the signal (-) and ground contacts. If you insert a mono 1/4" plug, you will patch an unbalanced signal into the power amp.

To connect an unbalanced signal source to the VX 2400, it is recommended that you connect a balanced cord to the VX 2400's input (using XLR or stereo 1/4" plugs). Bridge the signal (-) and ground wires or contacts at the other end of this cable (that is, at the output of the unbalanced source).

5.3 SPEAKER OUTPUT A, OUTPUT B

Each output channel of the VX 2400 is equipped with one four-pin Speakon connector and one binding post; the two are connected via a parallel circuit. The Speakon connector's pin assignments are: pin 1+ / pin 1-.
The binding posts are assigned to the following Speakon pins:
red binding post = Speakon pin 1+,
black binding post = Speakon pin 1-.

5.4 SPEAKER OUTPUT A+B / BRIDGE

Speakon output A may also be used for bridged or biamped operation. In biamp mode, the channel A signal is routed to pin 1+ / pin 1- and channel B output to pin 2+ / pin 2-. In bridge mode, the signal is sent to pin 1+ / pin 2+.

6 INSTALLATION IN A RACK

The amp's housing is designed to 19" specifications. When installing it in a rack, be sure to secure the VX 2400 via both the front panel and the back supporting brackets to protect the chassis from damage.

To ensure sufficient ventilation and prevent heat from building up, enable cooling air to circulate freely around the front and back of the amp (see the chapter Service). When installing amps into closed racks or cabinets, also install adequate fans for cooling the amps. When installing several power amps into a cabinet, it also recommended that amps are spaced at least one U apart to improve air circulation.

Before plugging the VX 2400 into a mains power supply, make sure the local mains voltage and line frequency matches the indicated specifications!
If you want to plug several VX 2400s into one mains outlet, make sure that all the connected cables and distributors are designed to handle the aggregate power.

Note:
Connect all cables first, and then switch on all other devices in the audio signal chain before switching the power amp on. When switching the system off, proceed in reverse order; that is, switch the power amp off first.

7 TECHNICAL DATA

Inputs (per channel):	1 XLR female 3-pin, 1 stereo ¼ " jack
XLR pin assignments:	Pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-)
Stereo 1/4" jack pin assignments:	ring = ground, sleeve = signal (-), tip= signal (+)
Input impedance:	20 k-ohms balanced, 10 k-ohms unbalanced
Input sensitivity:	1.4 V RMS
Outputs (per channel):	1 Speakon® NL4, 1 pair of binding posts
Outputs (both channels):	1 x Speakon® NL4
Speakon pin assignments Output A, Output B:	pin 1+ / pin 1-
Speakon pin assignments Output A+B / Bridge:	channel A = pin 1+ / pin 1-, channel B = pin 2+ / pin 2-
Mains voltage connector:	three-pole non-heating equipment connector
Continuous power per channel at 8 ohms:	750 W
Continuous power per channel at 4 ohms:	1200 W
Continuous power in Bridge mode at 8 ohms:	2400 W
Amplification:	39 dB
Frequency response:	20 Hz to 20000 Hz (1 dB)
Crosstalk at peak level at 1 kHz:	-75 dB
Crosstalk at peak level from 20 to 20,000 Hz:	-60 dB
Signal to noise ratio (at peak level):	-103 dB
Attenuation factor at 8 ohms from 20 to 400 Hz:	> 600
Mains voltage / frequency:	230 V / 50 - 60 Hz
Power consumption (average):	1800 watts according to IEC 60 065
Weight	19.8 kg g
Width:	48 cm (19")
Height:	9 cm / 2 HU
Depth:	44 cm

CHAPTER J

PATCHBAY PB5

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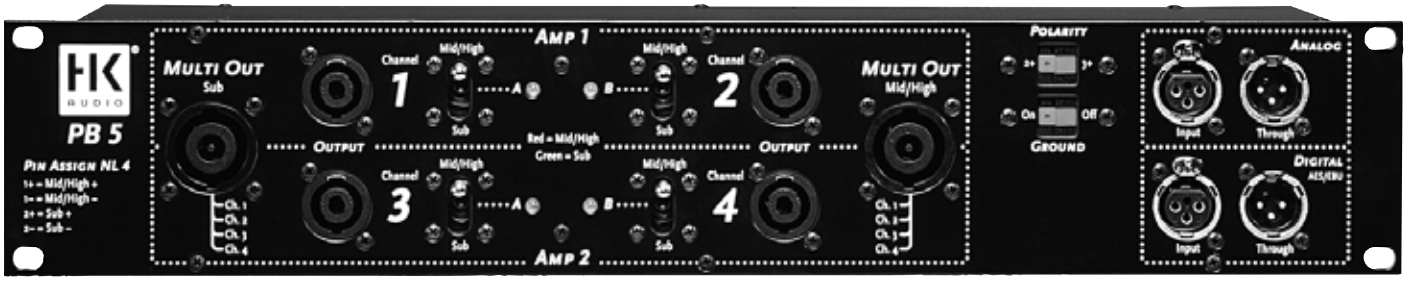


Figure 1: PB 5 front view with control features

PB 5 PATCHBAY

The PB 5 is an interface for connecting and switching one HK AUDIO® Digital Field Controller, two VX 2400 power amps, and the speaker system. It offers inputs for analog and digital audio signals and four outputs for speaker signals. Featuring flexible configuration possibilities, it affords you a variety of routing options. For example, you can assign the mid/ high or subwoofer signal to any power channel without having to reconnect patch cables. And that means you can easily and swiftly set up the desired rack configuration, for instance, Mid/ High only and Sub only. For more on this, see section 3.

