Digital FIR Controller

PRO C 28

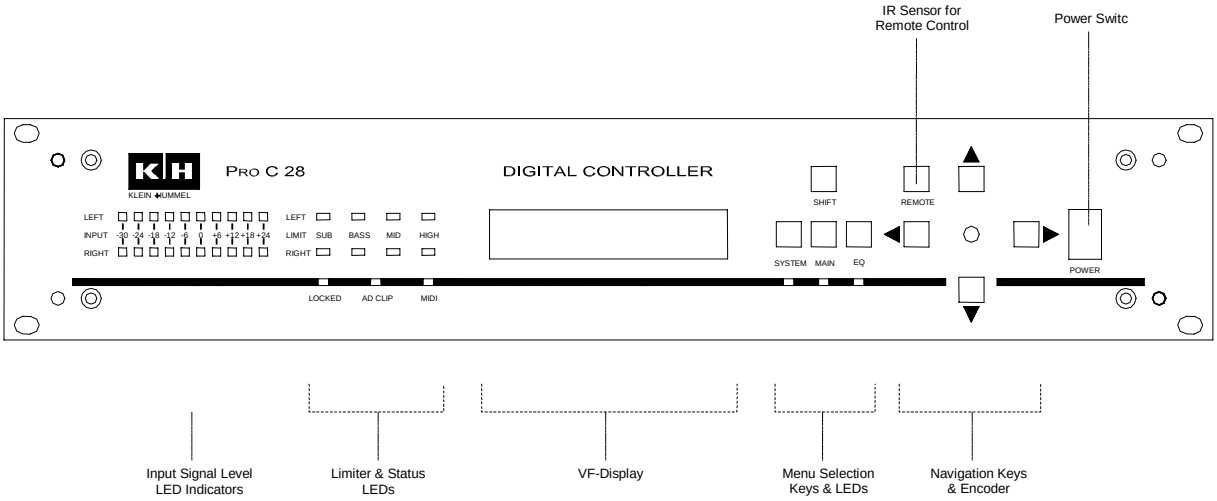
Operators Guide
& Connection Diagrams

058-E0161
Version 060426
SW Rev KH 1.045

K+H Vertriebs- und Entwicklungsgesellschaft mbH
Auf dem Kessellande 4a • 30900 Wedemark / Germany

Tel: +49 (0) 5130 5848-0
Fax: +49 (0) 5130 5848-11
Email: info@klein-hummel.de
www.klein-hummel.de
www.klein-hummel.com

1. Operating Instructions



1.1 Controls and Displays

- **Menu Selection Keys:** Operation of the digital controller is based on a menu structure, in which the setups and parameters can be accessed via the three Menu Selection Keys (System, Main, and EQ):
  - **SYSTEM Menu:** for infrequently used system adjustments, e.g. display brightness, password changes, etc.
  - **MAIN Menu:** for recalling and storing system setups, selecting parameters, changing settings, etc. In addition, the FIR Filter parameter setup files can be recalled.
  - **EQ Menu:** for recalling and storing parametric equalizer and IIR Filter setups
- **VF-Display:** the upper line in the VF display shows the menu option(s), e.g. Input Gain and Balance. The lower line displays the parameter value(s) that can be changed, e.g. –20 dB and L=R= 0 dB.
- **Up (▲) / Down (▼) Arrow Keys:** for scrolling through the menu and selecting setups, parameters or options.
- **Left (◄) / Right (►) Arrow Keys:** for selecting one of the parameters, within a menu, that is displayed in the upper line (e.g. Input Gain or Balance). The blinking cursor will indicate which parameter is selected.
- **Rotary Encoder:** for changing a parameter value or option. Simultaneously pressing the rotary encoder while changing the numerical value increases the increment (by a factor of 10, or by 6 dB, etc.). For some parameters, the encoder must be pressed after the new value is set, to store the new value. The round cursor in the upper line of the display will blink when a value is different than the stored value and will stop blinking when the new value is stored (or when the value is the same as the stored value) .

