

Digital Studio Monitor

O 500 C

Installation and Operation Manual

058-E0012
Version 021025



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Fig. 1: Front view



Fig. 2: Rear view



Fig. 3: IR Remote control RC-55

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0 Safety Instructions

It is absolutely essential that you read these safety instructions carefully before connecting and using this K+H product. Your safety depends on it. Furthermore, failure to follow these instructions voids the warranty. To ensure safe operation for years to come, keep these instructions in a safe place for future reference. K+H has manufactured this product in accordance with IEC 1992 (SEC) 39 standards, then tested and delivered it in safe operating condition. To maintain it in this condition, you must:

- observe all safety instructions,
- use the product only as described herein,
- have any maintenance, repairs, or modifications performed only by K+H or other authorized personnel, and
- ensure that the room in which you use this product is wired in accordance with the local electrical code.

Warning!

- When the interior of the cabinet is exposed, touching some parts can lead to an electric shock.
- If you need to gain access to the interior electronics of the unit, always disconnect the unit from any and all power sources first.
- Any repairs, maintenance, or other service of the unit when its interior compartment is exposed may only be performed safely (in accordance with VBG 4) by authorized technicians familiar with all the risks involved. Even in an unplugged state, a fully charged capacitor in the unit can zap the unsuspecting.
- Loudspeaker output jacks labeled with the IEC 417/5036 emblem (Fig. 10, right) may be carrying dangerously high voltages. If your unit has this emblem, ensure that any connections to be made between these jacks and the speakers themselves are made before powering up the unit, and are done so only with manufacturer-approved interconnecting cables.
- If you need to replace any fuses, ensure that the replacements are of exactly the same type, value and voltage as the originals, as spelled out in the technical specifications at the rear of this manual.
- Do not use "repaired" fuses.
- If you do not have any fuses on hand of the specified size, type, and value, do not hot-wire the contacts in the holder by short-circuiting them.
- Certain areas of the cabinet, cover, and rear panel can achieve extreme temperatures and are therefore marked with a "HOT" label (Fig. 11). Refrain from touching any heat sink or ventilation grille.
- High volume levels are known to cause permanent - i.e. irreversible - hearing damage, especially when listened to without sufficient breaks. The higher the levels, the more frequent and extended must be the breaks. Avoid standing too close to loudspeakers that are being driven at high levels. If you must be exposed to high sound pressure levels over an extended period of time, use hearing protection.



Fig. 10



Fig. 11

Mains Connection:

- This unit is designed for continuous operation.
- Ensure that the operating voltage of the unit matches that of the local mains current (AC line voltage).
- Always check before connecting the power cable to the mains socket that the power switch on the unit itself is set to off ("O").
- Use the power cable or power supply that came with the unit to connect to the mains socket (wall outlet).
- Power supply: a damaged power cable may not be repaired. Use a new cable.
- Avoid plugging the mains cable into a power strip that already has several other power-consuming devices connected to it.
- Avoid using extension cables. The unit must be connected to a mains socket close to it, and that socket should be freely accessible.

Installation:

- This product may only be placed on a stable, clean, horizontal surface.
- Do not expose this product to vibration.
- Do not operate this product anywhere near water or other liquids. Do not use it near a sink, swimming pool, bathtub, or in any damp room or area. Electrical shocks carried through water can kill. Do not place any beverages whatsoever on or near this product, as liquids can kill electronic components.
- Ensure sufficient ventilation around the product to allow for adequate heat dissipation, especially near the rear panel and the sides of the cabinet (minimum of 8 inches from the nearest wall). The unit may only be installed in a rack if measures are taken to ensure sufficient ventilation and if the mounting instructions of the manufacturer are followed. Do not block or cover any heat sink, fan, or vent.
- Do not place the product where it will be in the path of direct sunlight, and keep it a safe distance away from radiators and other heaters of any kind.
- If you bring this product from a cold environment into a warm one (such as from a vehicle into a studio), it is quite possible that condensation will form inside the cabinet. Please allow the unit sufficient time for acclimatisation to room temperature (minimum thirty minutes) before connecting and powering up.
- To avoid accidents, do not use any accessory equipment with this product which is not approved by the manufacturer, particularly mounting accessories. Do not place this unit on any unstable platform, cart, stand or table. Should the unit fall, it can cause bodily injury to persons, or can be damaged itself.
- To protect this product from lightning damage during a thunderstorm or from power surges during an extended absence, disconnect the power cable from the wall outlet.

1.1 Advantages of Digitally Controlled Monitor Systems

- optimizing of frequency responses, e.g. an absolutely linear adjustment from 30 Hz – 20 kHz. Any other desired frequency curves can be set/adjusted/stored
- setting of phase response(s) in any combination, such as linear-phase, minimum-phase, mixed-phase with the resulting group-delays (constant group delay, continuously decreasing, etc.)
- attack and release times of speakers will be remarkably improved
- more precise stereo-locating, as there is virtually no deviation in a stereo pair
- programmed EQ settings can be recalled instantly for special needs and functions
- a nearly unlimited number of EQ-settings can be stored and switched easily, e.g. for different listening locations in the same room, second control-room, different operating modes (mixing / demonstration) etc.
- the delay-times of the speakers can be adjusted and stored for different listening distances
- the monitor can be delayed for optimized sync with analog/digital film/video, as a delay-line in high-quality multi-speaker setups, concerts, multi-media or surround setups
- the slope at the crossover frequencies can be adjusted up to 96 dB per octave, which can be said is close to ideal (but never possible with analog designs). In this case the overlapping frequencies reproduced from both drivers in the x-over area is only a few Hz wide, which has the following advantages:
 1. every driver can be used in it's perfect frequency-response range
 2. in the area of the crossover frequency we can avoid phase-cancellations to a large extent
 3. it is possible to select a perfect horn for every driver with it's own directivity (individual depth of the horns can be adjusted by the system).

⇒ The directivity can be designed to be almost perfect for the horizontal and vertical level!
- problems caused by resonances and reflections in control rooms can be minimized and compensated to a high degree by adjusting the response of the speaker-system in the room. This will be made in a separate EQ and measuring session in the control-room
- for protection of the drivers fast and efficient limiters are provided which take care of the short-term max-level and the peak-power capacity of the driver, so in case of a possible overload the limiters will reduce the levels (feed forward limiter) without producing any distortions, as it is the case in analog limiters.
- Digital and analog audio input connectors
- Infrared remote-control for all parameters (can be selected individually without any PC)

1.2 System Concept

- Active 3-way studio monitor with integrated digital controller and high performance amplifiers with power amplifiers of 400 W RMS for the woofer, 230 W RMS for midrange driver and 290 W RMS for the tweeter

Concept of Speakers and Cabinet:

- 12" woofer with alloy-chassis, forced air cooling voicecoil, high efficiency and long, linear excursion
- 3" voicecoil midrange dome in sealed enclosure, with strong magnet and lowest distortion
- 1" titanium dome tweeter with high efficiency and ultra-low distortion
- Cabinet made of strong, resonance free HDF material. It is fitted with a moulded front-baffle with integrated horns and ducted ports for compression-free low frequency response, and optimized horns for midrange/tweeter, offering perfect dispersion for all three speakers by minimizing interferences and reflections
- Cabinet comes with multiple fittings for an individual choice of mounting adaptors

Digital Controller:

- The integrated digital controller includes the electronic crossover, the EQ for every driver-system, a delay of several milliseconds per chassis, all limiter functions, a master delay, flexible adjustments for local EQ and a fully parametric 10-band EQ
- Independent adjustments for amplitude and phase are provided for every chassis and for the complete system by the use of digital FIR filter technology (FIR = Finite Impulse Response)
- Unlike other internal or external digital controllers, the controller of the O 500 C is programmed with individual filter settings for every driver system which were measured in an anechoic chamber and set at the factory. All tolerances of the individual drivers, the power amps and the controller itself are recorded and will be taken into the calculation for the setup / equalizing of every specific O 500 C monitor system
- Adjustment for positioning in the control room or studio can be made by the fully parametric EQ with IIR filters directly in the monitor
- Individual FIR filter settings can be made by aligning the O 500 C in it's final position in the studio (optional). This way the room specific modes, such as resonances, standing waves etc. can be compensated
- A precise limiter section will allow for perfect system management by offering a "look ahead signal analysis" of the clipping mode of all power amps, the max. excursion of the drivers and the long term temperature management and it's peak allowances
- The important stages in the signal path of the digital controller are calculated accurately with 48 Bit performance
- Stacked A/D converters (gain ranging) in Delta/Sigma technology offer a wide dynamic range on the input side, by resulting in ultra-low distortion figures at the same time
- High performance quality D/A converters in Delta/Sigma technology in all input/output stages
- High quality concept for the PSU and fully capsuled controller electronics
- Variety of analog and digital audio connections
- Ergonomic and easy operation via infrared remote-control (no PC needed)

- Several levels of protection to avoid accidental mis-settings (user security levels)
- Remote control and link functions of the monitors via RS 232 or MIDI
- An output for an additional subwoofer is provided. FIR filtering for this output is provided inside the O 500 C.

Power amplifier:

- The O 500 C is fitted with high-performance, state-of-the-art power amps, which can deliver clean 400 W RMS for the woofer, 230 W RMS for the midrange dome and 290 W RMS for the tweeter.
- Stacked power-supply for better amplifier efficiency
- Very low non linear distortions: woofer < -110 dB, midrange < -100 dB, tweeter < -90 dB

1.3 Block Diagram

In Fig. 1.3/1 all modules which are included in the digital active studio monitor O 500 C can be seen. All modules shown are integrated in the monitor cabinet:

- Digital controller
- Three power amplifiers
- PCB with display, IR-receiver and illuminated logo
- PSU with torrodial transformer, PCB and regulators
- 3 drivers

All audio parameters, except for the power amplifiers, are controlled by the internal DSP. An analog signal, connected to the O 500 C, will be A/D converted and then fed to the DSP, where all parameters selected are processed in the digital domain. When the signal has passed all stages in the DSP, it will be D/A converted and then sent to the analog power amplifiers. The analog output signal to the external, optional subwoofer can be taken from the transformer-balanced XLR output on the rear of the monitor. The power amplifiers of the O 500 C have been designed in a bipolar topology and are built onto one PCB. Heavy-duty alloy heatsinks with a large surface allow for high power performance under „cool“ conditions.

The digital controller consists of a DSP-PCB, which carries the A/D and D/A converters with the analog input and output stages, plus the powerful DSP. A further PCB carries the microcomputer which contains the controller software plus the „core of the system“ the 8 Bit microcontroller. Both PCB's are shielded in a MU-metal case to avoid hum and side noises.

The VF display of the digital controller, the limit signalling and the IR receiver are mounted at the top of the front baffle.

The power supply system has separate voltages for the analog and digital signals, as well as for the power amplifiers. On the DSP and the microcomputer PCB an additional stabilisation is provided, again separated for the A/D and the D/A signal paths.