1 FRONT PANEL CONNECTIONS AND CONTROL FEATURES

1.1 ANALOG AUDIO INPUT

The PB 5 offers a three-pin female XLR port that accepts signals from audio sources with analog outputs. Signals can be patched through via a male XLR connector wired in parallel.
Pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).
You can reverse pin 2 and 3's pin assignments using the Polarity switch.

1.2 DIGITAL AES/EBU DIGITAL AUDIO INPUT

The PB 5 is equipped with a three-pin female XLR port that accepts signals from audio sources with digital AES/EBU outputs. Signals can be patched through via a male XLR port. Pin assignments are pin 1 = ground, pin 2 and 3 = signal.

1.3 CHANNEL 1 TO 4 SPEAKER OUTPUTS

The PB 5 is equipped with four NL 4 Speakon ports that depending on the given system configuration, connect to the outputs of up two VX 2400 power amps. The pin assignments of the NL 4 Speakon connectors are:
Pin 1+ = mid/ high+
Pin 1- = mid/ high -
Pin 2+ = sub +
Pin 2- = sub -

1.4 MID/ HIGH AND SUB MULTI OUTS

The PB 5 is equipped with two NL 8 Speakon ports, one for connecting the mid/ high multicore speaker cable and one for connecting the subwoofer multicore speaker cable. These connectors let you drive either eight mid/ high range cabinets or eight subwoofers using one PB 5 rack. The PB 5 is designed to handle a total of four channels (that is, eight cabinets), so the two Multi Outs can only be used simultaneously by employing two channels of the Subwoofer Multi Outs and two channels of the Mid / High Multi Outs. The pin assignments of the NL 8 Speakon connectors are as follows:

	Multi Out Mid/High:	**Multi Out Subwoofer:**
Pin 1+	Ch. 1 mid/high+	Ch. 1 subwoofer+
Pin 1-	Ch. 1 mid/high-	Ch. 1 subwoofer-
Pin 2+	Ch. 2 mid/high+	Ch. 2 subwoofer+
Pin 2-	Ch. 2 mid/high-	Ch. 2 subwoofer-
Pin 3+	Ch. 3 mid/high+	Ch. 3 subwoofer+
Pin 3-	Ch. 3 mid/high-	Ch. 3 subwoofer-
Pin 4+	Ch. 4 mid/high+	Ch. 4 subwoofer+
Pin 4-	Ch. 4 mid/high-	Ch. 4 subwoofer-

Note: When using factory-configured COHEDRA® Power Racks, never connect more than two cabinets in parallel to one output. On the PB 5, use either the individual NL 4 Speakon Outs or Multi Outs to ensure that you do not connect too many mid/high cabinets or subwoofers in parallel.



Figure 2: PB 5 rear view with patch cables

1.5 GROUND SWITCH

Ground On
This setting couples the audio signal's ground to the chassis ground of the power amps and controllers connected to the PB 5.

Ground Off
This setting severs the audio signal's ground from the chassis ground of the power amps and controllers connected to the PB 5 to eliminate humming caused by ground loops.

1.6 POLARITY SWITCH

You can reverse the pin 2 and 3's pin assignments of the audio input using the Polarity switch.
In the 2+ position, pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).
In the 3+ position, pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

1.7 MID/HIGH – SUB SWITCHES

These four switches configure the inputs and outputs of power amp channels 1 to 4.
LEDs indicate the selected mode.
Mid/High = red; Sub = green

Mid/High setting
The power amp's input is routed to the DFC's HF Out and the power amp channel's output is assigned to the NL 4 Speakon pins 1+ and 1-; that is, to the Mid/High Multi Out for driving mid/high cabinets.

Sub setting
The power amp's input is routed to the DFC's LF Out and the power amp channel's output is assigned to the NL 4 Speakon pins 2+ and 2-; that is, to the Subwoofer Multi Out for driving subwoofers.

2 Rear Panel Connectors

2.1 Patch Cables for Connecting the VX 2400 and DFC

DFC Digital In digital audio patch cord
Plug the DFC Digital In cord (a cable with a male XLR connector located in the bottom opening of the housing) into the DFC's Digital In. The XLR connectors' pin assignments are:
pin 1 = ground, pins 2 and 3 = signal.

DFC Fullrange In analog audio patch cord
Plug this patch cord (a cable with a male XLR connector located in the upper opening of the housing) into the DFC's Fullrange In input. The XLR connectors' pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

DFC LF Out analog audio patch cord
Plug this patch cord (a cable with a female XLR connector located in the bottom opening of the housing) into the DFC's LF Out output. The XLR connectors' pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

DFC HF Out analog audio patch cord
Plug this patch cord (a cable with a female XLR connector located in the top opening of the housing) into the DFC's HF Out output. The XLR connectors' pin assignments are:
pin 1 = ground, pin 2 = signal (+), pin 3 = signal (-).

Speaker cables
Equipped with Speakon connectors, these speaker cables connect to the VX 2400's speaker outs (Amp 1 and Amp 2). Please refer to Figure 2. The Speakon connectors' pin assignments are:
pin 1+ / pin 1-.

3 PB 5 Rack Configurations

3.1 Power Amp Channel Routing for a PB 5

Top power amp	Channel	PB 5 output
Amp 1	A	Output Channel 1
Amp 1	B	Output Channel 2

Bottom power amp	Channel	PB 5 output
Amp 2	A	Output Channel 3
Amp 2	B	Output Channel 4

Use the Mid/High - Sub switch to assign mid/high or subwoofer signals to any power amp channel. You have three rack configurations to choose from:

3.2 Mid/High-Sub

In this configuration, one Amp Rack powers both the mid/ high and subwoofer circuits. Set the Mid/High - Sub switches of Amp 1 and Amp 2's A channels to Mid/High mode. Route the DFC's HF Out (which carries the mid/high frequency signal) to Amp 1 and Amp 2's Inputs A. The pin assignments of the NL 4 connectors of Amp 1 and Amp 2's A Speaker Outs are:
pin 1+ = mid/ high+; pin 1- = mid/ high -.
The LED on the respective switch lights up red.