1.2 Operation

- **Loading and Changing Setups:** Press the MAIN menu key and then press the Down arrow key to scroll down through the menu until *Load Setup* is displayed. The first Setup number / name displayed is the one that is currently loaded (the round cursor in the upper right corner of the display will not blink). Turn the encoder until the desired setup number /

name is displayed (the round cursor in the upper right corner will blink). To load this setup, press the encoder knob (the round cursor will stop blinking). A Setup includes all of the settings for each parameter in the MAIN menu (except for *Input Gain*). Setups 001 through 004 can also be selected with the infrared Remote Control using the Setup 1, 2, 3 and 4 buttons.

- **Input Gain (Volume) Adjustments:** Press the MAIN menu key and then press the Down arrow key to scroll through the menu until *Input Gain* is displayed. The level for the input signals (analog or digital) may be changed by turning the encoder. Volume level can also be changed with the Remote Control using the Vol+ / Vol- buttons. Note: The PRO C 28 will display the *Input Gain* mode when power is first turned on or when the controls have not been used for over 5 minutes.
- **Channel Balance Adjustments:** Press the MAIN menu key and then press the Down arrow key to scroll through the menu until *Input Gain* and *Balance* is displayed. Press the Right arrow key so that the cursor blinks on *Balance*. The relative balance between the input signal levels (analog or digital) may be changed by turning the encoder (left or right).
- **Delay Settings for Satellites und Subwoofers:** Press the MAIN menu key and then press the Down arrow key until *Delay Link* is displayed. Turn the encoder until *Off* is displayed on the lower line. Then press the Up arrow key until *Delay Sub Low Mid Hi* (not *Master Delay* or *Delay Offset* !) is displayed. Press the Left / Right arrow keys to select *Sub Low Mid* or *Hi* (be sure that *LR*, not *L*, is displayed on the lower line !). Turn the encoder to set the delay time in ms. Delay changes occur in real-time.
  Note: use *Delay Link* to link the delay settings for several outputs together, so that their delay settings can be changed simultaneously
- **Gain Settings for Satellites und Subwoofers:** Press the MAIN menu key and then press the Down arrow key until *Gain Sub Low Mid Hi* (not *Input Gain* !) is displayed. Press the Left / Right arrow keys to select either *Sub Low Mid* or *Hi* (be sure that *LR*, not *L*, is displayed on the lower line !). Turn the encoder to set the gain in 0.1 dB increments. Gain changes occur in real-time.
- **Polarity Inversion for Satellites und Subwoofers:** Press the MAIN menu key and then press the Down arrow key until *P.Inv Sub Low Mid Hi* is displayed. Press the Left / Right arrow keys to select *Sub Low Mid* or *Hi* (be sure that *LR*, not *L*, is displayed on the lower line !). Turn the encoder to set the polarity inversion to *No* or *Yes (Yes* will invert the signal's polarity 180 degrees for the selected band). Polarity changes occur in real-time.

1.3 Recalling Loudspeaker FIR Parameter Files:

Note: Loudspeaker FIR Parameter Files are based on the calculated data from K + H, or consultants, for setting the FIR Filter and Limiter of the PRO C 28 in combination with a specific loudspeaker/amplifier combination. **Important**: When either the loudspeakers or amplifier are changed, the FIR Parameter Files must also be changed!

- Press the MAIN menu key and then press the Down arrow key until *Top Subwoofer* (for standard K+H Matrix-Software) or *Filter Select* (for special X-Software) is displayed.

For Standard K + H Matrix-Software (i.e. *Top Subwoofer* is displayed)

- Press the Left arrow key to select *Top* with the blinking cursor. Turn the encoder until the desired loudspeaker / delay combination is displayed (the round cursor in the upper right portion of the display will blink). Then press the encoder to store the displayed setting (the round cursor will stop blinking).
  Note: FIR Parameter Files with phase correction will result in higher delay values than those without.

- Press the Right arrow key to select *Subwoofer* with the blinking cursor. Turn the encoder until the desired subwoofer setting is displayed (the round cursor in the upper right portion of the display will blink). Then press the encoder to store the displayed setting (the round cursor will stop blinking).