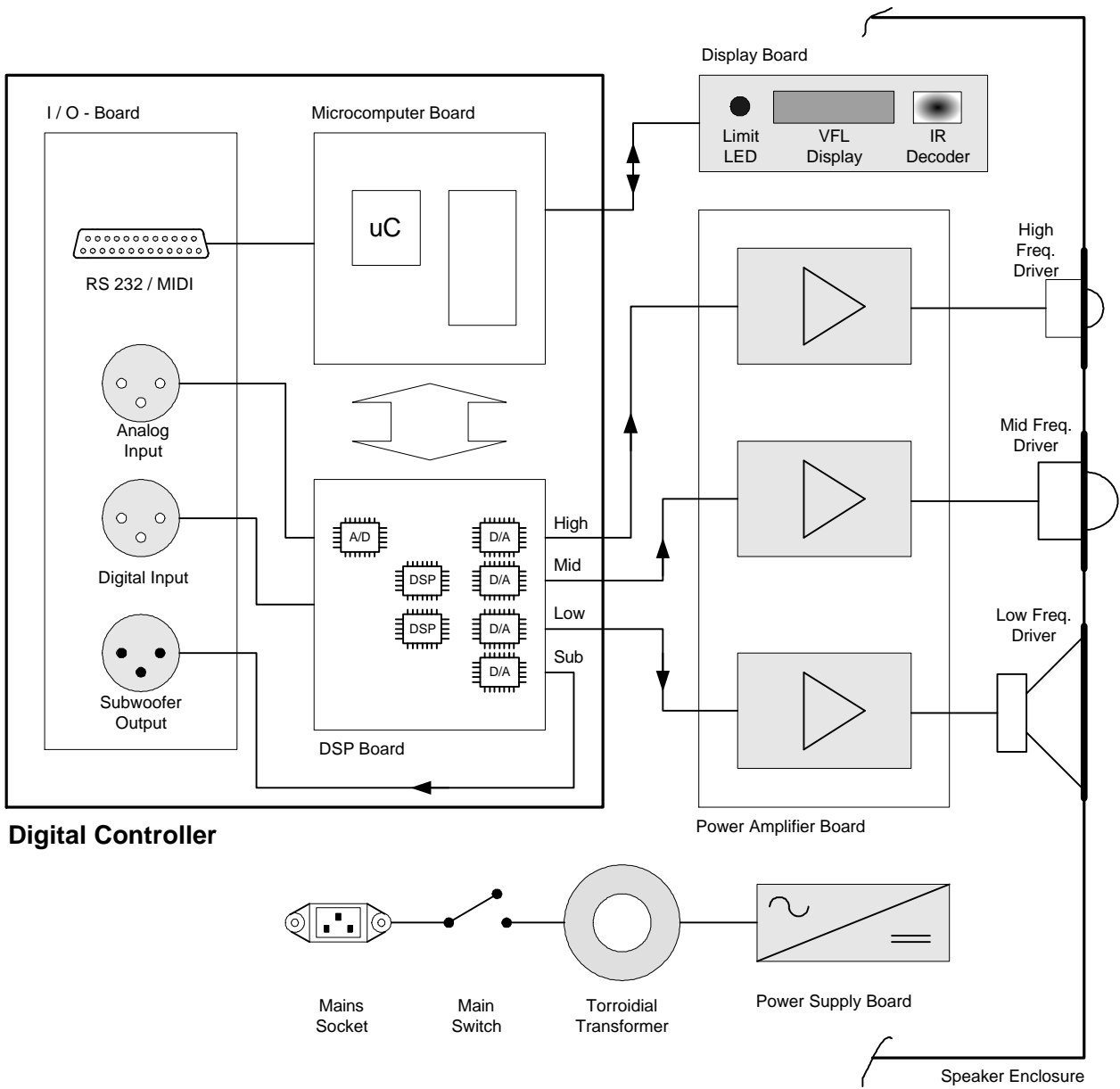


Fig. 1.3/1: Block diagram of the O 500 C studio monitor

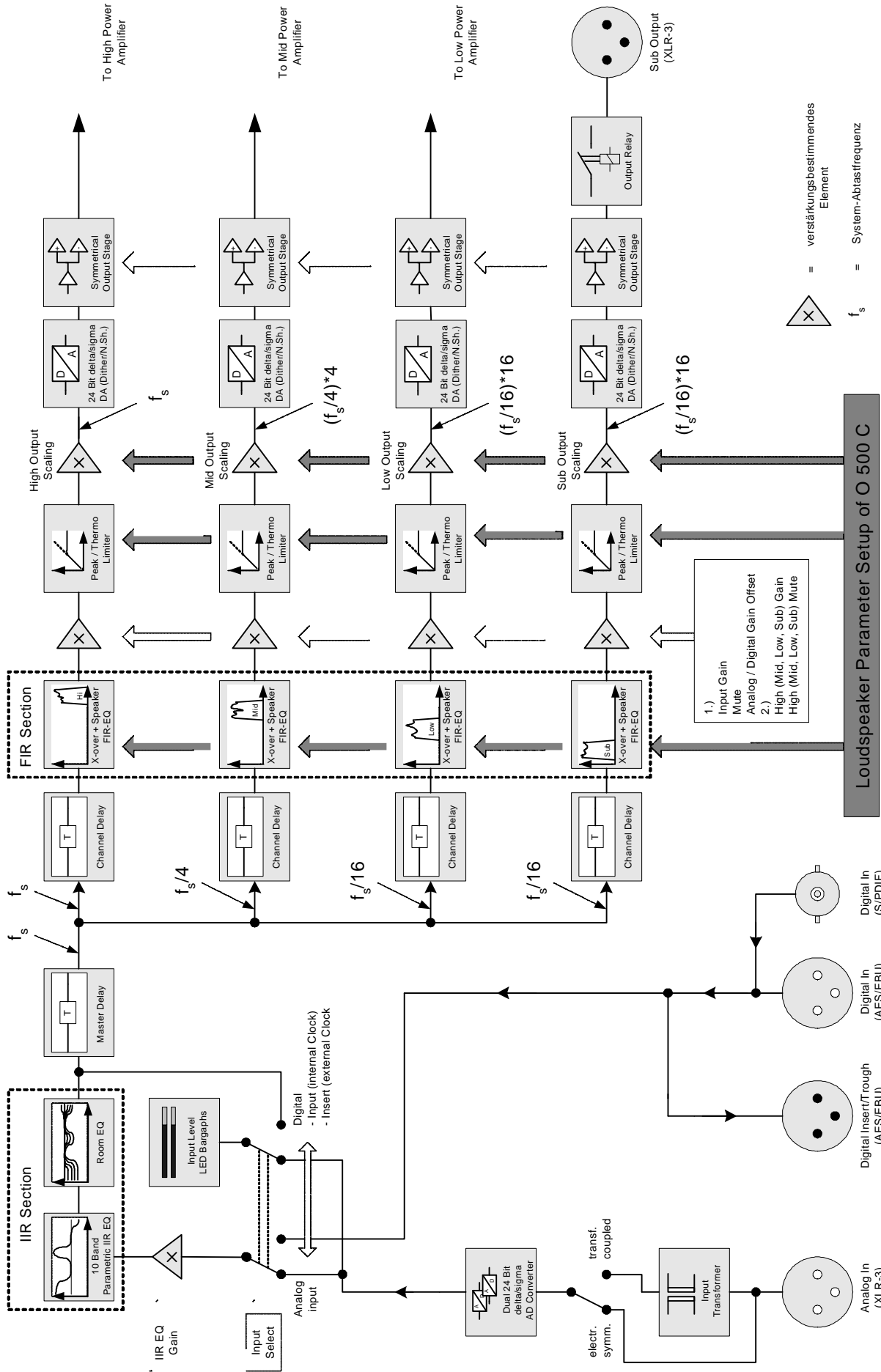
1.4 The Modules of the Digital Controller

This is a brief description of the „modules“ provided inside the O 500 C. Please understand that these modules are not meant to be physically independent, many of them are part of the integrated DSP. To keep the description simple and understandable, it is restricted to the modules which are important for understanding the internal functions in the signal path.

- **Analog Input:** The input for the analog signals is balanced on studio-level (+ 6 dB) and can be selected between electronically balanced or transformer balanced by a switch next to the XLR.
- **AD Converter:** in this stage of A/D conversion the „gain rangeing“ method was chosen to obtain the max. possible dynamic in the input stage by using two A/D converters. The first A/D converter is fed directly from the audio input signal and is set to produce a fixed level of gain, which is then processed into the second converter. This way a much higher dynamic headroom and gain than in any other A/D design is obtained.
- **Digital Input:** The O 500 C has digital inputs following the AES/EBU format, connected to a transformer-balanced XLR socket, and a S-PDIF format connecting to a BNC socket.
- **Input Select:** The selection of the input-type is made via the remote control in the main menu, step INPUT SELECT, here shown as a selector switch.
- **Digital Output:** The digital output of the O 500 C is in the AES/EBU format connected to an XLR socket. Factory preset is parallel „input to output“, i.e. a direct link to the output, so the signal can be fed to the next O 500 C in a stereo setup. In the menu DIGITAL INPUT SELECT you now may choose the L or R channel from the digital data stream.
- **EQ Gain:** at this stage the digital signal can be reduced or raised by an adjustment of the word length to match the peaks or dips in the following parametric EQ. The level selected at this point also remains valid, if the PEQ is in EQ OFF. This way it is possible to make A/B comparisons without level mismatch.
- **10-Band parametric IIR EQ:** the parametric EQ (PEQ) of the O 500 C is designed as an IIR digital filter and contains 10 fully parametric bands with selectable characteristics. By using these filters it is possible to obtain a system-EQ separately for the LEFT and RIGHT channel. The full adjustment procedure of the EQ's is explained in chapter 5.2
- **Room IIR EQ:** this room EQ is designed to be an IIR filter, just like the PEQ filters. It is designed for simple compensation of typical room influences and nonlinearities. The adjustment is made in the EQ setting of the EQ menu, as described in chapter 5.1.
- **Master Delay:** The master delay is the final stage in the signal path, before the signal is divided by the 4-way electronic crossover. Adjustment is made in the menu „MASTER DELAY“, the delaytime selected is effecting all four signals. It can be adjusted in meters or seconds.

In the crossover section there are four identical modules from which the user may select the wanted parameters. As these paths are almost identical, (the MID, LOW and SUB have additional downsampling filters to compensate for calculation-speed) the HIGH signal to describe the functions is chosen here.

- **High (Mid, Low, Sub) Delay:** every signal in the 4-way crossover can be delayed individually. This can be done in the MAIN menu *Channel Delay*.
- **High (Mid, Low, Sub) X-Over + Speaker EQ:** Here the bandpass filters were chosen to be FIR digital filters for every driver. Please note that this feature does not only offer an EQ for the



frequency response, but also for a very complex adjustment of the system, including the phase adjustments! Furthermore the reaction of the drivers and the electric performance of the amplifier and the digital controller itself are monitored by the controller.

- **Gain:** This function adjusts the individual gain in every signal path of the crossover. The values of possible parameters are influenced by a multitude of menu settings, which can be selected individually.
 - All adjustments (values set) in the menus INPUT GAIN, MUTE and ANALOG/DIGITAL Gain Offset will become effective in every signal path of the crossover.
 - In the menus HIGH/MID/LOW/SUB GAIN and HIGH/MID/LOW/SUB MUTE it is possible to select the individual signal path in the crossover, where the parameter adjustments or changing the gain should become active.
- **Peak / RMS / Thermo limiter:** The following limiter section contains a PEAK/RMS limiter and a thermo limiter. They have been designed to avoid the clipping of the power amps, a too high peak power to the drivers and a limitation of the max. excursion of the voice coils and cones. The thermo limiter has been added to avoid a thermal overload of the voice coils. All these parameters are set at the factory and cannot be adjusted by the user. Only the release time of the peak limiter can be varied by him.
- **High (Mid, Low, Sub) Output Scaling:** This part of the controller takes a strong influence on the signal level, finally driving the D/A converter. This function is recalled and reset with every LOAD memory.
- **Balanced Output Stage:** The analog output driver of the digital controller of a fully balanced design. In combination with the balanced input stages a very low influence of noises to the audiosignal is achieved.
- **Analog Subwoofer Output Stage:** This analog output from the digital controller is on a balanced XLR socket for direct connection of an optional active subwoofer.

on the tilting adaptor LH36, which is fixed to the bottom of the cabinet. When adding the TV-adaptor LH29 or the tripod stand adaptor LH28, the monitor can be mounted on a speaker stand. Alternatively it is possible to use the U-shaped mounting bracket LH 35, which has its threaded holes on the side of the cabinet. Here, too, it is possible to add the LH 29 and LH 28 for mounting the monitor on a speaker stand. With the LH 35 mounting bracket it is also possible to have the O 500 C mounted from the ceiling (may need additional adaptors, depending on the construction).

Horizontal operation

In some cases a vertical operation of the monitors may not be possible, due to lack of space or for architectural reasons. For this case K+H offers a special version for horizontal operation (please specify for horn LEFT / horn RIGHT) where the horn is rotated by 90 degrees, and special heatsinks are provided to

follow this type of operation. This way the heat dissipation from the power amps is maintained optimized. Monitors in this version have to be ordered specially at the factory, a local conversion is not possible.

Flush mount into a wall

The O 500 C can also be flush mounted into a wall or other areas where limited or no airflow can be provided. For these cases K+H offers a special wall-mount adaptor kit, which will accomodate the O 500 C electronics and an extension cable for the speaker connectors. Now the electronics can be mounted in an area with better air circulation. The O 500 C can be ordered with this option at the factory, but it is also possible to make a local change after installation with the wall mount kit.