Set the Mid/High - Sub switches of Amp 1 and Amp 2's B channels to Sub mode. Route the DFC's LF Out (which carries the low frequency signal) DFC's Amp 1 and Amp 2's Inputs B. The pin assignments of the NL 4 connectors of Amp 1 and Amp 2's B Speaker Outs are:
pin 2+ = sub +; pin 2- = sub -.
The LED on the respective switch lights up green.

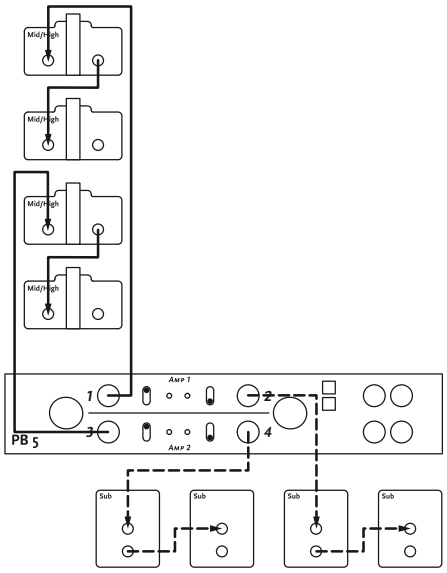


Figure 3: Mid/High - Sub

3.3 MID/HIGH ONLY

Set all Mid/High - Sub switches to Mid/ High mode. This routes the DFC's HF Out (mid/high frequency signal) to all four audio inputs. In this configuration, all power ramps in the rack deliver the mid/high signal to the mid/high range enclosures. The pin assignments of all of Amp 1 and Amp 2's NL 4 speaker outs are:
pin 1+ = mid/ high+; pin 1- = mid/ high -.
All LEDs light up red.

3.4 SUB ONLY

Set all Mid/High - Sub switches to Sub mode. This routes the DFC's LF Out (low frequency signal) to all four audio inputs. In this configuration, all power ramps in the rack deliver the low frequency signal to the subwoofers. The pin assignments of all of Amp 1 and Amp 2's NL 4 speaker outs are: pin 2+ = sub +; pin 2- = sub -.
All LEDs light up green.

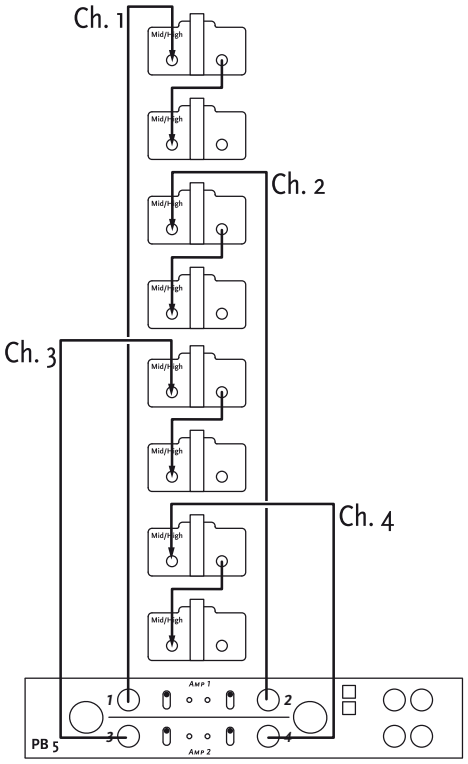


Figure 4: Mid/High only connected to Ch. 1-4 out

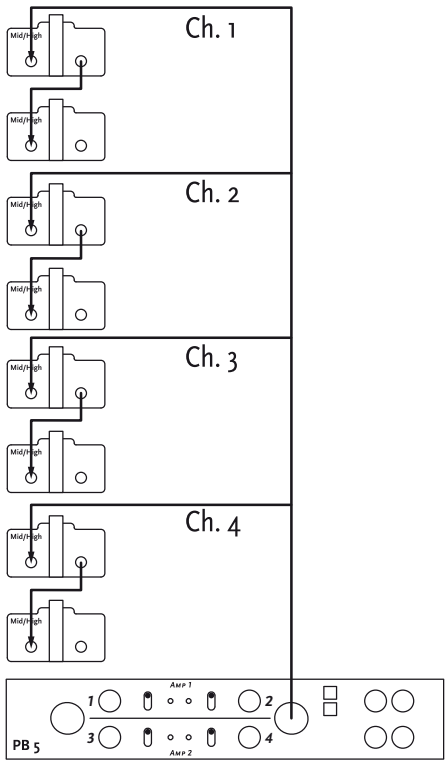


Figure 5: Mid/High only connected to Multi out

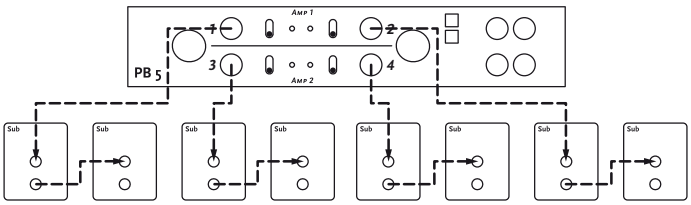


Figure 6: Sub only connected to Ch. 1-4 out

Chapter K

Service Cohedra

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Figure 1: The VX 2400's air intake

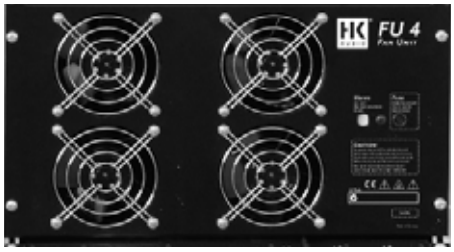


Figure 2: The COHEDRA® Power Rack 16's fan unit



Figure 3: Foam rubber and fleece

1 Routine Maintenance and Service Checks

1.1 Power Rack 16 and VX 2400 Fans

Clean the fans in the Power Rack 16 and VX 2400 power amp regularly!

