



# The new HDSP-V Series



HDSP family has arrived  
with the following features:

- 16-ch. DSP + HiRes audio player up to 24-bit/192 kHz & 5Hz-45kHz
- Extremely powerful 64-bit DSP with Ti Dual-Core CPU 2 x 450 MHz
- DSP sampling rate: 96 KHz (16 ch.) or 192 KHz (8 ch.)
- Supports WAV, AIFF, FLAC, ALAC, AAC, MP3 via USB stick (up to 2TB)
- Extremely low noise from DSP & Player: -140 dB
- Modular design to upgrade AD/DA signal converters, inputs/outputs
- AD/DA converter with native 32 bit/768 KHz
  - 3" touch screen remote control
  - Power supply stable 6-16V for Stop/Start ignition systems
- PC software with fully scalable user interface

Zapco began making amplifiers in 1974 and introduced the first full function DSP for the Car Audio Market, along with a full line of amplifiers with on-board DSP in 2004.

**Now presenting the new HDSP-V series, the ZAPCO state-of-the-art DSP in its fifth generation**



**ZAPCO**



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## Incredible numbers for the Zapco HDSP-V

The HDSP-Z16 V is the best hardware that Zapco has ever built. The numbers are incredible. Although the HDSP is composed of 18 individual pieces put together in a modular version that is easy to adapt or update according to your needs, the background noise and the crosstalk numbers are unheard-of. Difficult to imagine, surpassing the expectations of the designers and engineers who built it. It took almost three years, but eventually came a masterpiece of hardware that will remain in the history of Zapco and the entire Car Audio market. The numbers are proof of this and the first two are: -140 dB of background noise and -115 dB of crosstalk.

For a 16-channel device, crosstalk at -115 dB (average around 1 KHz) is proof of the accuracy with which the layout was made. But of course, background noise and crosstalk are not the only numbers that are record-breaking. All the others, maybe they are not so spectacular, but they are also big numbers. So, the digital inputs have 114 dB of A weighted signal and the analog ones 109 dB. All referred to 4 Volt output. We kept the output voltage at 4 Volts to improve distortion. Distortion of analog and digital inputs are lower than 0.001% at 4 Volt output and lower than 0.00175% at 1 Volt output.

The HDSP-V has a power supply that continues to work down to 6 Volts to solve the problem of cars that have the stop-start ignition system. The main processor is a dual core 452 + 452 MHz, 8/16 channels solution have a 192/96 KHz sampling rate and the converters are new devices from AKM at 32 bit/784 KHz.

**But first of all, it is a Player that works at 24 bit/192 KHz integrated with DSP.** There is no connection between the Player and the DSP, no PCB, no connectors, no cables. Player and DSP are integrated in one dual core chipset that has a total power of 912 MHz. Then there is a microprocessor that controls only the Player and does not have to do other heavy computational work like can happen, for example, with a computer. So, you can say it is a DSP, a sophisticated DSP, the most sophisticated DSP existing connected with a Player. The player has a dedicated browser that starts to work immediately when you insert the USB memory stick. It can read all formats up to 24 bit / 192 KHz, compressed or not compressed, and from the 3" touch screen display, you can control all the functions using 3 different levels of folders. The dash board that controls the Player also controls the DSP and can manage up to 10 tuning presets with instantaneous switching of one to another for A.B comparisons