For Special X-Software (i.e. *Filter Select* is displayed)

- Turn the encoder until the desired FIR Parameter Filename is displayed (the round cursor in the upper right portion of the display will blink). Then press the encoder to store the displayed setting (the round cursor will stop blinking).

1.4 Saving a Setup

Note: A Setup is a combination of all parameter settings in the MAIN Menu, including the FIR Parameter File, plus all settings in the EQ Menu - with the exception of *Input Gain* (Volume). The PRO C 28 has the capacity to store 60 unique user-defined Setups.

- Press the MAIN Menu key and then press the Down arrow key until *Save Setup* is displayed.
- Press and release the encoder: *Save: Enter Setup Name* will be displayed.
  - > Turn the encoder to select the first character or symbol for the Setup Name
  - > Press the Up or Down arrow keys to change the character / symbol set
  - > Press the Right arrow key to move to the next position in the *Setup Name*
- Press and release the encoder: *Save: Enter Setup No.* will be displayed.
  - > Turn the encoder to select one of the Setup Nos. (001 through 059)
    Note: Setup Nos. 001 through 004 can also be selected with the *Setup 1* through *Setup 4* keys of the remote Control
- Then press the encoder to store the Setup

Note: To cancel the procedure before the Setup is stored, press the SYSTEM Menu key.

A stored Setup can be recalled in the MAIN Menu from *Load Setup*

Since *Input Gain* (Volume) is not a stored parameter, the volume level remains constant when different Setups are selected (in *Load Setup*). Different (relative) volume levels for each Setup may be stored in *Gain Offset* in the MAIN Menu. Different (relative) volume levels for the Analog and Digital Inputs within the same Setup No. may also be stored in *Gain Offset*.

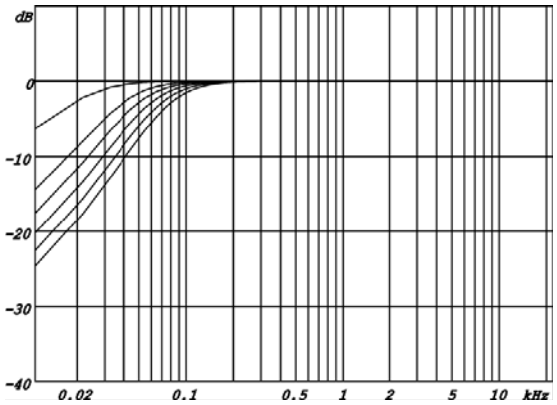
1.5 Setting the IIR EQs (EQ Menu)

Note: The EQ Menu contains all of the EQ and IIR Filter setups including an EQ for speaker placement and a 10-Band full-parametric EQ. IIR EQ changes occur in real-time (unlike changes to the FIR settings).The amplitude and phase behavior is similar to that of an analog EQ.

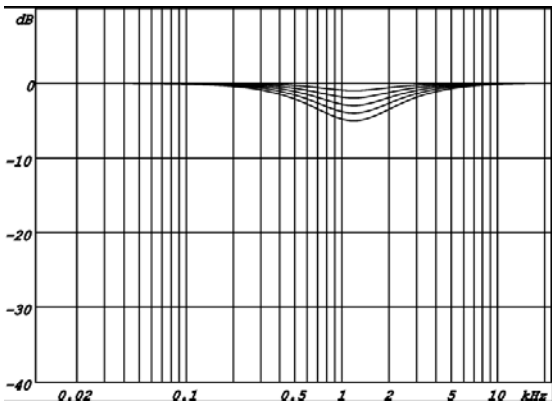
1.5.1 Placement EQ

Press the EQ Menu key and then the Down arrow key until *EQ Set* is displayed. Press the Left / Right arrow keys to select *LowCut Bass Mid* or *Hi* (indicated by a blinking corsor). Turn the encoder to set the EQ level in dB.