1.2 Fleece in Mid/High Enclosures

Located in front of the acoustics lens, the fleece used these housings is made of a special fiberglass fabric.
Remove the two front grilles to replace fleece. You'll find it under the acoustic foam, wedged in with the grilles.

2 COHEDRA® Replacement Parts

If you require a replacement part for HK AUDIO® COHEDRA®, please request it using the designation and part number indicated in Table 1!

Note:

- If your equipment requires service, please turn to your HK AUDIO® dealer or the HK AUDIO® distributor in your country. They stock the required spare parts.
- In the event of a fault, always indicate the defective device's serial number. This way the HK AUDIO® service team can ascertain immediately if an update is available for your product.
- Use only original HK AUDIO® replacement speakers and parts! Most of these have been developed especially for HK AUDIO® products and are not available directly from speaker manufacturers!

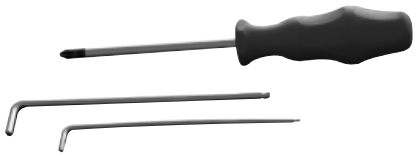
Designation	Replacement part no.
10" Subwoofer	E 994157
Speaker housing CDR 210 Sub	E 400154
Connector plate CDR 210 Sub	E 520088
Front grille CDR 210 Sub	E 970577
Rubber foot CDR 210 Sub	E 976009
Insert handle CDR 210 Sub	E 974096
8" midrange speaker	E 994158
Speaker housing CDR 208 S	E 400152
Front grille CDR 208 S left side	E 970575
Front grille CDR 208 S right side	E 970607
Speaker housing CDR 208 T	E 400153
Front grille CDR 208 T left side	E 970576
Front grille CDR 208 T right side	E 970608
Fiber glass fleece for mid/high enclosures	E 972073
1.4" B&C DE 900 high frequency driver	E 994154
Diaphragm for DE 900	E 994163
Quick-release pin 8x 30 mm	E 976126
Crossover CDR 208 T complete	E 520087
Crossover CDR 208 S complete	E 520092
Rear rigging connector CDR 208 S	E 970572 + 970574
Rigging connector front CDR 208 S	E 970570
Rear rigging connector CDR 208 T	E 970573 + 970574
Rigging connector front CDR 208 T	E 970571
Left grip CDR 208	E 970556
Right grip CDR 208 T	E 970555
Left grip CDR 208 S	E 970569
Right grip CDR 208 S	E 970556
COHEDRA® acoustic lens [1])	E 994155
Subwoofer dolly	E 193533
Blue wheels, 100 mm	E 976013
Blue wheels, 100 mm w/brakes	E 976129
Dolly lashing strap	E 976128
[1]) This replacement part is available exclusively in exchange for the defective part!	

Table 1: Replacement parts list as of August 2003

3 Overview of Required Tools

Just three tools are needed:
- Allan (hexagonal socket) wrench, 3 mm to replace the voice coil
- Allan (hexagonal socket) wrench, 4 mm to replace the 8" speaker and rigging connector
- Screwdriver/power screwdriver

(see figure 4).



4 Replacing Loudspeakers and Voice Coils

4.1 Subwoofer

All you have to do to replace the subwoofer is remove the front grille. To this end, unfasten the Phillips (cross-headed) screws on the front panel of the grille and remove the grille. Then unfasten the hex head bolts holding the subwoofer in place.

When installing a replacement speaker, connect speaker wires to the proper posts, ensuring that the polarity is correct! Red = +, black = -.

Note:
The two 10" subwoofers are wired in series!

4.2 8" Midrange Speaker

Proceed as follows to replace one of the two 8" speakers:
- Unfasten and remove the grille's four Phillips (cross-headed) screws. Remove the grille.
- Unfasten and remove the four hex head bolts holding the 8" speaker in place.
- Now that the speaker is detachable, disconnect the speaker wires.

When installing a replacement speaker, connect speaker wires to the proper posts, ensuring that the polarity is correct! The two 8" subwoofers are wired in series.

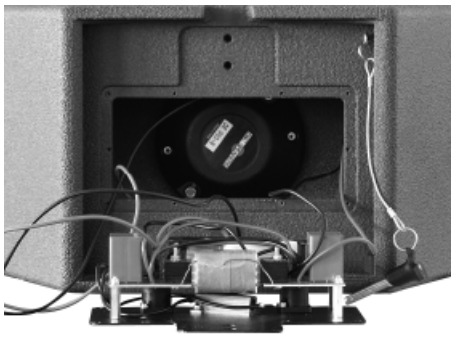
4.3 The Driver's Voice Coil

Proceed as follows to replace the DE 900's voice coil:
- Unfasten the mid/high enclosure's rear rigging connector. To do this, loosen the four hex head bolts in the rail.
- Unfasten and remove the eight Phillips (cross-headed) screws holding the connector panel.
- Remove the connector panel along with the attached crossover from the housing.
- Unfasten the voice coil housing's four hex head bolts. Be sure to use an Allan (hexagonal socket) wrench with a chamfered head because you will unable to insert a straight wrench into the screw head! Disconnect the wires from the push-pins.
- Take the lid off the voice coil housing.
- The voice coil can now be replaced.