## HDSP-V Main Features

- Player & DSP: All-in-one dual core processor
- Modular device: High-end solution with 18 independent PCB
- Total Power main processor: 912 MHz (456 MHz + 456 MHz)
- Player power: 450 Mhz - Arm 9 32 Bit
- Audio formats: WAV, AIFF, FLAC, ALAC, AAC, MP3
- Directories: File/Artist/Album/Title
- DSP Power: 450 MHz - 32 Bit (till 64-bit/IEEE double precision)
- DSP Processor Point: Fixed & Floating
- DSP Sampling Rate: 96 KHz (16 ch.), 192 KHz (8 Ch.)
- ADC Processor: AK5558 32 Bit 784 KHz
- DAC Processor: AK4458 32 Bit 784 KHz
- Frequency response: 5Hz @ 45 KHz
- THD+N: 0,0008 (Digital Input), 0,001 (Analog In, 1V Out)
- S/N Floor Noise: 140 dB A
- S/N Ratio: 114 dB A (Digital In), 109 dB A (Analog In)
- Crosstalk: 115 dB (1KHz average all ch.)
- Dash Board: 3" Touch Screen, 10 Preset
- Dash Board Control: Volume/Sub/Balance/Fader/Tone
- Wireless Control: Wi-Fi External Module (included)
- BT Streaming: External APTX HD Module (optional)
- Tuning: Easy and Expert modes, "Double Front"
- I/O Setup: 2ch, 4ch, 6ch, 8ch, OEM SUM, AUX
- Digital Input Mode: HD, Optical, Coax, i2S 1, 2, 3
- EQ: Parametric 30 / 6 poles (16 ch.), Parametric 15 poles (8 ch.)
- Crossover Filters: Linkwitz, Butterw., Bessel, Tsecheb.
- Phase Filter: All channels 1Hz/1 Degree step
- VSEQ Filter: 50-200 Hz - 1 Hz step
- Stop-Start ignition system support
- Main unit overall dimensions (mm): 217(L) x 164(W) x 57(H)
- Dash Board dimensions (mm): 111(L) x 16(W) x 49(H)



### HDSP-Z16 V 16 Ch. DSP with HD Player

DSP 456 Mhz, 64 Bit, 96 KHz  
HD Player 450 Mhz, 192 KHz SR  
3"Touch-Screen LCD  
Floor Noise S/N: 140 dBA  
Wi-Fi module, BT port  
Overall dim. (mm): 217(L) x 164(W) x 57(H)

### HDSP-Z8 V 8 Ch. DSP with HD Player

DSP 456 Mhz, 64 Bit, 192 KHz  
HD Player 450 Mhz, 192 KHz SR  
3"Touch-Screen LCD  
Floor Noise S/N: 140 dBA  
Wi-Fi module, BT port  
Overall dim. (mm): 217(L) x 164(W) x 57(H)



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## HD Player

Player Processor: TI OMAP-L138 - 450 MHz  
 Audio Formats: WAV, AIF, AIFF, FLAC, ALAC, AAC, MP3  
 Read till: 192 KHz - 24 Bit - USB Key: FAT32  
 Command: Double speed "Touch Screen"  
 Display resolution: 240 x 400, 3"  
 DB Control: Volume/Sub/Balance/Fader/Tone  
 Preset Selection: 10 Presets  
 Directories: File/Artist/Album/Title

## DSP Processor

DSP Processor: Texas Instruments OMAP L-138  
 DSP Processing Power (clock): 450 MHz  
 Processor Resolution: 32 Bit  
 Proc. Working: Double precision 64 Bit  
 Processor Point: Fixed & Floating  
 Sampling Freq: 96 KHz (16 ch), 192 KHz (8ch.)

## ADC Processor

Processor: Asahi Kasei AKM AK5558  
 Processor Resolution: 32 Bit  
 Dynamic Range: 115 dB  
 THD+N: -106 dB  
 Sampling Frequency: 768 KHz  
 Number of Channels: 8

## DAC Processor

Processor: Asahi Kasei AK4458  
 Processor Resolution: 32 Bit  
 Dynamic Range: 115 dB  
 THD+N: -107 dB  
 Sampling Frequency: 768 KHz  
 Number of Channels: 8

## Analog Inputs

Low level (Pre): 6/8  
 Low Level Sensitivity: 1/5 Volt  
 Low Level Impedance: 5 KOhm  
 High Level (Speaker In): 8  
 High Level Sensitivity: 4/20 Volt  
 High Level Impedance: 200 Ohm  
 Aux Input: 1, 1/5 Volt  
 Independent Gain Control: 8 (for each ch.)