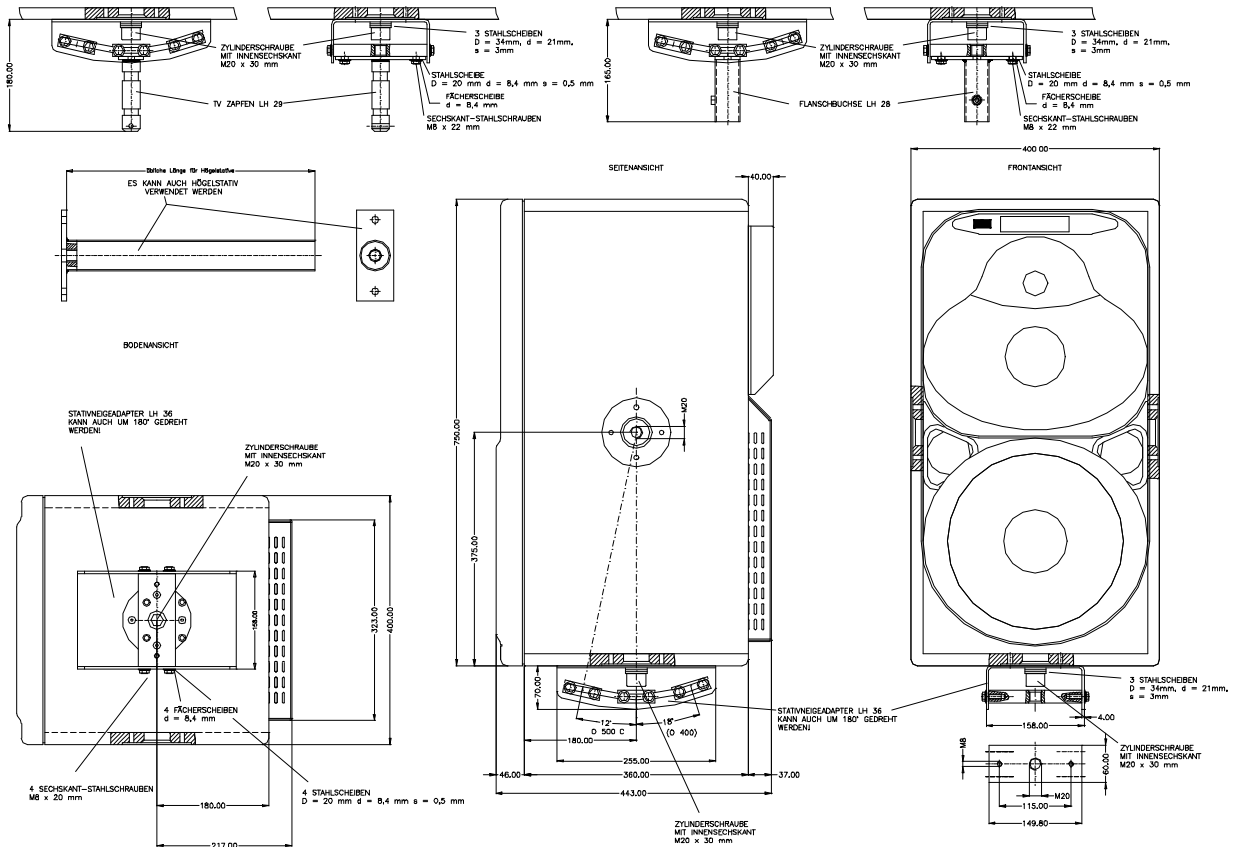


Fig. 2. 1/2: Mounting of the tilting adaptor LH36

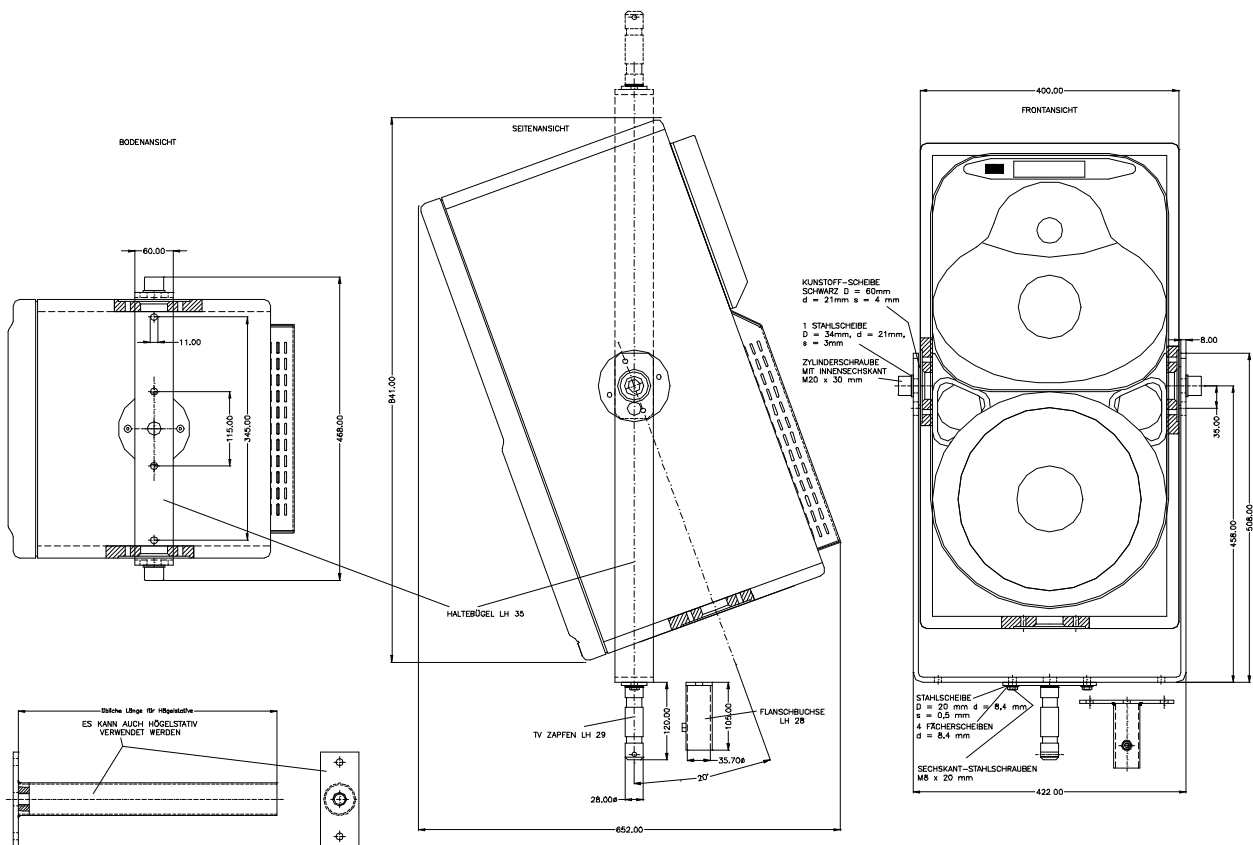


Fig. 2.1/3: Fixing holes for mounting LH 35 bracket

2.2 Connectors and Wiring

2.2.1 The connectors on the rear panel

All connectors of the O 500 C are located on the rear panel, placed in two areas. When installing the monitor under narrow or tight conditions, care must be taken for the cables and their minimal bending radius.

Mains connector, Mains switch, Groundlift

Fig. 2.2/1 shows the connectors which are located on the lower part of the monitor.

The connection between the O 500 C and the mains is made by a standard socket, which also includes the mains fuse.

Above the power socket is the mains switch with a built-in controllamp.

The groundlift switch is provided to separate the

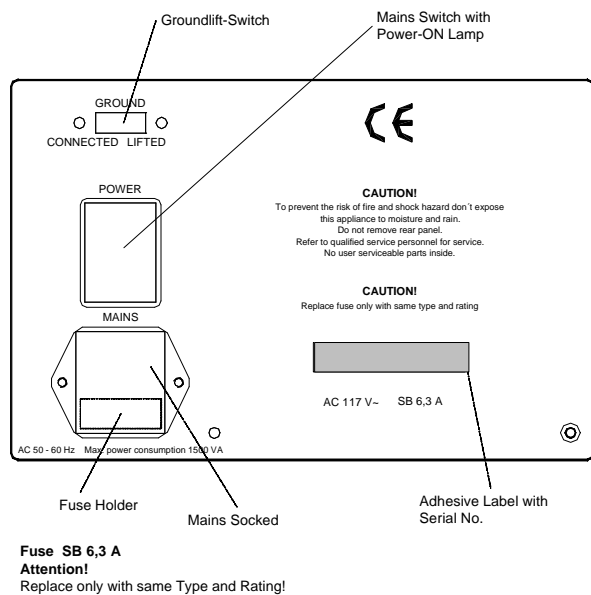


Fig. 2.2/1: The connectors at the lower part of the rearpanel

internal ground from the mains earth, just in case there should be any hum problems occurring due to different potentials between the connected units.

Signal connections

The signal connections are located in the centre of the rear panel, directly under the large heatsink, please see Fig. 2.2/2 and read the following description:

Analog Input:

Analog signal sources will be connected to this XLR socket. Via the selection switch „**Input Section**“ the input stage of the O 500 C can be selected for the electronically balanced format, or a transformer balanced input stage. Although the transformer is of very high quality, the position „electronically balanced“ should be preferred for best signal quality. Only in case of hum problems or special installations, where transformer isolation is a must, the transformer balanced position should be chosen.

Serial Port:

This connector (SUB-D 25 Pin) has several functions: It contains the serial RS-232 ports, which are

needed to connect an external PC for downloading the presets into the O 500 C. In combination with this, a complete MIDI interface (In, Out, Through) is provided in this connector, so that several O 500 C monitors can be interconnected to each other. Chapter 4 shows the complete wiring scheme of this connector and gives a description of the connecting cables needed.

Reset:

The RESET key is used to restart the internal digital controller without switching OFF the system as it is the case with mains ON / OFF.

Digital S/P-DIF Input:

This BNC socket is connected to incoming S-PDIF audio signals. The selection of the signal source is described in chapter 3.2. When using this BNC input for digital audio signals, make sure that no connection is made to the AES/EBU input!

Digital AES/EBU Input:

Incoming digital signals in the AES/EBU format are connected to this XLR socket. When this input is used for digital audio signals, please make sure that no connection is made to the BNC socket!

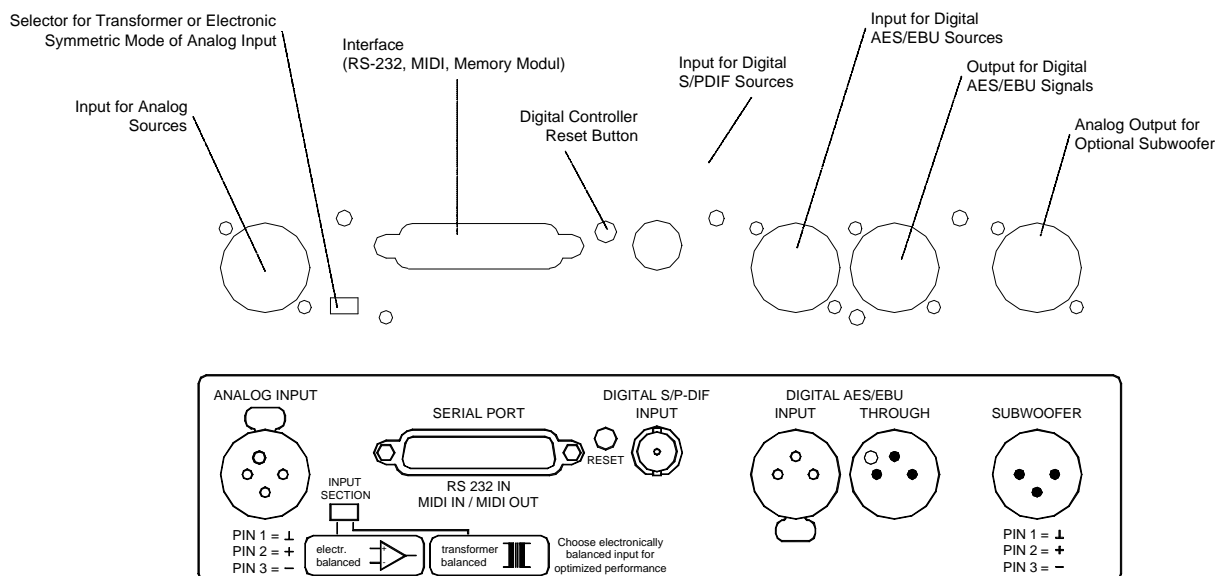


Fig. 2.2/2: The signal connectors in the middle of the rear panel of O 500 C

Digital AES/EBU through:

This XLR socket will carry a parallel digital output signal, which is fed either to the BNC or XLR digital input. There will be a format conversion inside the O 500 C, so any S-PDIF signal in the BNC input will be an AES/EBU signal on that XLR output. This signal may now be fed to a second O 500 C and the user may select for the L or R channel from the digital data stream.

Subwoofer:

This XLR output will carry the analog output signal from the digital controller, which is provided for an external, optional subwoofer. This output will only be active, if a special 4-way setup has been loaded for the O 500 C.

most of these units do not have a mains earth connection (Euro mainsplug) the receivers, tuners or TV-systems often are connected to antennas, which are normally grounded. In this case the groundlift should be switched to ON and the O 500 C input should be selected for „transformer balanced input“. If the hum problem still remains, PIN 3 on the XLR plug should be disconnected (cut), and the shielding wire on the cinch plug should not be connected.

Connecting the O 500 C to a consumer / HiFi unit with a digital S-PDIF output, a connection cable as seen in Fig. 2.2/5 is needed, in case there is no BNC output on that unit.

2.2.2 Variety of Connections

Cables

The figures 2.2/3 to 2.2/5 show the pinning of the cables which are used in the variety of connections, described in the following passages:

Fig. 2.2/3 shows all balanced connections, such as to a studio console with balanced outputs, also for the digital AES/EBU connections. When using AES/EBU-connections, please make sure that your cable has a characteristic impedance of 110 Ohms. Do not use ordinary XLR cables as normally used for microphones or Line-levels!

To connect the O 500 C to analog sources from consumer / HiFi units, an adaptor cable as per Fig. 2.2/4 should be used. Although

Examples for connections

In Fig.s 2.2/6 to 2.2/9 are some examples how to connect the O 500 C to various signal sources.