Important:
Replace the voice coil in a clean working environment only. Be sure to keep dust and dirt out of the open driver. If despite your precautions particles manage to get in, use a strip of adhesive tape to remove them or carefully blow compressed air into the back of the driver to whisk the particles out.
When installing the new voice coil, ensure it is centered properly. Proceed as follows to check this: Close the voice coil chassis' cover and reconnect the cords (red = plus, black = minus). Feed a sine wave signal between 1000 Hz and 1500 Hz into the mid/high enclosure's input. Sweep through the frequency. If you hear abrasive noises like crackling or scratching, the voice coil is not centered properly. Reopen the voice coil chassis and turn the voice coil a bit until the signal is rendered cleanly!







CHAPTER K 1

SERVICE COHEDRA® COMPACT

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1 Routine Maintenance and Service Checks

1.1 Fans in the Power Racks and VX 2400

Regularly clean the fans in the PR 16 and the VX 2400 power amp!

2 COHEDRA® Compact Replacement Parts

If at some point you require a part for the HK AUDIO® COHEDRA® Compact system, please use the names and part numbers listed in Table 1 to order it!

Note:

- If your equipment requires service, please turn to your HK AUDIO® dealer or the HK AUDIO® distributor in your country. They stock the required spare parts.
- In the event of a fault, always indicate the defective device's serial number. This way the HK AUDIO® service team can ascertain immediately if an update is available for your product.
- Use only original HK AUDIO® replacement speakers and parts! Most of these have been developed especially for HK AUDIO® products and are not available directly from speaker manufacturers!

3 Overview of Required Tools

Just three tools are required to perform service work on speakers - a 3-mm Allen (hexagonal socket) wrench, a 4-mm Allen wrench and a Phillips (cross-headed) screwdriver or power screwdriver (see Figure 3).

4 Replacing Loudspeakers and Voice Coils

4.1 8" Midrange Speaker

Proceed as follows to replace an 8" speaker:

- Unfasten and remove the grille's Phillips screws. Remove the grille.
- Unfasten and remove the four hex head bolts holding the compression chamber and remove it.
- Unfasten and remove the four hex head bolts holding the 8" speaker in place (see Figure 6).
- Disconnect the speaker wires and remove the speaker. When installing a replacement speaker, connect speaker wires to the proper posts, ensuring that the polarity is correct!

4.2 The 1" Driver's Voice Coil

Caution:
Because COHEDRA® voice coils are preselected, their quality tolerances are narrower than those of standard DE 160 voice coils. To make the most of CohedraTM Compact mid/high cabinets' performance capability, always use HK Audio voice coils!

Proceed as follows to replace the voice coil:

- Remove the mid/high unit's service panel (the sheet metal cover on the left side). To do this, unfasten the eight Phillips head screws.
- Remove the service panel from the housing.
- Unfasten the voice coil housing's four hex head bolts. Use a chamfered 3-mm wrench since the bolts are not directly accessible! Disconnect the wires.
- Take the lid off the voice coil housing.
- The voice coil can now be replaced.

Important: Replace the voice coil in a clean working environment only. Be sure to keep dust and dirt out of the open driver. If despite your precautions particles manage to get in, use a strip of adhesive tape to remove them or carefully blow compressed air into the back of the driver to whisk the particles out. When installing the new voice coil, ensure it is centered properly. Proceed as follows to check this: Close the cover of the voice coil housing and reconnect the cords (red = plus, black = minus). Feed a sine wave signal with a frequency between 1000 Hz and 1500 Hz into the mid/high enclosure's input. Sweep through the frequency. If you hear abrasive noises like crackling or scratching, the voice coil is not centered properly. Reopen the voice coil chassis and turn the voice coil a bit until the signal is rendered cleanly!