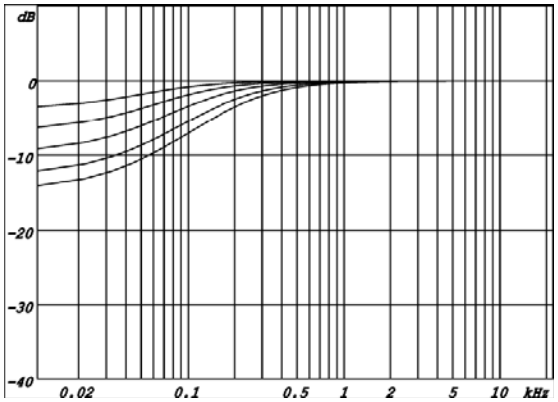
- **Low Cut:** Sets the low cut-off frequency. The low cut-off can be set from 40 to 80 Hz (in 10 dB increments) or to *Off* (no cut-off) as shown in the diagram below:



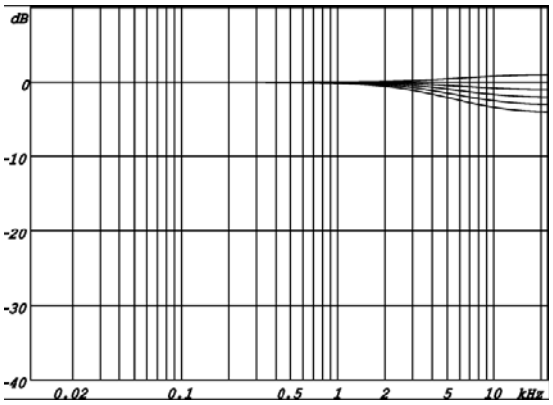
- **Mid EQ:** can be set from 0 to –5 dB (in 1 dB increments), as shown in the diagram below:



- **Bass EQ:** can be set from 0 to –10 dB (in 2 dB increments), as shown in the diagram below, without effecting the Low Cut frequency setting.



- **Hi EQ:** can be set from +1 to –4 dB (in 1 dB increments), as shown in the diagram below:



1.5.2 10-Band Parametric EQ

The 10-band full-parametric EQ is setup as 10 individual parameters in the EQ Menu.

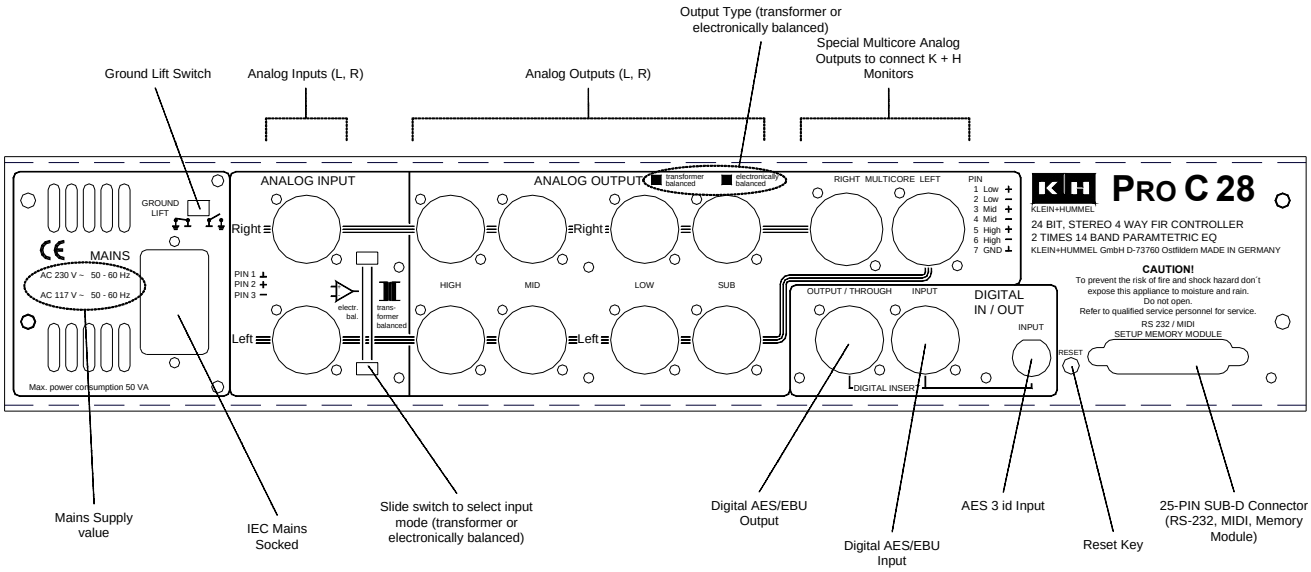
Press the EQ Menu key and then the Down arrow key until *EQ 1 Type Q Hz dB* is displayed.