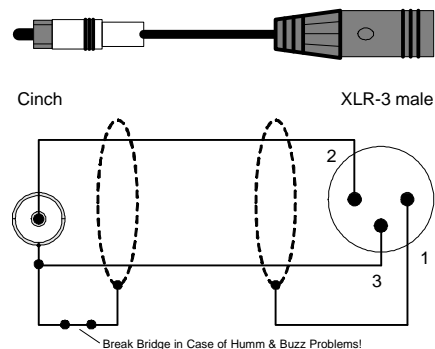


Fig. 2.2/4: Adapter from cinch to XLR

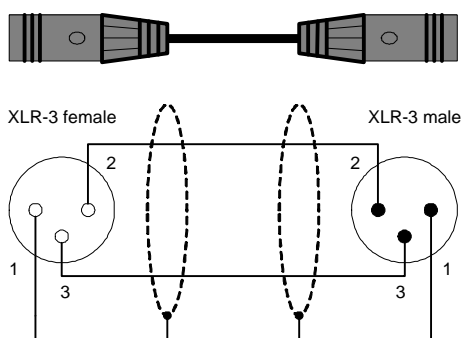


Fig. 2.2/3: XLR standard cable

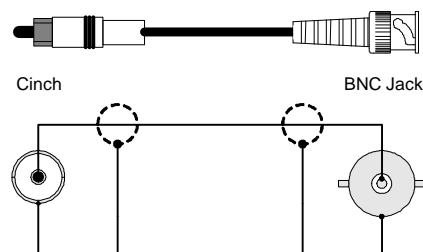


Fig. 2.2/5: Adapter from cinch to BNC

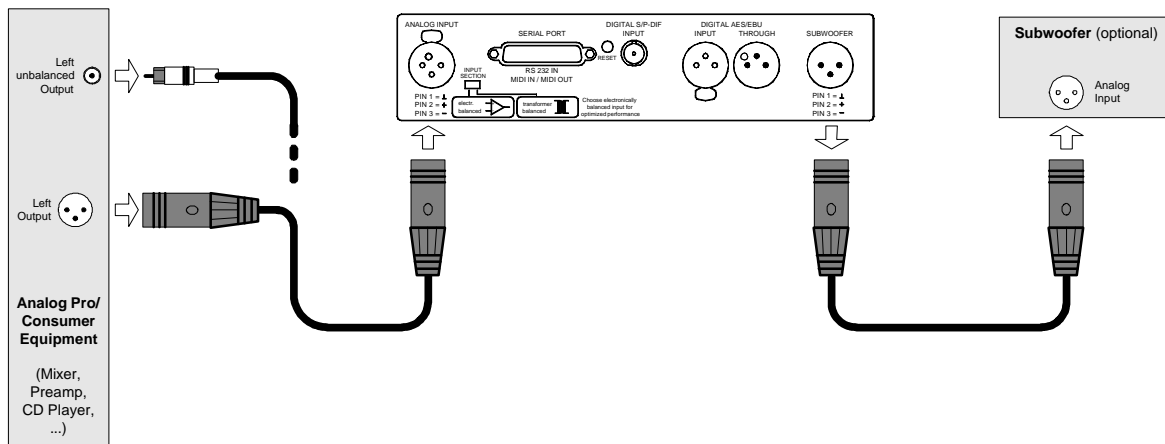


Fig. 2.2/6: Operation of the O 500 C and an optional subwoofer from an analog signal source. For a balanced connection in a studio-system please use a standard XLR-cable. If the O 500 C is connected to an unbalanced signal source, please make sure to use a proper adaptor cable as per Fig. 2.2/4, or have it wired up that way.

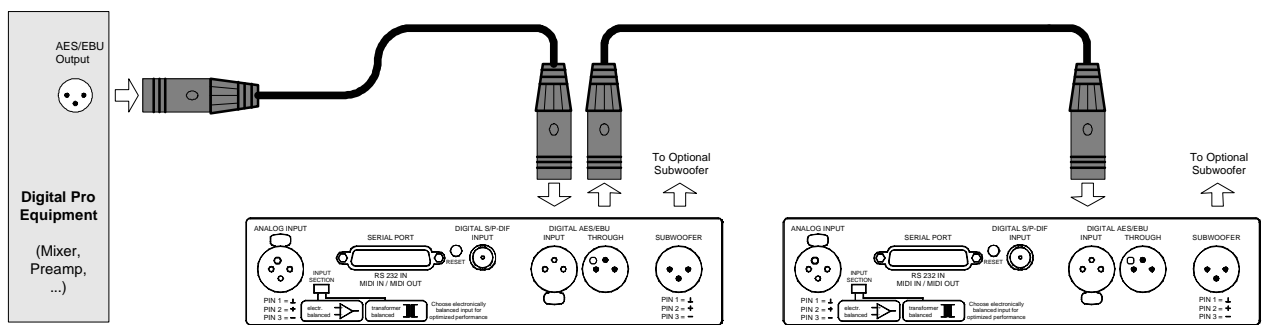


Fig. 2.2/7: The O 500 C connected to a signal source with a digital AES/EBU output. The L or R channel can be selected separately for every monitor from the digital data stream. Please refer to „Digital Input Select“ in chapter 3.2

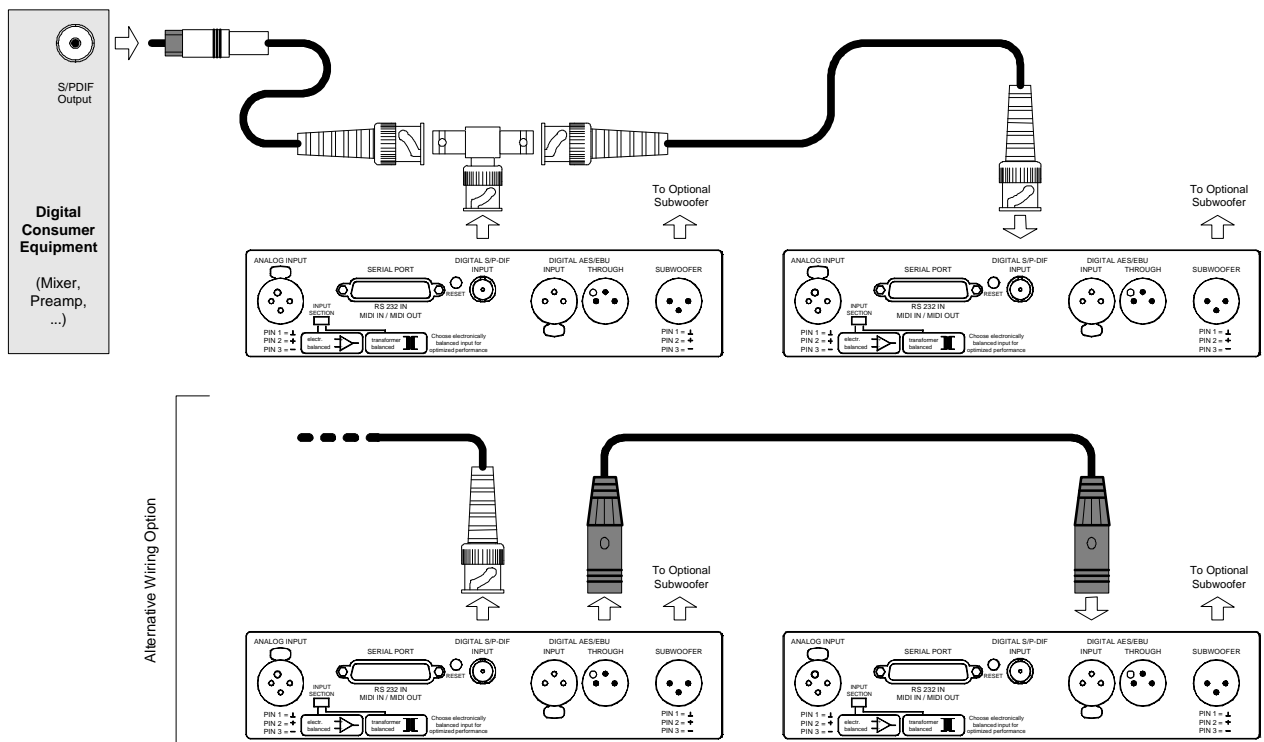


Fig. 2.2/8: Connection of the O 500 C to a source with digital S/PDIF output. To connect a second O 500 C in the signal chain, either a T-adaptor for the BNC input can be used, or the signal to the second monitor can be taken from the digital output XLR socket. Please note, that this output is AES/EBU! The selection for either L or R signal from the digital data stream ist the same as before.

2.3 VF-Display on the Front Baffle

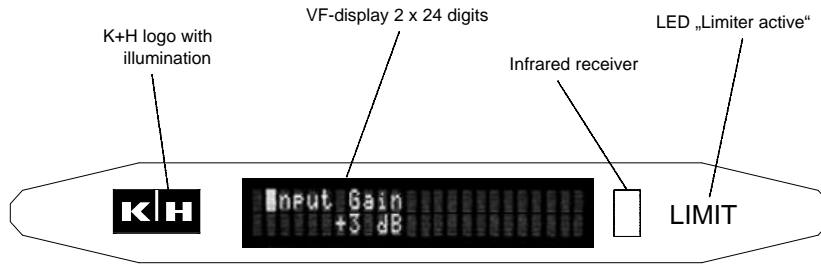


Fig. 2.3/1: The indicators of the O 500 C

The display on the front baffle is covered with a tinted plexiglass panel. This panel is right above the HF driver. Fig. 2.3/1. shows the functions from left to right:

- Illuminated K + H Logo as a standby indicator: it will only light up, when the digital controller has booted correctly. This light may be shut off, see chapter 3.3
- Vacuumflourescent display (blue) with 2x24 digits, can be adjusted in brightness (see chapter 3.3)
- Infrared receiver for the IR remote control, which is part of the system
- Indicator „LIMIT“, which will light up when one or more limiters of the system become active

2.4 Recall of the Loudspeaker Parameter Setup

The O 500 C is supplied with factory presets of all loudspeaker-relevant parameters like speaker equalization, limiter settings,... which are stored in a Flash-ROM of the digital controller. Additional parameter presets can be ordered at extra charge, or can be determined on the installation-site of the monitors and copied into the Flash-ROM (Room eqalization).

During the first installation of the monitor it has to be checked, whether the right preset has been activated. If not, the correct Loudspeaker Parameter Setup has to be looked up and recalled into the system.

The O 500 C is operated by the IR-remote controller RC 55.

The procedure is as follows:

- Switch ON the monitor with the power switch on the rear panel
 - Wait until the digital controller has booted and the K + H Logo is illuminated
 - The menu „Input Gain“ appears in the display, showing a default dB-value
 - By pressing the numeric key „8“ on the RC 55 the menu step 8 *Speaker Select* will become active, the display will now show „Monitor/Subwoofer“.
- Note:** If this menu step doesn't appear, the user security level has to be changed, see chapter 3.3, step 3.
- The blinking cursor now can be moved into the LEFT area of the display (by pressing the LEFT cursor button of the RC 55) into the position of „M“ for *Monitor*.
 - By pressing the +/- buttons on the RC 55 the correct „Monitor“ name is selected and stored by pressing ENTER Key
 - The flashing dot in the centre of the display asks for confirming this choice. Once done, it will permanently be illuminated.
 - By pressing the RIGHT arrow key the cursor is changing into the RIGHT half of the display to the position of „S“ for *subwoofer*, adjustments are made in the same sequence as above
 - By pressing the numeric key „3“ on the remote control the system changes to the „Input Gain“ menu.
 - By pressing the +/- keys the desired signal level can be adjusted
 - The O 500 C now is ready to work, and even after switching OFF/ON all parameters that were set prior to switch-OFF are active again.

3.1 Menu Structure and Concept of Operation

The operation of the O 500 C digital controller is based on a special menu structure, where the individual menu steps have been concentrated into three main menus:

- **Main Menu (Chapter 3.2):** This menu includes the most needed control functions for the normal operation of the monitor, such as the level setting for the input signals, setting and recall of setups, adjustment of internal delay and finally the choice of the desired Loudspeaker parameter setups which are stored in the Flash-ROM.
- **System Menu (Chapter 3.3):** This menu contains the basic settings of software and hardware, which are used occasionally, such as configuration of the MIDI channel, passwords for the user levels etc.
- **EQ Menu (Chapter 3.4):** This menu is completely reserved for the setups and adjustments of the integrated Room- and parametric EQs, where changes in the overall frequency response can be made, such as the line-up procedure for adjustments in the control room.

Recall and adjustments of the individual menus will be made via the IR-remote control unit RC 55, see chapter 4.1.

- **Menu selection keys:** Sys - Main - EQ for selection of the menu
- four **ARROW keys:** UP - DOWN - LEFT - RIGHT for navigation through the individual points within a menu
- the two +/- increment keys located under the L/R arrow keys will be used for adjusting the parameters of the selected functions
- The **ENTER key** in the centre of the arrow-keys

The other keys of the IR remote control will be explained in chapter 4.1 .

When selecting any of the menu sections the system will show the headline of the relevant menu. When pressing the MAIN key for example

the „K + H O 500 C Main Menu“ headline will appear in the VF-display of the O 500 C.

From this headline all visible (activated for the user) menu points can be recalled by pressing the DOWN arrow-key. to get back to the headline, simply press the UP arrow key.

When a menu point has been activated, the name of the menu will appear in the left part of



Fig. 3.1/1: Menu step 4 (Input Gain) of the main menu

the upper line of the VF-display:
When pressing the +/- increment keys, the parameters marked by the blinking cursor can be modified. Here it is either possible to modify the value of a numerical parameter, or to step through a list of options. Illus. 3.1/1 shows the position of the blinking cursor ready to modify the „Input Gain“ which can be changed by pressing the +/- incrementkeys.