Figure 1: The VX 2400's air intake

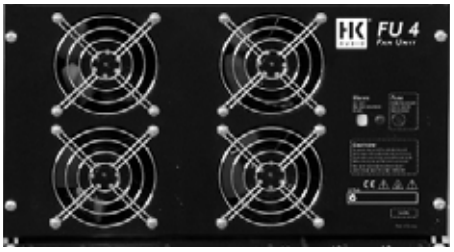


Figure 2: The COHEDRA® Power Rack 16's fan unit

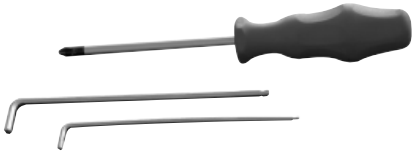


Figure 3: Required service tools



Figure 4: CDR 108 C with grille and compression chamber removed



Figure 5: Rear view of the CDR 108 C with service panel removed

CHAPTER L

APPENDIX/REFERENCE LIBARY

1 NEAR FIELD AND FAR FIELD LINE ARRAY

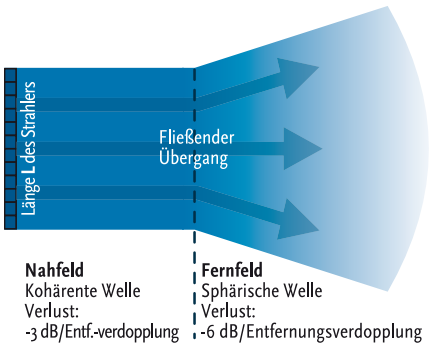


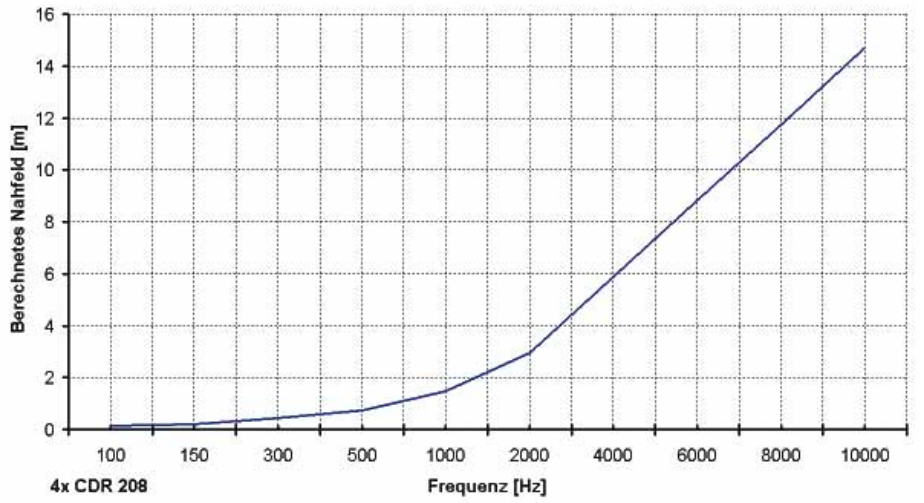
Figure 1: Near field to far field transition for a line array

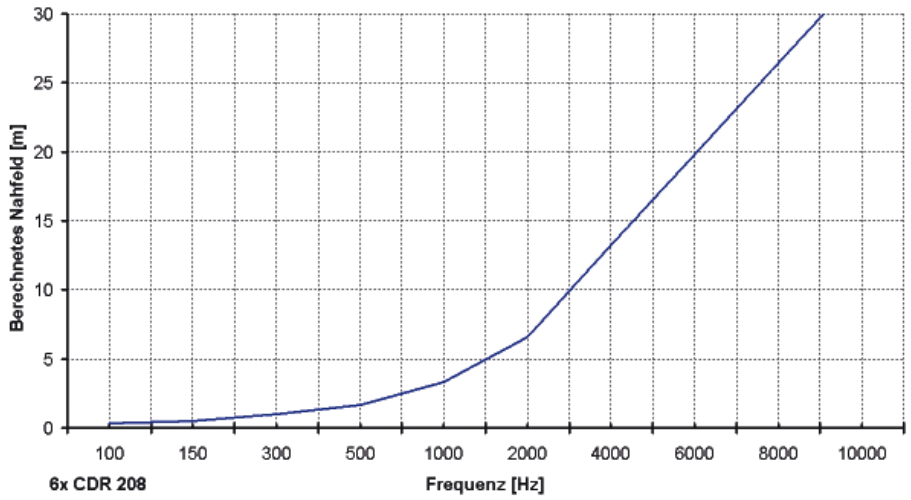
Frequency: 50 Hz	100 Hz	150 Hz
Length [m] Near field	Near field	Near field
4	1,18	2,35	3,52
6	2,64	5,29	7,94
8	4,71	9,41	14,11
10	7,35	14,70	22,10
12	10,6	21,20	31,80
14	14,40	28,80	43,20
16	18,80	37,60	56,50
18	23,80	47,60	71,50
20	29,40	58,80	88,20

Table 1: Theoretical near field for sub floors arrays according to bass line length and frequency

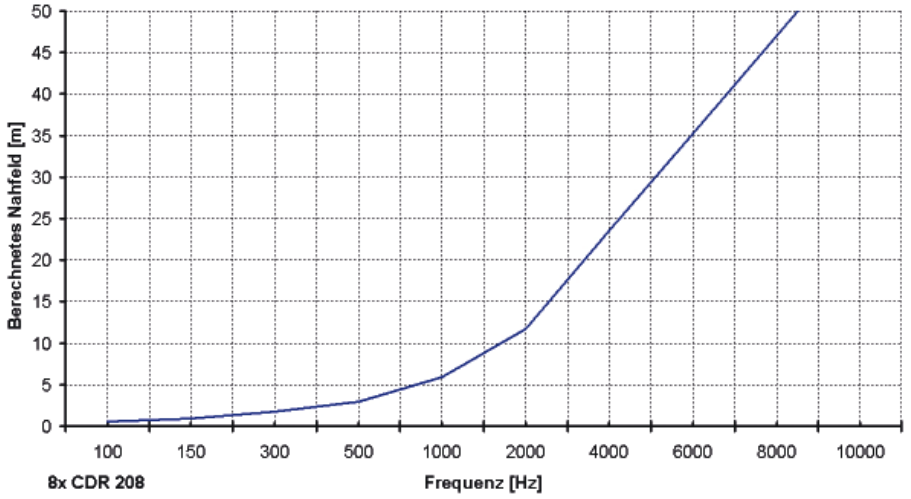
Frequency:	300 Hz	500 Hz	1 kHz	2 kHz	4 kHz	6 k Hz	8 kHz	10 kHz
Cluster Height	Near field	Near field	Near field	Near field	Near field	Near field	Near field	Near field
4 Mid/High	0,44	0,74	1,47	2,94	5,88	8,82	11,76	14,70
6 Mid/High	0,99	1,65	3,30	6,61	13,23	19,80	26,47	33,00
8 Mid/High	1,76	2,94	5,88	11,76	23,53	35,28	47,06	58,80
12 Mid/High	3,97	6,61	13,23	26,47	52,94	79,38	105,88	132,30
16 Mid/High	7,05	11,76	23,53	47,05	94,11	414,18	188,22	235,30
20 Mid/High	11,03	18,38	36,76	73,53	147,00	220,56	294,00	367,60
24 Mid/High	15,88	26,47	52,94	105,88	211,76	317,64	423,52	529,40