Note: to have the same EQ settings for the Left and Right channels, be sure that *LR*, not *L*, is displayed on the lower line!

- **EQ Type**: Press the Left / Right arrow keys to select *Type.* Turn the encoder to select the type of EQ, as described below,
  - □ HS12 (High-Shelving 12 dB/Oct.)
  - □ HS 6 (High-Shelving 6 dB/Oct.)
  - □ LS12 (Low-Shelving12 dB/Oct.)
  - □ LS 6 (Low-Shelving 6 dB/Oct.)
  - □ Peak (Bandpass / bell-shaped curve)
  - □ HP12 (High-Pass 12 dB/Oct.).
  - □ HP 6 (High-Pass 6 dB/Oct.)
  - □ LP12 (Low-Pass 12 dB/Oct.)
  - □ LP 6 (Low-Pass 6 dB/Oct.)

  and then press and release the encoder.
- **Q:** Press the Left / Right arrow keys to select *Q.* Turn the encoder to select the Q value.
  Note: Q is only adjustable for bandpass filters.
  - ♦ If *Peak* was selected as EQ *Type*, *Q* can be adjusted from 0 to 6355.
  - ♦ Q is adjustable in 0.1 increments from 0 up to 100 (above 3.0 press and hold the SHIFT key to adjust in 0.1 increments.
  - ♦ To adjust in larger increments, press the encoder while turning it.
- **Frequency:** Press the Left / Right arrow keys to select *Hz.* Turn the encoder to select the frequency (center frequency for a Peak filter or the –3 dB frequency for a shelving, high-pass or low-pass filter). Frequency is adjustable from 0 to 20,000 Hz.
- **Gain:** Press the Left / Right arrow keys to select *dB (Gain).* Turn the encoder to adjust the Gain in dB (press and hold the SHIFT key to adjust in 0.1 increments). Gain is adjustable from -99 to +12 dB.

2 Connection Diagram



- **GROUND LIFT Switch:** Disconnects the signal ground from the power supply ground and should only be switched to the disconnected position when there is excessive audible hum.
- **ANALOG INPUTS:** Two XLR-F connectors (labeled *LEFT* and *RIGHT*) for balanced analog input signals. Each Input can be set to transformer balanced or electronically balanced using the slide switches next to the Inputs.
- **ANALOG OUTPUTS:** Eight XLR-M connectors (labeled *HIGH MID LOW* and *SUB* for the *LEFT* and *RIGHT* channels) deliver balanced analog output signals. Output type (transformer or electronically balanced) is factory set and marked on the rear panel.
- **MULTICORE Outputs:** Two 7-PIN XLR-M connectors (labeled *LEFT* and *RIGHT*) deliver the same *HIGH MID LOW* and *SUB* balanced analog output signals via one multicore cable for each channel.
- **DIGITAL OUTPUT / THROUGH:** XLR-M connector (labeled *OUTPUT* / *THROUGH*) delivers the left and right digital output signals in AES/EBU Format.
- **AES/EBU DIGITAL INPUT:** XLR-F connector (labeled *INPUT*) for digital input signals in AES/EBU Format. **Note:** When this input is used for digital signals, no cable can be connected to the AES 3id INPUT (BNC connector).
- **AES 3id DIGITAL INPUT:** BNC connector (labeled *INPUT*) for digital input signals in AES 3id Format. **Note:** When this input is used for digital signals, no cable can be connected to the AES/EBU INPUT (XLR-F connector).
- **RESET Button:** to restart the PRO C 28 (same as switching the front panel *POWER* switch Off and On).
- **Serial Port:** SUB-D 25-Pin connector has several functions:
    - Serial RS-232 interface for loading the Loudspeaker Parameter Sets from a PC
    - MIDI interface (In, Out, Thru) for daisy chaining several PRO C 28s or connecting them to other MIDI equipment