In some menus the actual changes do not become valid immediately. To avoid accidental modifications the system will wait for an ENTER command by pressing the ENTER key after that modification. Now the setting is stored by the system and becomes active.

An illuminated dot in the upper centre of the VF-display is signalling the following conditions:
A flashing dot signals waiting for confirming a setting. When this is done by pressing the ENTER key, the dot will be ON permanently.

Note:
After a parameter has been changed without being confirmed by pressing ENTER the changes will not become active and the original setting will remain.

In some of the menus it is possible to modify several parameters. In these cases all parameters are shown on the VF-display next to each other and can be selected by moving

the blinking cursor with the LEFT and RIGHT arrow key.

There are some menus which offer a larger number of parameters which would not fit onto the VF-display. In these cases the menu is spread onto several subpages.

The menu points with a subpage are marked with an arrow in the upper right corner of the display, if there are more than one pages there will be a double arrow shown.

To get to the next subpage the cursor can be moved by the LEFT or RIGHT cursor key, which then will be displayed.

Examples for the splitting of one menu point into several subpages can be seen in points 10...13 of the main menu.

This general description of the operation is valid for all menus.

Remarks:

The listing in the following chapters contains all menu points of the O 500 C software. The selected user security level affects the relevant menus, which can be displayed and modified (see system menu chapter 3.3, step 3). These are marked with an "X" in the following overviews.

be seen that this level setting is done at the same location as the *Input Gain*.

5 Mute

When MUTE is activated, the level will be reduced by the value preselected in the *Mute Attenuation* menu.

6 Input Select

In this menu the analog or digital input is activated. When selecting digital, the 500 C will be triggered by the signal source, the internal clock generator is deactivated.

7 Digital Input Select

In this menu the L or R channel may be selected from the digital datastream. In a normal stereo-setup the LEFT monitor will have the selection LEFT and the RIGHT monitor will be selected for RIGHT.

In the setting „LEFT + RIGHT“ the system will generate and reproduce a mono sum of both channels.

8 Speaker Select

In this menu the loudspeaker parameter setup will be recalled. At „*Monitor*“ and „*Subwoofer*“ the desired presets can be selected by pressing the +/- increment keys, followed by ENTER to load the settings. A signal beep will confirm this selection, which also can be made during reproduction of a signal. If the selected loudspeaker parameter setup can not be recalled, the system will respond with the notice: „not available“ after pressing the ENTER key. The parameters previously set will remain active in this case.

9 Master Delay

In this menu the signal fed through the O 500 C can be delayed either in milliseconds or meters. The shortest delaytime is determined by the basic delay time of the digital controller which depends on the selected loudspeaker parameter setup. Based on that basic time the delaytime may be varied by max. 999 mS, which is equal to 339,90 meters.

10 Delay Offset

This menu adjusts the overall delay of the monitor in very small steps. It will adjust the basic delaytime of the monitor in a multichannel setup.

11 Channel Mute

In this menu step each signal path (High, Mid, Low and the optional subwoofer) can be muted. Changing the status (Mute on/off) is made by the +/- increment keys of the remote control.

12 Channel Gain

This menu adjusts the gain of every path by max. +6/-18 dB. Regarding the selection of the channel, the same options are provided as described above.

13 Channel Phase Invert

In this menu the phase of every signal path can be inverted by 180°. Here the same options for adjustments are provided as in the previous menus.

14 Channel Delay

This menu adjusts an individual delay time for every signal path after the electronic crossover, for example the compensation for different delay times between the O 500 C and an optional subwoofer.

15 Delay Link

In this menu the individual signal paths for the adjustments as described in the *Channel Delay* menu can be combined for ease of operation, i.e. adjusting all three signals at the same time.

16 Limiter

This menu allows for a change of the release-time constant of the internal peaklimiter which prevents the system from clipping of the power amps and from too long excursions of the cones. The desired value is selected by pressing the +/- increment keys.

17 PWR Amp -10 dB

When selecting the option „ON“ the gain of the O 500 C power amps is reduced by 10 dB. When operating the system at low listening levels this option should be selected to increase the word length of the digital signal given to the digital controller's DACs.

3.3 System Menu

(Eprom-Version-Nr. KH 1.038)

K+H O 500 C System Menu			
No. / Name of Menu Step	Options	Units	Default Settings
0			
1	Brightness	Display [%]	25,50,100 %
			100
		Channel	1...16
		out [out only / out-trough / loop]	1
			out only
2	Midi Settings	Baudrate [Midi / RS232]	31250 / 9600
			RS-232 (9600)
		ParaChg [on / off]	off
		TX-Chn	1...16, OCM
		Midi-Monitor [start]	1

3	Security Level / Password	Load Level Nr.	0...5
		Passwort	locked
4	Change Password	(Name)	---
			0000
5	IR Control	[on / off]	---
			on
6	AES Stat./ Sample Rate	S.Rate [kHz]	---

7	Version No. (Betriebssystem)	Reeboot	---
		Initialize	---
8	Service Section	Check LED Bargraph	---

9	Version No. (Eprom)	---	---
			App V KH 1.0XX
10	Logo	on / off	---
			on

User Security Levels					
0	1	2	3	4	5
		X	X	X	X
					X
X	X	X	X	X	X
					X
			X	X	X
				X	X
					X
X	X	X	X	X	X
		X	X	X	X

Description of the Menu Steps:

K+H O 500 C

- System Menu -

Menu headline

1 Brightness

Here the brightness of the VF display can be adjusted. The selection of the steps can be made by pressing the +/- increment keys. The new setting is activated by pressing ENTER.

2 MIDI Settings

In this menu the internal MIDI/RS-232 – interfaces are determined. The individual options are spread across several menu-subpages, which are selected by the LEFT / RIGHT - arrow keys. For more details see chapter 4.2.

3 Security Level / Password

In this menu step it is possible to select 6 different user security levels (0...5) for operating the O 500 C. By hiding menupoints it is possible to make adjustments and operation of the O 500 C accessible to different groups of users with different background / knowledge, to avoid misuse. Apart from this it is possible to make the everyday use much easier, because for this purpose all rarely needed adjustments are not accessible in normal operation, so it will be less confusing and the „toy effect“ is kept low.

The security levels can be recalled with the numbers 0 to 5 after the correct password has been entered. First, the cursor has to be

moved to the right side of the display. After pressing ENTER, the correct password positions can be reached by pressing the LEFT / RIGHT arrow keys, and the correct characters are selected by pressing the +/- increment keys. After pressing ENTER, the writing „unlocked“ appears, if the password was correct. After moving the cursor to the left display side at *Security Level Nr.* the number of the desired security level is entered by the +/- increment keys. By pressing the ENTER key the level is changed and locked again.

4 Change of Password

This menu changes the name of the password of the digital controller. First, the active password has to be entered as described above and to be confirmed by pressing ENTER. Now the display will show „unlocked“ and with the DOWN arrow key the CHANGE PASSWORD page will be opened. After pressing ENTER the display will show the actual password, which now can be changed / modified by pressing the LEFT / RIGHT arrow keys and the +/- increment keys. When ready, the new password should be noted and confirmed by pressing ENTER.

Important note: If the password can not be remembered it will not be possible to find it on site. In this case it is recommended to initialize the O 500 C by activating the menu

Version No. in the Sys-Menu or by holding down the ENTER key when switching ON the monitor. Now the password is set to the default value 0000. Attention: This reset also affects all the adjustments in the menus which have been made by the user, only the loudspeaker parameter setups which are stored in the Flash Rom will remain. (please see the menu „Default adjustments“).

5 IR Control

In this menu the IR remote control can be switched ON / OFF.

6 AES Stat. / Sample Rate

In this menu the clock frequency is shown, which the O 500 C is locked to. In normal mode, this will be 44,1 kHz for S-PDIF or 48 kHz for AES/EBU format. This is a straight status display, just for user information, and non-adjustable.

7 Version No. (Operating System)

In this menu the release number of the operating system of the digital controller will be displayed. In case of service this number may be needed for reference or updates.

When activating the option *Reboot* via the ENTER key, the digital controller will boot like it does if you power-up the O 500 C. All settings and presets in the individual menus remain active. When the option *Initialize* is selected, all individual settings in all menus will be erased and the system will only work with the default settings of the factory presets. When pressing the ENTER key an additional confirmation is necessary by pressing the Main key. Otherwise, it is possible to turn back by pressing the SYS key.

8 Service Section

This menu has no function in the O 500 C.

9 Version No. (Eeprom)

In this menu the number of the DSP software version will be displayed, which is stored in the internal E-PROM.

10 Logo

In this menu it is possible to switch OFF the illuminated K+H logo, which is located on the left of the VF display. This selection is stored in the main setup, too. (see Chapter 3.2, step 1)

3.4 EQ – Menu

(Eeprom-Version-No. KH 1.038)

K+H O 500 C				
EQ Menu				
No. / Name of Menu Step	Options	Units	Default Settings	User Security Levels
				0 1 2 3 4 5
1 EQ Set	Low Cut [Hz]	30...80 [10] Hz	30	
	Bass EQ [dB]	-10...0 [2] dB	0	
	Mid EQ [dB]	-5...0 (1) dB	0	X X
	High EQ [dB]	-4...1 (1) dB	0	
2 EQ	Gain [dB]	-24...0 dB	-3	
	EQ [on / off]		on	X X
3 EQ 1	Type [HS12, HS6, LS12, LS6, Peak, HP12, HP6, LP12, LP6]	---	Peak	
	Güte	0,1...6355	2	X
12 EQ 10	Frequenz [Hz]	---	(misc.)	
	Gain [dB]	-99...12 dB	0.0	
13 Load EQ Setup	No. / Name	---	000 Default Setup	
14 Save EQ Setup	Enter Setup Name / Enter Setup No.	---	Default Setup / 000	X X X

Description of the menu steps:

K+H O 500 C

- EQ Menu -

Menu headline

1 EQ Set (Room EQ section)

In this menu step the adjustments for a room equalisation can be done easily. The settings

are made by pressing the +/- increment keys on the remote control, the changes are done immediately without confirming with ENTER. By pressing the LEFT / RIGHT arrow keys the cursor can be moved between the four possible options of this menu (for further explanations see chapter 5.1).

2 Gain / EQ

The gain reduction to be made in this menu is calculated upon the max. gain increase made in any frequency band which has been adjusted in the menu *EQ Set* or *EQ1...EQ10*. By compensation of the signal gain at this stage it is possible to avoid any overload in the following signal stages. By selecting EQ OFF all adjusted EQ settings in the EQ 1 ...EQ 10 presets will be taken out of the signal flow. The adjustments made in *EQ Gain* are not bypassed, i.e. the preselected value remains active.

3 EQ1...12 EQ10 (PEQ section)

Each of these 10 menu steps provides a fully parameteric EQ band. The type of every band can be selected to be peak, shelving or low/highpass characteristics by moving the cursor to PEAK and then stepping through the options by pressing the LEFT / RIGHT arrow keys. A setting is confirmed by pressing the ENTER key. In PEAK mode the following options are accessible: Q-factor, frequency and +/- gain in the mid band frequency. When selecting a shelving filter the -3 dB frequency and gain can be adjusted. All of these settings are done by moving the cursor to the desired position and then changing the values by using the +/- increment keys. The settings are confirmed without using ENTER. For further explanations see chapter 5.2.

13 Load EQ Setup

In this menu it is possible to store EQ setups. An EQ setup contains all adjustments of the menus 3 *EQ1 ... 12 EQ10*. To recall them,

simply press the +/- increment keys until the name of the desired setup appears in the display. By pressing ENTER this preset will be instantly recalled.

14 Store EQ Setup

To store modified settings of the EQ bands 1...10 (PEQ section) in a new SETUP, select *Enter Setup Name* by pressing the ENTER key. Now it is possible to select a character A, a, O with the DOWN arrow key and then select the desired characters or numbers by pressing the +/- increment keys. With the LEFT / RIGHT - arrow keys the cursor can be moved between the individual letters of the word. After entering the desired name it has to be confirmed with ENTER. After that the number of the setup is selected by the increment key in the following menu *Enter Setup No.* . Finally press the ENTER again key to store the modifications. The setup can be recalled under *1 Load EQ Setup*, as described above.

Note: the menu point STORE SETUP can be left at any time by pressing the SYSTEM MENU key.

Important note: All setups and the current adjustments of all menu points will be stored in the SRAM of the digital controller. When the monitor is switched OFF, the SRAM will be powered by the internal buffer battery. This lithium battery has a life of several years and should only be replaced by skilled engineers according to the factory recommendations!

4.1 Infrared Remote Control

The IR remote control RC 55 is supplied with every O 500 C monitor. Even when ordering a pair or a 5.1 system, every O 500 C will have its own remote control. All RC 55 are identical, it is just a matter of providing the user with a spare RC of the same type. The RC 55 remote control has 36 rubber keys, which are operating all functions of the O 500 C. In addition to the standard controls such as menu select, cursor keys and increment keys which have been described before, a number of DIRECT ACCESS keys are provided for controlling important functions of the O 500 C.

Fig. 4.1/1 shows the layout of the keys. The silkscreening / naming of every key will explain the individual keys:

Numeric keys

With the number keys (1 ... 0, *, #) the menu-steps of the selected menu (Main, Sys, EQ) can be recalled directly by typing in the related menu number (can be looked up from the selection in chapter 3).