Table 2: Theoretical near field for mid/high enclosures according to cluster height and frequency

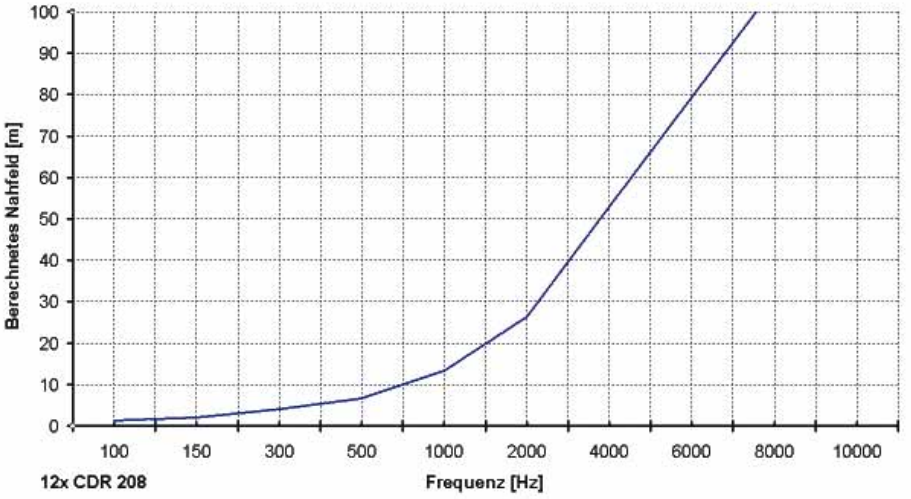




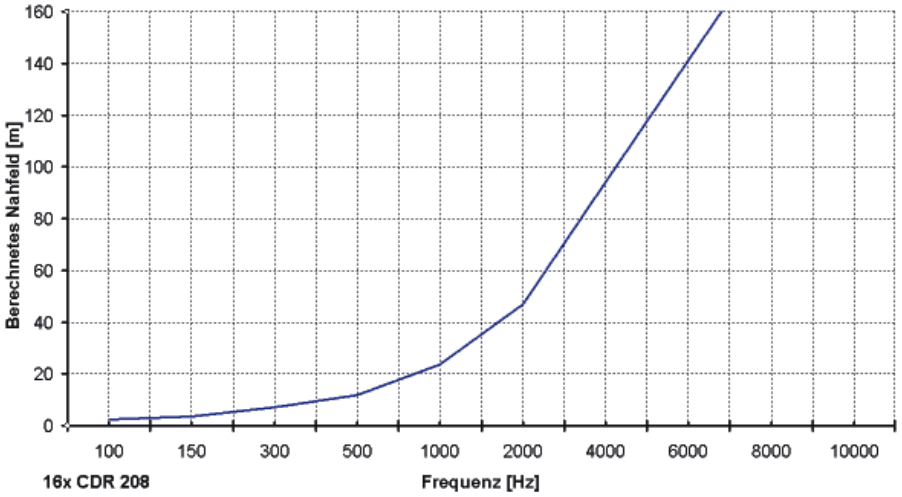
6x CDR 208



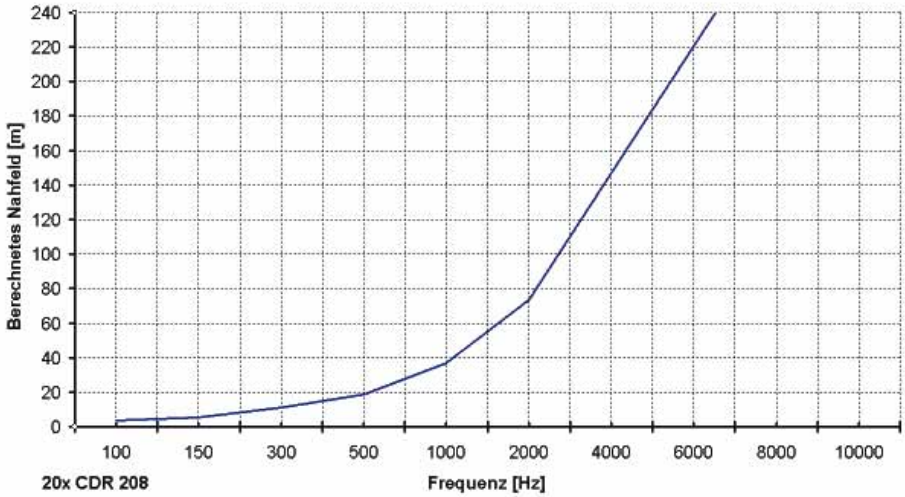
8x CDR 208



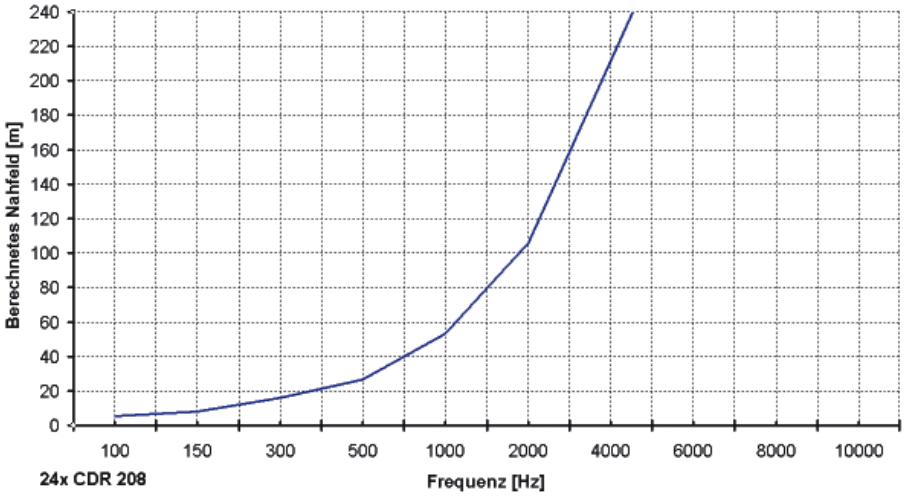
12x CDR 208



16x CDR 208



20x CDR 208



24x CDR 208

2 Overview of COHEDRA® -DFC Filtersets

Application (per side)	Filter Name	Version	Date
4x CDR 208 w/o Subwoofer	CDR208-4 fullr	1	24.06.04
4x CDR 208 + 4 x CDR 210 F	CDR208-4 100Hz	1	24.06.04
4x CDR 208 + 4 x CDR 210	CDR208-4 130Hz	1	24.06.04
6x CDR 208 w/o Subwoofer	CDR208-6 fullr	1	24.06.04
6x CDR 208 + 6 x CDR 210 F	CDR208-6 100Hz	1	24.06.04
6x CDR 208 + 6 x CDR 210	CDR208-6 130Hz	1	24.06.04
8x CDR 208 w/o Subwoofer	CDR208-8 fullr	1	24.06.04
8x CDR 208 + 8 x CDR 210 F	CDR208-8 100Hz	1	24.06.04