## Digital Inputs

Optical: 24 Bit - 192 KHz  
 SPDIF Coaxial: 24 Bit - 192 KHz  
 i2S by Z.COM Slots: nr. 3 x 24 Bit - 192 KHz

## Analog Outputs

RCA Output: 16 (HDSP-Z16), 8 (HDSP-Z8)  
 Output Volt (5 KOhm): 4 VRMS  
 Output impedance: 100 Ohm  
 Minimum Load Impedance: 2 KOhm  
 Ideal Load Impedance: Not less 5 KOhm  
 Output Volume Control: -100dB @ 0db

## Signal Stage

Frequency response (-3dB): 5Hz-45 KHz  
 S/N Ratio Digital In.: 114 A (0dB/1V 103/4)  
 S/N Ratio Analog In.: 109 A (1V-1V 101/2)  
 (5V-4V 110/11)  
 THD+N Digital In: 0,0008  
 THD+N Digital In (1V RMS Out): 0,0015  
 THD+N Analog In: 0,001  
 THD+N Analog In (1V RMS Out): 0,00175  
 Crosstalk at 100 Hz: 100 dB (average all ch)  
 Crosstalk at 1 KHz: 115 dB (average all ch)  
 Crosstalk at 10 KHz: 100 dB (average all ch)

## Connection

For Personal Computer: A USB  
 For USB Memory Stick: B USB  
 For Dash Board: RJ45  
 Wi-Fi External Module: Included  
 Z.COM Slots: 3 x i2S 24 Bit - 192 KHz  
 BT External Mod: CSR8675 Qualcomm aptx HD (optional)  
 Digital Devices: 2 Extra Digital Units

## Power Supply

Operating Voltage: 6-16 V  
 Current Draw: 750 mA at 14.4V  
 Operating Out Voltage: 1.8/3.3/5/+5/-+13  
 Conversion Frequencies: 250/570 KHz  
 Fuse: 1A

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## Crossover

General Features: 3 Indipendent Crossover  
 Graphics for Front, Rear, Effect tuning, Default  
 set-up for 16 speakers, Full / High-Pass / Low-  
 Pass / Band-Pass  
 Cross. Type: Linkwitz, Butterw., Bessel, Tsecheb.  
 Slope: 6-12-18-24-30-36-42-48 dB  
 Frequency Step: 1 Hz

## Delay/Polarity

Time Alignment (ms/step): 0/100 ms / 0.01 ms  
 Maximum Delay (cm/step): 3400 cm. / 0.34 cm  
 Delay Groups: All Channels: GP1, GP2, GP3  
 Polarity: 0/180°

## Equalizer

Front Equalizer (ISO 1/3 Oct.) Band:  
 HDSP-Z16V: 1-6 ch.: Parametric Eq: 30 Poles  
 HDSP-Z8V: 1-8 ch.: Parametric Eq.: 15 poles  
 Rear Equalizer (ISO 1/3 Oct.) Band:  
 HDSP-Z16V: 7-12 ch: Parametric Eq.: 30 Poles  
 Effect Equalizer (ISO 1/3 Oct.) Band:  
 HDSP-Z16V: 13-16 ch: Parametric Eq: 6 Poles  
 Dinamic Gain/Steps: +6dB -15dB - 0.1dB

## Phase

Phase Shift Frequency/Step: All Channels - 1 Hz  
 Degrees of Shift/Step: All Channels - 1 Degree

## VSEQ

THR Regulation: L-H @ 0 -18dB  
 Shift Frequency: 50-200 Hz - 1 Hz  
 Gain: 0-6 dB - 0.1 dB



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## All-in-one Dual Core Processor - Why Player more DSP?