Please note that only the visible menu-points of the activated user security level can be recalled!

Setup-Keys

These keys can be used to recall the main setups 1...4 which have been stored in menu step 2 of the Main menu (see chapter 3.2)

IR ON/OFF

This direct access key will allow for the ON / OFF switching of the IR remote control.

Room EQ

When pressing this key, the menu step 1 EQ Set of the EQ-menu becomes active to adjust the room EQ (see chapter 5.1) of the O 500 C.

EQ ON/OFF

When pressing this key, menu 2 EQ of the EQ-menu is activated and the EQ is switched ON / OFF.

-20 dB

This key will select the function 17 PWR Amp -10 dB as described in chapter 3.2 and will lower the listening level by 10 dB. Pressing again will return to the original volume.

Mute

When pressing MUTE, the function described in 4 Mute of the main menu will reduce the signal level by the value as adjusted in the „Mute Attenuation“ menu.

Vol+/Vol-

With these keys the level of the monitor can be adjusted. Pressing any of these two keys will automatically activate the menu *Input Gain* of the main menu. Any changes of the settings in this menu do not need to be confirmed by pressing ENTER.

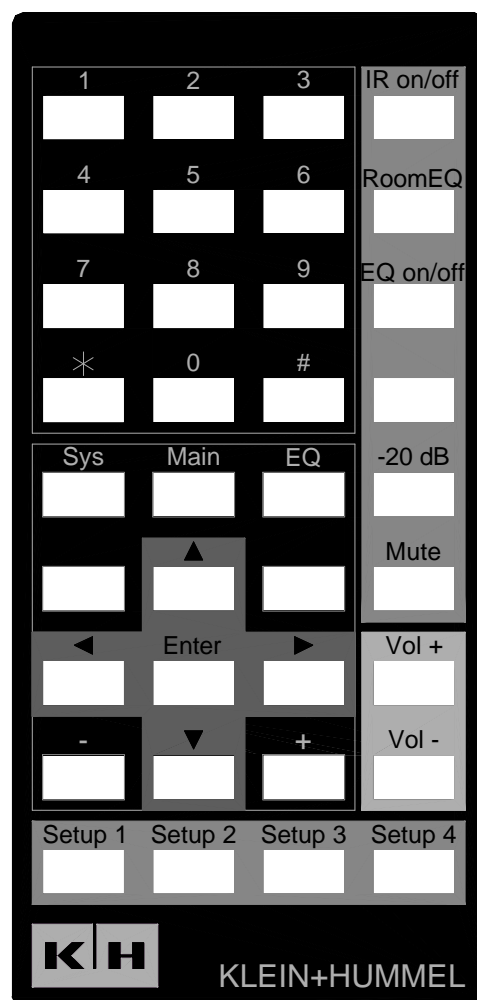


Fig. 4.1/1: The labelling of the IR- remote control RC 55

4.2 Control via RS-232 or MIDI

4.2.1 Wiring of the interface socket

The Sub-D socket on the rear of the O 500 C contains several interfaces of the internal digital controller:

- MIDI-Interface with MIDI In, MIDI Out and MIDI Through
- RS-232 interface
- Interface for future options

Fig. 4.2/1 shows the actual wiring and pinning of the 25-pole SUB-D connector.

Please take care to provide individual ground-connections for every mode, see Fig. 4.2/1

To make the MIDI interface accessible with the standard 5-pole DIN connectors, an adaptor has to be made up (or bought in computer shops) wired up according to Fig. 4.2/2.

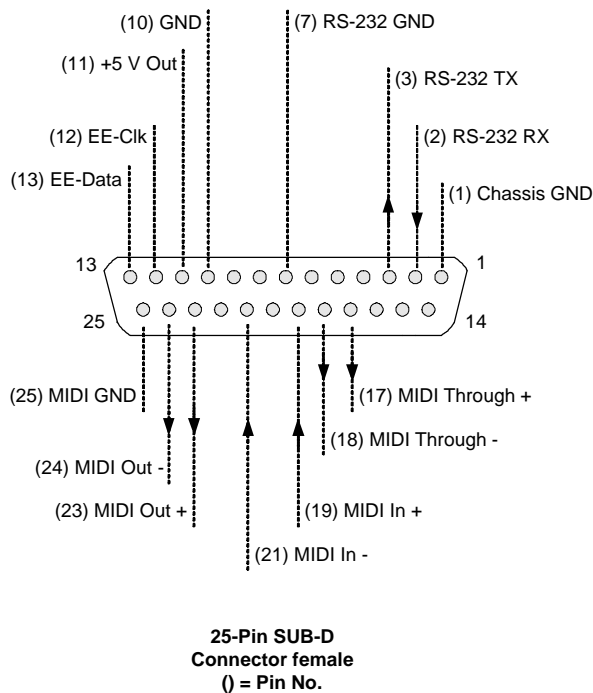


Fig. 4.2/1: Pinning of the interface-connector

The MIDI-interface will allow for a simultaneous controlling of several O 500 C, so one adjustment in a monitor will be routed to the other systems as well.

If, for example, two O 500 C are linked together, the MIDI OUT socket of one monitor is connected to the MIDI IN socket of the next monitor, the distance between two boxes may be up to 15 meters.

In menu 2 *Midi Settings* of the System-Menu the following default adjustments have to be selected:

Menu: 2 *Midi Settings*:

Baudrate = MIDI

ParaChg = ON

To select one monitor as the MASTER and the other one (ones) to be the receiving SLAVE, the slave monitors are selected for „ParaChg“ to OFF. Alternatively the adaptor shown in Fig. 4.2/3 may be used for the interconnection of the two systems.

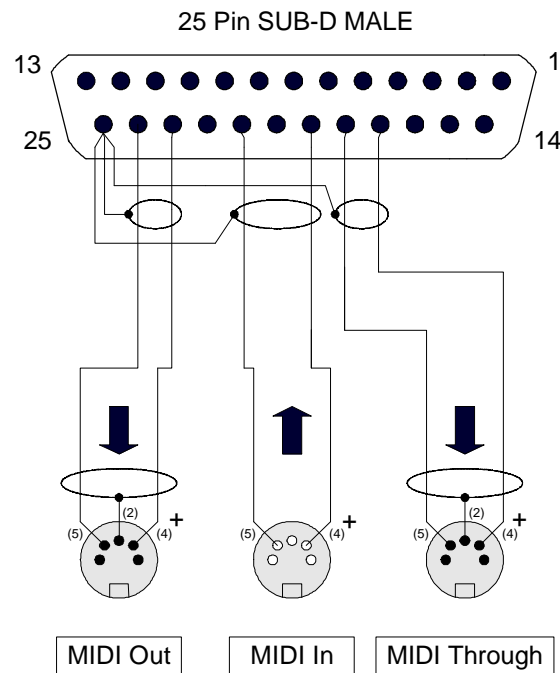


Fig. 4.2/2: Wiring scheme of a MIDI adaptor

The real advantage of a MIDI operation can be seen when two or more units are connected: Here a daisychain-structure is built up, where the MIDI Out of the first monitor is connected to the MIDI In of the next system, and here from MIDI Through to the MIDI In of the third system etc., see Fig. 4.2/4.

This way all monitors in the chain will be controlled by the master.

In menu 2 *Midi Settings* the option „Out/Thr“ has to be selected, and the IR remote control of the slave systems has to be disconnected by pressing the IR ON / OFF key on the remote control pointing to every slave, so only the master will remain active for the RC 55 .

Note: If any problems with the data transfer should occur when MIDI is active (such as MIDI overflow) please check the bandrate in the MIDI Settings menu and select the option „RS-232“.

The RS-232 interface in general has been provided to allow for a data-transfer between the O 500 C and a personal computer. The presets for this interface are made in menu 2 *Midi Settings*, as described above, in the position „Baud-rate“ the option „RS-232“ is selected.

Fig. 4.2/5 shows the wiring scheme of the connecting cable between the O 500 C and a personal computer for transferring parameter settings, as described in chapter 6.2. This is a so called modem cable, which is available in normal computershops, e.g. RS Components Nr. 777-558.

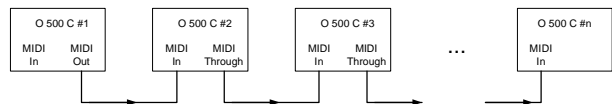


Fig. 4.2/4: MIDI-chain (Out: Option Out/Through)

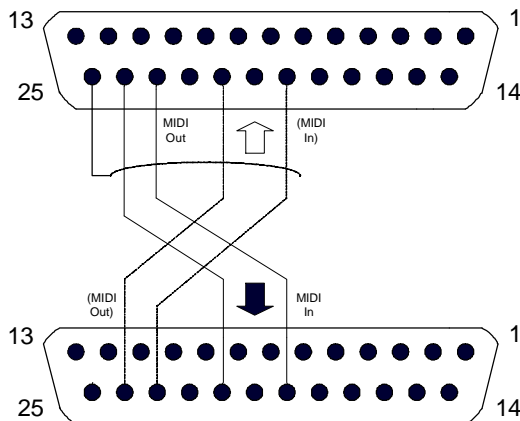


Fig. 4.2/3: Wiring scheme of the cable for a Master-Slave-operation of two O 500C

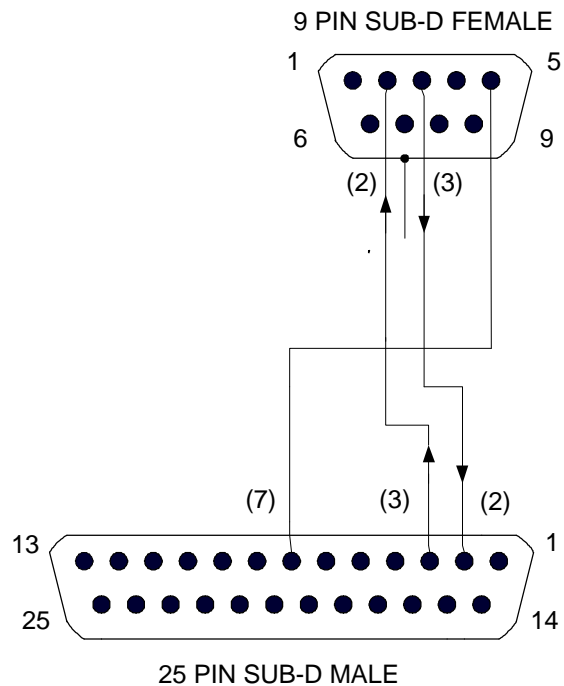


Fig. 4.2/5: Wiring scheme of the connecting cable between O 500 C and a PC

4.2.2 Midi-Commands

This paragraph explains the structure of commands, which is controlling the individual functions of the digital controller and recalls adjustents or setup-menus. As an external controller any IBM-compatible PC may be used, which is coppednected to the O 500 C via the adaptocable, as described in Fig. 4.2/5.

For the data-transfer a separate, small DOS-programme „BIN2SYX“ will be needed, which can be supplied free of Charge by KLEIN + HUMEL.

This programme is copied into a menu of the HDD in the PC and when copied it is recalled by typing in:

```
C:\bin2syx p x 2 9600 XXX Y
```

The syntax of this command is described more detailed in Fig. 4.2/6, which als contains the possible control-functions of the system.

Examples:

The O 500 C is connected to the COM2 port of a PCs and the bin2syx software has been copied into file C:\

1. Recall setup 004:

Type in: `c:\bin2syx p x 2 9600 64 4`

2. Adjust the Input Gain setting to -10 dB :

Type in: `c:\bin2syx p x 2 9600 65 118`

3. Adjust „Power Amp -10 dB“ :

Type in: `c:\bin2syx p x 2 9600 129 1`

O 500C MIDI Commands



Syntax: `BIN2SYX p x 1 9600 XX Y`
 1 = Int: 1=COM1; 2=COM2
 9600 = Baud Rate
 XX = No. Of Command (taken from table)
 Y = Value (as taken from table)

No. Of Command	Name / Function	Value
64	Load Setup	0 = Setup 000 ... 14 = Setup 014
65	Input Gain	0 = -128 ... 128 = 0
66		
67	Channel Gain Sub	0 = -18 dB ... 48 = +6 dB (Inc. 1 = 0.5 dB)
68	Channel Gain Low	--- " ---
69	Channel Gain Mid	--- " ---
70	Channel Gain High	--- " ---
71		
72		
73		
74		
75		
76		
77	Channel Delay Sub	t[ms] = Y * 0.3628
78	Channel Delay Low	--- " ---
79	Channel Delay Mid	--- " ---
80	Channel Delay High	--- " ---
81		
82		
83		
84		
85		
86		
87	Phase Invert Sub	0 = no, 1 = yes
88	Phase Invert Low	--- " ---
89	Phase Invert Mid	--- " ---
90	Phase Invert High	--- " ---
91		
92		
93		
94		
95		
96		
97	Channel Mute Sub	0 = no, 1 = yes
98	Channel Mute Low	--- " ---
99	Channel Mute Mid	--- " ---
100	Channel Mute High	--- " ---
101		
102		
103		
104		
105		
106	Input Select	0 = Analog, 1 = Digital
107	Master Delay	t[ms] = Y * 0.3628
108		
109		
110		
111	Limiter Release	0 = 10 dB/s ... 240 = 250 dB/s
112		
113		
114	Mute Attenuation	0 = +40 dB ... 40 = 0 dB
115	Mute	0 = off, 1 = on
116	Delay Link	0 = off, 1 = Mid + Hi, 2 = Mid + Hi + Low
117		
118		
119	Top (= Line)	0 = Z1, 1 = Z2, 2 = Z3 ...
120	Subwoofer (= Column)	0 = S1, 1 = S2, 2 = S3 ...
121	Gain Offset Analog	0 = -30 dB ... 60 = +30 dB
122	Gain Offset Digital	0 = -30 dB ... 60 = +30 dB
123	Logo	0 = off, 1 = on
124		
125	Input Routing	0 = Left, 1 = Right, 2 = Left + Right

Fig. 4.2/6: Listing of the individual commands for the O 500 C

5.1 Room EQ

General

The parameter settings of the O 500 C have been optimized by K + H in the way, that in a non-reflecting surrounding there will be a linear frequency response at the system.