8x CDR 208 + 8 x CDR 210	CDR208-8 130Hz	1	24.06.04
12x CDR 208 w/o Subwoofer	CDR208-12 fullr	1	24.06.04
12x CDR 208 + 12 x CDR 210 F	CDR208-12 100Hz	1	24.06.04
12x CDR 208 + 12 x CDR 210	CDR208-12 130Hz	1	24.06.04
16x CDR 208 w/o Subwoofer	CDR208-16 fullr	1	24.06.04
16x CDR 208 + 16 x CDR 210 F	CDR208-16 100Hz	1	24.06.04
16x CDR 208 + 16 x CDR 210	CDR208-16 130Hz	1	24.06.04
24x CDR 208 w/o Subwoofer	CDR208-24 fullr	1	24.06.04
24x CDR 208 + 24 x CDR 210 F	CDR208-24 100Hz	1	24.06.04
24x CDR 208 + 24 x CDR 210	CDR208-24 130Hz	1	24.06.04

Tabelle 2: Overview of COHEDRA®-DFC filter sets as of June 2004

3 CDR 208 S, T

MEASUREMENT CHARTS

See figure 2 and 3!

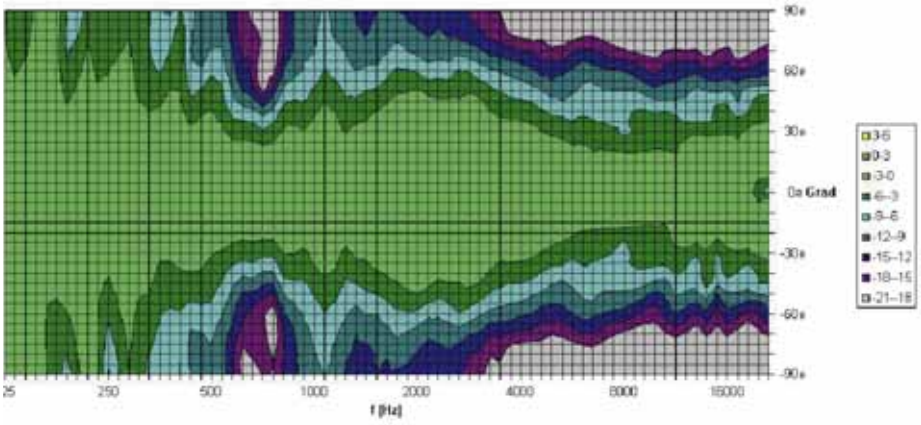


Abbildung 2: CDR 208 S, T horizontal directivity

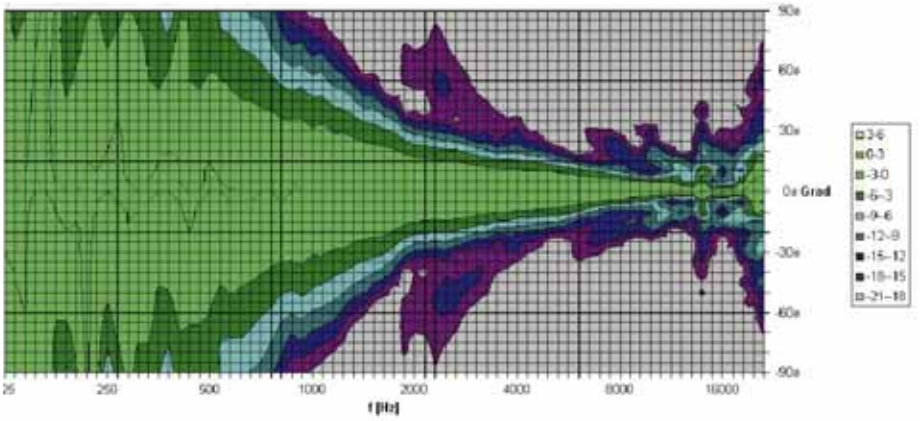


Abbildung 3: CDR 208 S, T vertical directivity, 1 unit