3 Loading Loudspeaker Parameter Sets into the Pro C 28

Loading Loudspeaker Parameter Sets into the PRO C 28 via the RS-232-interface requires a PC running in DOS mode. The PRO C 28 and the PC can be interconnected using a 9-Pin D-SUB to 25-Pin D-Sub Modem cable.

Warning: Turn Off all amplifiers connected to the PRO C 28 before beginning this procedure.

The transfer procedure depends on the firmware in the PRO C 28 and is different for the standard K + H Matrix-Software or the special X-Software.

The easiest way to determine which software is loaded is to look at the displayed parameter for the ninth Menu step (see Appendix below) in the MAIN Menu:

- if *Top Subwoofer* is displayed, the K + H Matrix-Software is loaded
- if *Filter Select* is displayed, X-Software is loaded

3.1 Standard K + H Matrix-Software: Loading Data Sets with DOS-Batch

In this version of the software, the data records (up to 70) are organized in a matrix structure with each data record designated by a Monitor-Subwoofer combination. No special software is required for the data transfer and all required files are provided with the data record.

- Copy the supplied files into a directory (e.g. PRO C 28 Matrix Files) on the PCs hard drive.
- Start the transfer procedure with the command “TXMATRX“
- The MIDI LED on the front panel of the PRO C 28 will be illuminated while the transfer is occurring.
- The transfer is complete when *Input Gain* is displayed on the PRO C 28 front panel

3.2 Special X-Software: Loading MFX Parameter Sets

In this version of the software, the MFX ***.blk data files can be loaded directly into the Pro C 28. Approximately 3 - 5 data files can be loaded, depending on the range (number of filter coefficients) in the data records

- In MFX press Alt + E and then select > *Crossover Work* > *Dispatch FIR Set to Hugo* from the Menu to call up the Data Transfer. Then select the files to be transferred.
- For each data set to be transferred, select:
  - *Append* to add a new data set to an existing file
  - *Overwrite* to attach a new data set and delete the existing data set
- Press the “S” key to toggle between overwrite or append mode
- Press the “L” key to start the data transfer. The MIDI LED on the front panel of the PRO C 28 will be illuminated while the transfer is occurring.

4 Appendix

4.1 Menu options in the MAIN Menu (from top to bottom):

1. ***Load Setup:*** to load a setup
2. ***Save Setup:*** to save a setup
3. ***Input Gain:*** to set the overall gain and balance between channels
4. ***Gain Offset:*** to set a gain offset between the analog and digital inputs
5. ***Mute:*** to activate/deactivate mute and set the attenuation level
6. ***Input Select:*** to select the input signal (analog or digital input)
7. ***Digital Output:*** to activate/deactivate the digital outputs
8. ***Input Routing:*** to select normal, reverse or mono for the inputs
9. ***Top/Subwoofer*** (K+H Matrix-Software) or ***Filter Select*** (X-Software):

   To select and load the FIR loudspeaker data set from the MFX software
10. ***Master Delay:*** to set the overall delay for all outputs, the minimum value is dependent on the selected FIR Loudspeaker Data set and represents the total latency
11. ***Delay Offset:*** to set a delay offset between the left and right channels
12. ***Mute (Sub Low Mid Hi):*** to mute individual output channels
13. ***Gain (Sub Low Mid Hi):*** to set individual gain levels for each output channel
14. ***Phase Invert (Sub Low Mid Hi):*** to set individual polarities for each output channel
15. ***Delay (Sub Low Mid Hi):*** to set individual delays for each output channel
16. ***Delay Link:*** to define if/which outputs will be combined for the delay settings in Menu option 15
17. ***Limiter Release:*** to set the release time for the peak limiter

4.2 Signal Path: PRO C 28