Such a reflection-free surrounding will not be possible under practical conditions- on the contrary- room and positioning of the monitors will lead to significant nonlinearities in the frequency-response.

How nonlinearities of the frequency-response are generated by the location in the room. Base of this acoustic reaction is the principle of interferences of soundwaves. In general, there will be always two or more sound waves needed, which are generated from two sources with a certain distance to each other.

two interfering signals may to the double level (0°-phase shift) or a complete cancellation of a frequency (180°-phase shift). In between these two figures all levels/phaseshifts are possible.

How to use the internal room-EQ Feature

The O 500 C is offering three powerful functions for the compensation of nonlinearities in the frequency response, which were caused by the monitor's location: The compensation through individually generated parameter setups (chapter 6.4), the fully parametric EQ (chapter 5.2) plus the comfortable local EQ-function, as described below. All adjustments will be made in the menu *1 EQ Set* of the EQ-menu. On the following pages all options from this menu will be introduced, including some typical examples.

Important notes

When adjusting the local EQ function please keep in mind that the examples given here are not a strict line to be followed, they are just a recommendation how to do it practically.

After every adjustment we recommend to listen carefully to the system by a selection of well-known music. It would be advantageous to make a plot of the resulted frequency response before and after the adjustment, so it can be seen from the curves how the frequency curves have been changed.

The last point takes a very important role, as here will be the largest influence to the relation of absorption or reflection of sound energy, and the level of the secondary sound sources.

The number of frequencies or ranges of frequencies of such a frequency influenced by interferences can hardly be determined, as their levels, phases and results are depending on many factors, which cannot be calculated or eliminated, such as:

- The distances between test-microphone (or listening area) to the monitor and any reflecting surface
- The dispersion of the speaker-system over the whole frequency-range
- Various **Eigenschaften** of the surface-structure, material, mechanical construction etc.

Interferences will always occur, if two or more signal sources are active in a room. One of these sources is the monitor itself, so it is called the **PRIMARY SOURCE**.

Secondary signal sources are generated by the dispersion of the primary source, which is reflected from various surfaces, such as walls, ceiling, windows, floor, and even furniture and decoration in that room. The diffusion of a soundwave on any surface is determined by two parameters: the bending of the soundwave at the edges of the surface and the reflection from it's plain surface, if it is larger than the wavelength of the soundwave's frequency.

These reflected secondary soundwaves are interfering with the primary waves from the monitor, and will lead to an audible difference.

Low Cut

With this function it is possible to adjust the low frequency cut off of the complete system. The low cut can be set between 30 Hz and 80 Hz in steps of 10 Hz with a steepness of 12dB per octave:

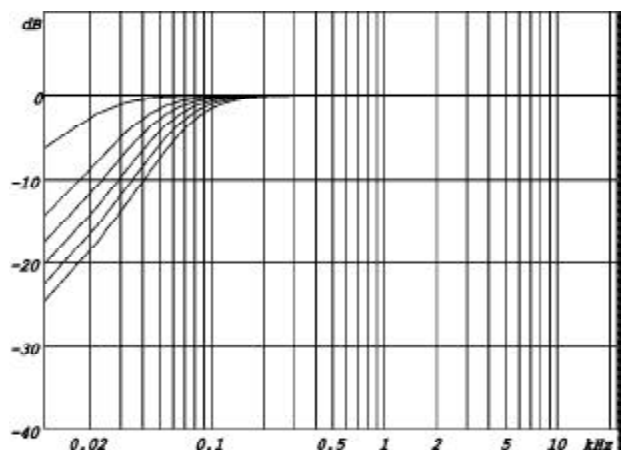


Fig. 5.1/1: Low Cut function, plotted from 30...80 Hz (in steps of 10 Hz)

Lifting the lower cut off frequency is recommendable in case there is a strong room mode, so cutting off the system below that frequency will cure that problem. It will also serve to simulate the sound of a smaller monitor system.

Bass roll off EQ

Here the intensity of the low frequency level can be lowered in steps of 2 dB up to -10 dB without changing the lower cut off frequency:

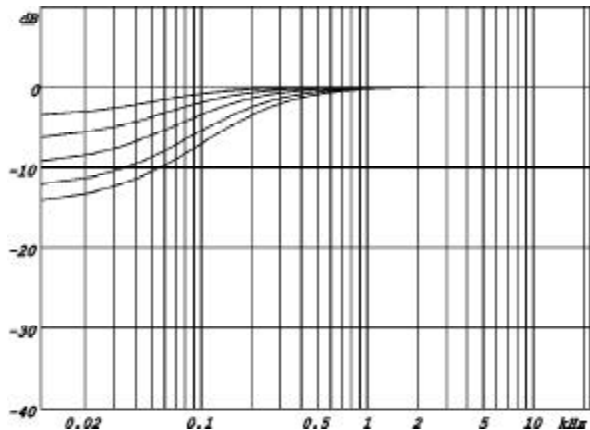


Fig. 5.1/2: Bass EQ - funktion, plotted from 0...-10 dB (in steps of -2 dB each)

Lowering the level in the bass frequency range will allow for a perfect match when the monitor is close to a wall or in a corner, as these locations always will lead to increase LF intensities.

Mid EQ

With this funktion the level of the mid frequencies can be reduced in 1 dB-steps up to a max. of -5 dB:

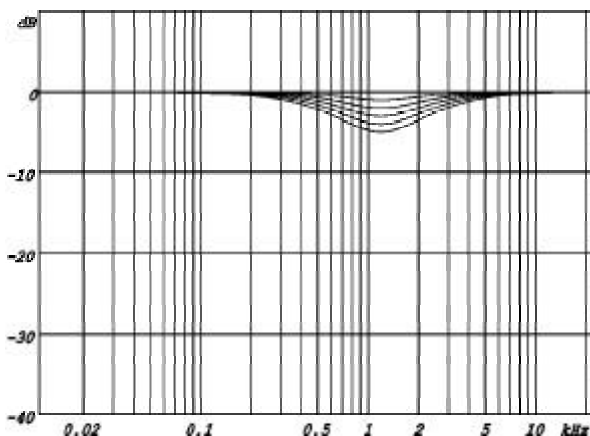


Fig. 5.1/3: The Mid EQ – funktion, plotted from 0...-5 dB (in steps of -1 dB)

High EQ

The high EQ will have influence on the level at higher frequencies, the adjustment ranges from +1 dB to -4 dB:

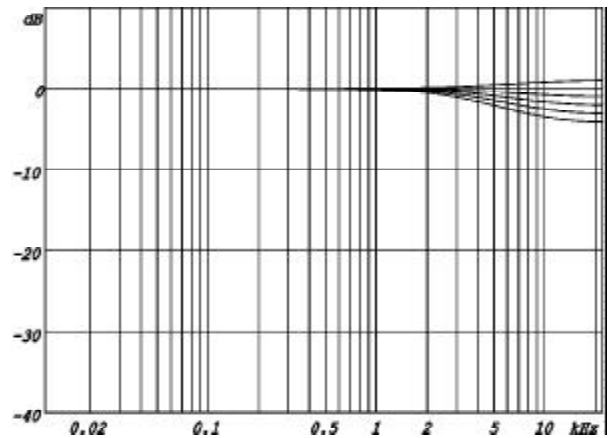


Fig. 5.1/4: The High EQ – funktion, plotted from +1...-4 dB (in steps of 1 dB)

Increasing the high level gain may have some positive results in studios, where a dry acoustic or high absorption of high frequencies may occur.

Here we do not have the typical interferences as in the low and midrange, but a highly reduced diffuse sound field which can be compensated.

5.2 Parametric EQ

General

In addition to the previously described local EQ, the O 500 C is fitted with 10 fully parametric EQ bands, which can be selected to be either bell or shelving and highpass/lowpass character with adjustable gains, Q-factor and slopes.

The individual EQ bands are arranged in a sequence of 10 menu points of the EQ menu, every EQ band has it's own menu point. The first EQ band can be found in menu 3 *EQ1*, the last one in point 12 *EQ10*. All adjustments can be stored in menu point 4 *EQ Setup* under a user selectable name, and can be recalled at any time.

These EQs may be used in addition to the room EQs to achieve a more detailed correction of nonlinearities in the frequency response, which have their origin in the local positioning of the monitor.

The main area of use is for the compensation of nonlinearities which are mainly caused by the room itself (construction, shape, material etc.) which can not be fully compensated with the room EQs.

In this chapter the complex operations and adjustments of the parametric EQ's are described and backed up by practical examples and diagrammes. Please note: all examples and diagrammes given may not be useful for an individual setup!

In a normal, average listening zone (room) the absorption of materials in the room can be very different, and are very much depending on the frequencies. As a result there are frequency depending levels in the diffuse sound field and the sound field as it is recognized by the listener, both adding up in a non-linear frequency response.

Description of parametric EQ's

Following the various adjustments and operation-modes of the 10-band parametric EQ will be described in detail, and made more understandable by offering some examples of frequency responses. All 10 bands are equipped

with the same properties and adjustments as described in menu 3 *EQ1 ... EQ10*.

Type:

Here the basic mode of the individual EQ-band is determined.

The following options will be possible:

- o High shelving with 12 dB/Oct. slope
- o High shelving with 6 dB/Oct. Slope
- o Low shelving with 12 dB/Oct. Slope
- o Low shelving with 6 dB/Oct. Slope

- o Peak (bell characteristic)

- o Highpass with 12 dB/Oct. Slope
- o Highpass with 6 dB/Oct. Slope
- o Lowpass with 12 dB/Oct. Slope
- o Lowpass with 6 dB/Oct. Slope

The figures 5.2/1 and 5.2/2 are showing

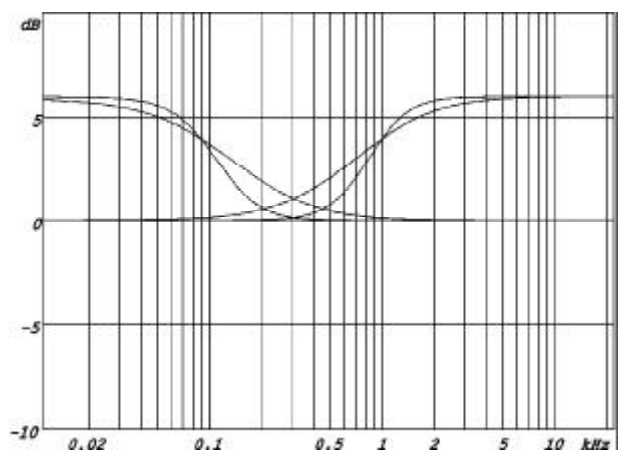


Fig. 5.2/1: Low and high shelvingfilter, slope: 6 and 12 dB/Oct., Gain = +6 dB, Q-factor = 0.7

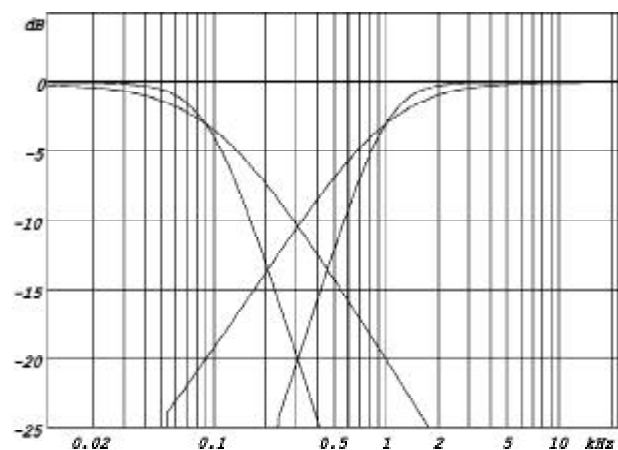


Fig. 5.2/2: High and lowpasses, slope: 6 and 12 dB/Oct., Gain = 0 dB, Butterworth characteristic.

examples for high- and low - shelving filter and high- and lowpass filters with different slopes from the -3 dB corner frequencies 100 Hz resp. 1 kHz.