Players (portable or non), often have a DSP inside, simple or sofisticated, but it is a DSP. Zapco has been inspired by this to offer its customers a professional DSP with the Player inside, and it is a bit the same thing. What are the advantages of our integrated solution compared to that of connecting a Player to the DSP? Meanwhile, it must be said that not all portable players have a digital output. If it were analogical, even if of excellent quality, it would always result in a degradation of quality due to the presence of two more converters on the signal path. Therefore a coupling with an external player on an analogue input is strongly inadvisable. If, on the other hand, the external player has a digital output, then the situation is much better than that of the analogue connection, but still there are the limit of an SPDIF connection. The SPDIF protocol have a maximum resolution of 24 bits and a maximum sampling rate of 192 KHz. Another limitation of the SPDIF connection is that the receiver does not control the speed of data, so it is possible to have connection problems. In any case, the maximum integration of the two products, dsp and player inside the same chipset, protects from any inconvenience of connection whatever the nature of the problem may be.

## High-End Solution: 18 independent PCB - Why Modular?

The modularity of the apparatus offers considerable advantages. The first advantage is that the customer can request the product with the cards that he needs without having to buy what he does not need. Subsequently it is possible to easily up-graduate a part of the product keeping all the rest unaltered. This allows to keep the value of the product higher over time. The 16-channel HDSP-V is composed of 18 boards such as the 8-channel HDSP-V of 15.

## 96 KHz (16 ch) and 192 KHz (8 ch) - What is the Sampling Rate?

The Sampling Rate represents the capacity of the digital signal to reproduce the analog signal more faithfully. The higher it is, the better it is, but the difficulty in processing the signal increases proportionally as well as the power of the processors used. 44 KHz is the sampling rate of a CD disc. The DSPs are normally at 48 KHz. 96 KHz and 192 KHz are the sampling rates of the most sophisticated DSPs. With 192 KHz sampling rate it is possible to have a 192 kHz digital signal line, starting from the Player up to the amplifiers.

## Up to 16ch, 0.0008% THD+N (Dig. In), 115 dB Crosstalk, 140 dB(A) Floor Noise, etc. - The HDSP-V Numbers

All these numbers are exceptional. Some of them still make the HDSP-V unsurpassed. For example the 16 channels. There are currently no other DSPs on the 16-channel Car Audio market. With it it is possible to have in the machine two perfectly calibrated listening areas and also 4 channels dedicated only to the effects. All the numbers are at the maximum that has been possible but two of them, more than the others, can give a measure of the meticulousness with which the HDSP was built and are the 140 dB of the noise plane and the 115 dB of the average crosstalk of the 16 channels at 1 KHz (and 100 dB, always average of the 16 channels, at 100 Hz and 10 KHz).

## Stop-Start Ignition System - Power Supply

The HDSP-V has no problems working perfectly with the new generation machines that use the stop and start injection system. This is because it has a power supply that can work from 5.5 Volt. And it can do it uninterruptedly, so not just for a few seconds, as it usually happens for other devices that have this function.