Q-factor (adjustment from 0...6355):

Here the Q-factor of every filter band can be adjusted. The example in the diagram shows a peak EQ of a mid frequency at 1 kHz and a gain of +10 dB with different adjustments for the Q-factor:

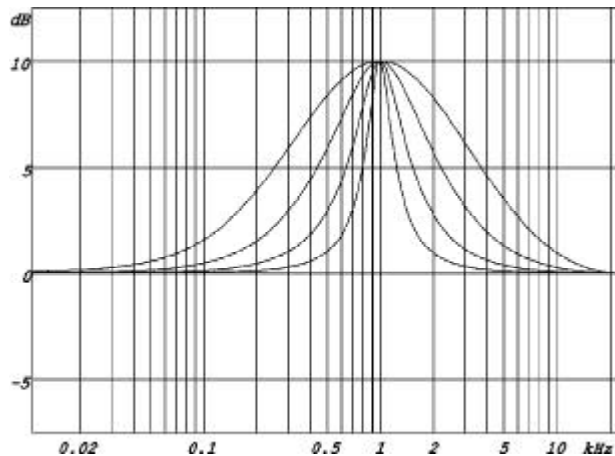


Fig. 5.2/3: PEQ-filter (Bell); Q = 0.5, 1, 2, 4; Gain = +10 dB; midfrequency = 1 kHz

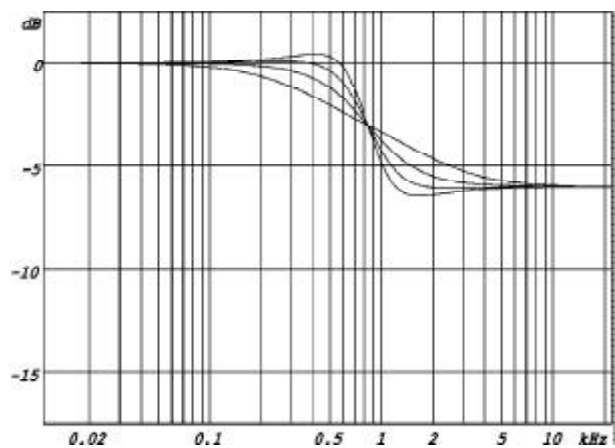


Fig. 5.2/4: High-shelvingfilter; Q = 0.4, 0.6, 0.8, 1.0; Gain = -6 dB; crossover frequency = 1 kHz

Frequency (range of adjustment 10...20000 Hz):

When the Peak mode is selected, the mid frequency is adjusted, in case of the shelving filters or high- and lowpasses the -3 dB corner frequency is selected.

The example in the drawing shows highpasses with a number of corner frequencies:

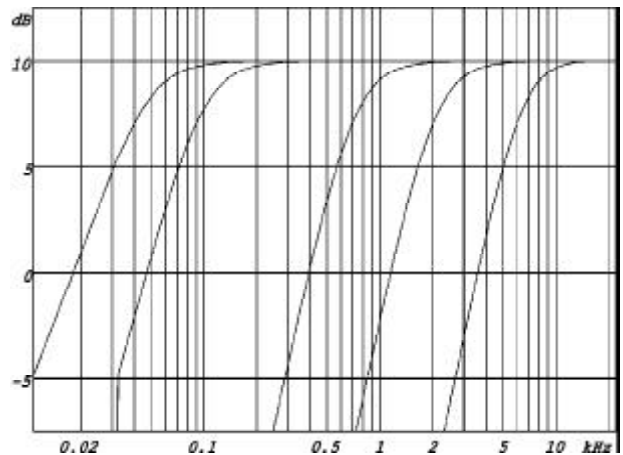


Fig. 5.2/5: highpasses with crossover frequencies of 50Hz, 100Hz, 700Hz, 2kHz, 6kHz; selected Slope 12 dB/Oct; Gain = +10 dB; Butterworth characteristic resp. at high and lowpasses the adjustment of the 3dB corner frequency.

Gain (range of adjustment -99...+12 dB):

This adjustment has a direct influence on the gain of every filter band. The examples in figure 5.2/6 and 5.2/7 are showing different gain adjustments in a peak and a shelving filter:

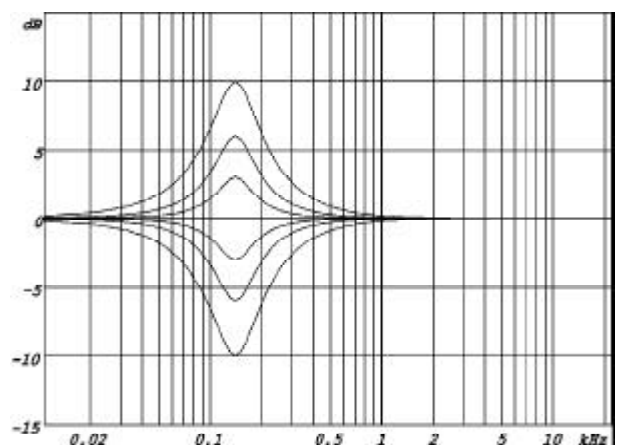


Fig. 5.2/6: PEQ filter (Bell); Gain: -10, -6, -3, 0, +3, +6, +10 dB; mid frequency = 150 Hz; Q = 2

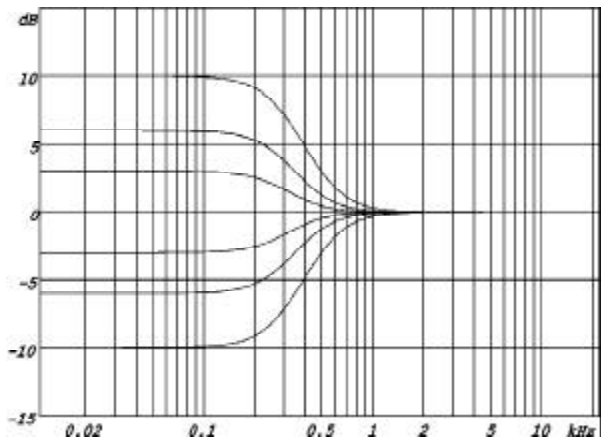


Fig. 5.2/7: Low shelving filter; Gain: -10, -6, -3, 0, +3, +6, +10 dB; crossover frequency = 300 Hz, $Q = 0.7$

Remarks fo adjustments

The necessary adjustments of the parametric EQ's should be based on a correct measurement in the beginning. This measurement should not only be taken in the listening position, but also at a number of other positions in the listening area (10 to 15 are recommended). These results should be taken for an „averaging result“ and for the final decision, which frequencies should be adjusted or not! With some experience it will be possible to see which adjustment will also have some influence on other bands at an octave or more above. Finally the result of the adjustment should be checked and verified again by a number of measurements in the listening area.

A measurement in different listening position is based on the knowledge, that a positive adjustment may have a negative result in an other part of the listening zone.

Accurate measurements are the basics for a successful adjustment of the PEQ functions described here.

This is the main reason why a complete adjustment on audible results from the individual filter bands is not recommended. The adjustments should be reduced to the low frequency area.

6 Calculation of Parameters

General

The loudspeaker parameter setup contains all adjustments and informations of the internal digital controller to obtain the desired frequency and phase response plus all limiter and protection functions for the O 500 C.

For every O 500 C an individual set of parameters will be set at the factory. This set of parameters contains far more information as it is the case in any other digital or analog controlled monitor on the market today. Normally these functions are reduced to the selection of crossover frequencies and gains in every amplifier stage, an EQ of the frequency response for a better linearisation and a setup for the limiters.

The O 500 C is supplied with a complex equalisation for every driver system. The EQ is not only reduced to the frequency and amplitude of the whole system, but also includes the adjustment of the phase response down to 40 Hz!

The adjustments contained in loudspeaker parameter setup can be looked at in three groups:

1. Filter coefficients of the FIR filter bandpasses (FIR = Finite Impulse Response)
2. Limiter parameters
3. Output scaling factors

The adjustments within a loudspeaker parameter setup can not be influenced by the user, as any change (if possible) would result in a loss of quality of the transmission data of the monitor. In the FlashROM-memory of the built-in digital controller a number of parameter settings are stored as a standard. Each of them can contain different acoustic results.

A change between the stored parameter settings is made in the menu „*Monitor / Subwoofer*“ of the MAIN menu and can be made while using the monitor (see chapter 3.2, menu step 8).

Loading of loudspeaker parameter setups

Note: New loudspeaker parameter setups can only be downloaded into the system by erasing the old, existing files. It is not possible to add new settings to the list!

- The serial interface (RS-232) socket of a PC is linked to the serial connector of the O 500 C by using a standard interface cable, as described in chapter 4.2.
- Switch ON the O 500 C by the POWER SWITCH and check if in menu 2 *Midi Settings* of the System-Menu „*Baudrate*“ the option „*RS232*“ is activated, see chapter 3.
- Now copy all new data files supplied by K+H (on a FDD, by E-Mail or on a CD-R) into a file of the HDD of the PC. Then the PC has to be rebooted and started in the DOS-mode.
- After changing into the directory containing the files just type in „*TXMATRX*“ to start the data transfer
- Wait until the display will show „*Input Gain*“, now the transfer is completed.
- Switch OFF the O 500 C and - after a few seconds - ON again, wait for the notice: „*Wrong Filter Setup*“ and press ENTER
- Now disconnect the O 500 C from the PC.

Room specific parameter settings

To compensate for room and positioning specific nonlinearities in the frequency response, it alternatively is possible to make up a room specific loudspeaker parameter setup instead of using the Room- or PEQ sections described in chapter 5.1 and 5.2. This will contain the adjustments of the EQ's but without the characteristic influence on the phase response. In order to do this it is necessary to make a complete measurement of the installed monitor system in the relevant room or studio by using a special measuring setup which is capable of calculating the new filter setups. In addition to this it will be possible to also include a „individual coloration“ of the response according to personal preferences.

The measurements needed for this setup, plus the necessary calculations and corrections can be carried out at extra cost by K+H or by a subcontractor.

7 Technical Data

Acoustical Specification

Freefield frequency response		30 Hz - 20 kHz, +/- 1,5 dB
Self generated noise level at 10 cm distance		25 dB(A)
THD	< 0,5% in 1 m distance from	100 Hz @ 101 dB /SPL
Sound Pressure Level (SPL)	in halfroom	123,4 dB /SPL @ 1% THD averaged between 100 Hz und 6 kHz

Connectors

Inputs analog	Number, type Impedance elektron. balanced Impedance transformerbalanced max. input level Common mode rejection (CMMR)	1 x XLR 10 kOhm 10 kOhm 24 dBu > 80 dB @ 15 kHz
Outputs analog	electronically balanced (Sub Out) Output impedance resolution, principle Outputrange steps	1 x XLR < 70 Ohm 24 bit AD, D/S 16, 12, 6 dBu
Inputs digital	AES/EBU S/P-DIF Impedance AES/EBU S/P-DIF	XLR BNC 110 Ohms (transformer balanced) 75 Ohm (unbalanced)
Outputs digital (through)	AES/EBU	XLR
Remote control, Data interface	MIDI, RS232 Baudrate IR-remote controle	D-Sub D 25 9600, 31520 IR-receiver

Performance

THD @ 1 kHz, + 6 dBu	0,0004 %
Noisefloor	- 126 dBFS

Signal processing

AD-Conversion	resolution, principle Clockrate Pre-Emphasis	24 bit stacked AD, Δ/Σ 44,1 kHz, 48 kHz 50/15 μ s
DA-Conversion	resolution, principle	24 Bit, D/S
Latency behaviour	basic latency filter latency	5-7 ms depends on type and setting of filter

Filter section and Limiter

Factory presets	Filter algorithm max. number of filters Type of filters	FIR-Filter (finite impulse response) depending from filter length, typ. 50 Linear-, mixed linear/minimal, minimalphase
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	Number of ways Equalisations	4 individually amplitude and phase linearised
	Slopes Crossover frequencies Peaklimiter	fixed and defined 520 Hz and 2800 Hz feed-forward with 1,5 ms, controlled overshoot for max. peak power efficiency of the power amps
	RMS-Limiter	Modelling of coil and magnet temperature
Room specific filter settings	see factory presets, needs individual lineup on site by K+H or subcontractor	
User defined equalizer	Filter algorithm Number of filters per channel fullparametric filtertypes	IIR-Filter (infinite impulse response) 10 High-/Low-shelving 6dB/oct, 12dB/oct; High-/ Low-pass 6dB/oct, 12dB/oct; peakfilter
EQ for local adjustments response)	Filteralgorithm Number of filters Type of filters	IIR-Filter (infinite impulse 4 Low-Cut; Low; Mid; High
Delay	Master Delay Channel Delay	0 - 999 ms; 0 - 333 m 0 - 92 ms
Poweramplifiers		
Bass	PMS (THD < 0,1%) Peak	400 W 500 W
Midrange	RMS (THD < 0,1%) Peak	230 W 280 W
Treble	RMS (THD < 0,1%) Peak	290 W 360 W
Mechanical Specification		
Size	High Wide Deep	750 mm 400 mm 467 mm
Volume		140,0 l
Weight		65 kg
Drivers, all magnetically shielded	Woofer Midrange dome Tweeter	300 mm / 12" 76 mm / 3" 25 mm / 1"
Mounting hardware		1 x M20 per side / 1 x M20 bottom
Fitting-hardware		LH35 + LH28/LH29 LH36 + LH28/LH29
Enclosure	Surface Colour Other colours	Painted charcoal grey (RAL 7021) upon request