## Very accurate Phase Filter

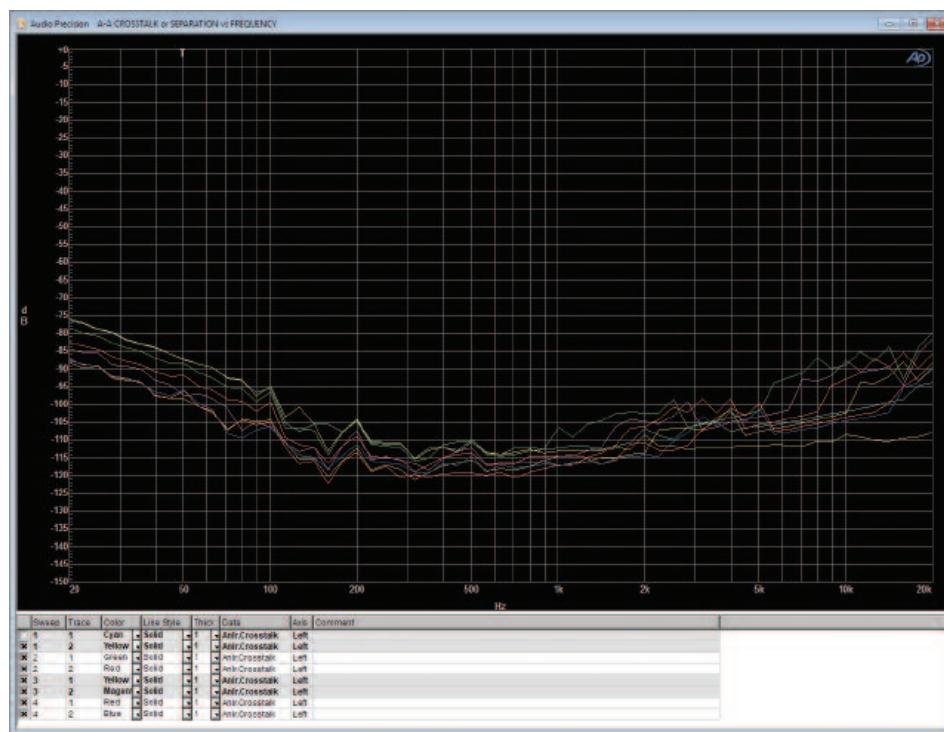
The HDSP-V has a very precise All Pass filter. In fact with it it is possible to fix the working frequency of the filter as accurate as 1 Hz and the phase degree of it also precise as 1 degree. It is a new possibility to change both data as normally until now it was possible to change only the degree of phase.

## VSEQ Filter

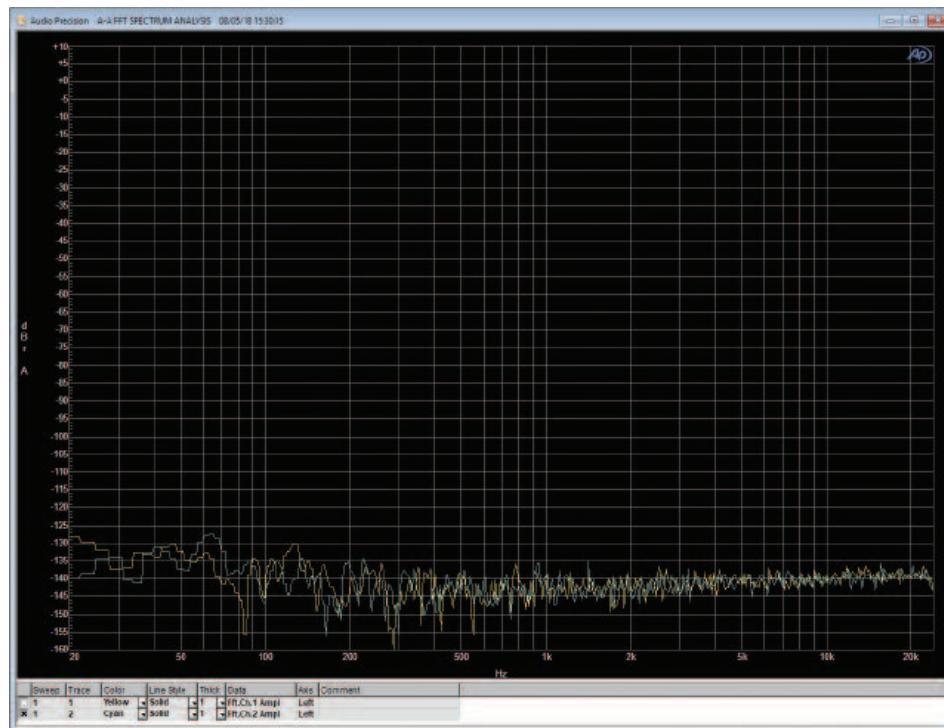
This is another innovation of the HDSP-V. Zapco has already introduced this function from long time in the analogue ASP-OE8 and ASP-OE2 processors. This allows to restore the response on the low frequencies of the OEM systems as it is altered by the original manufacturers in order to protect their weak speakers when the volume of the radio is increased above a certain level.



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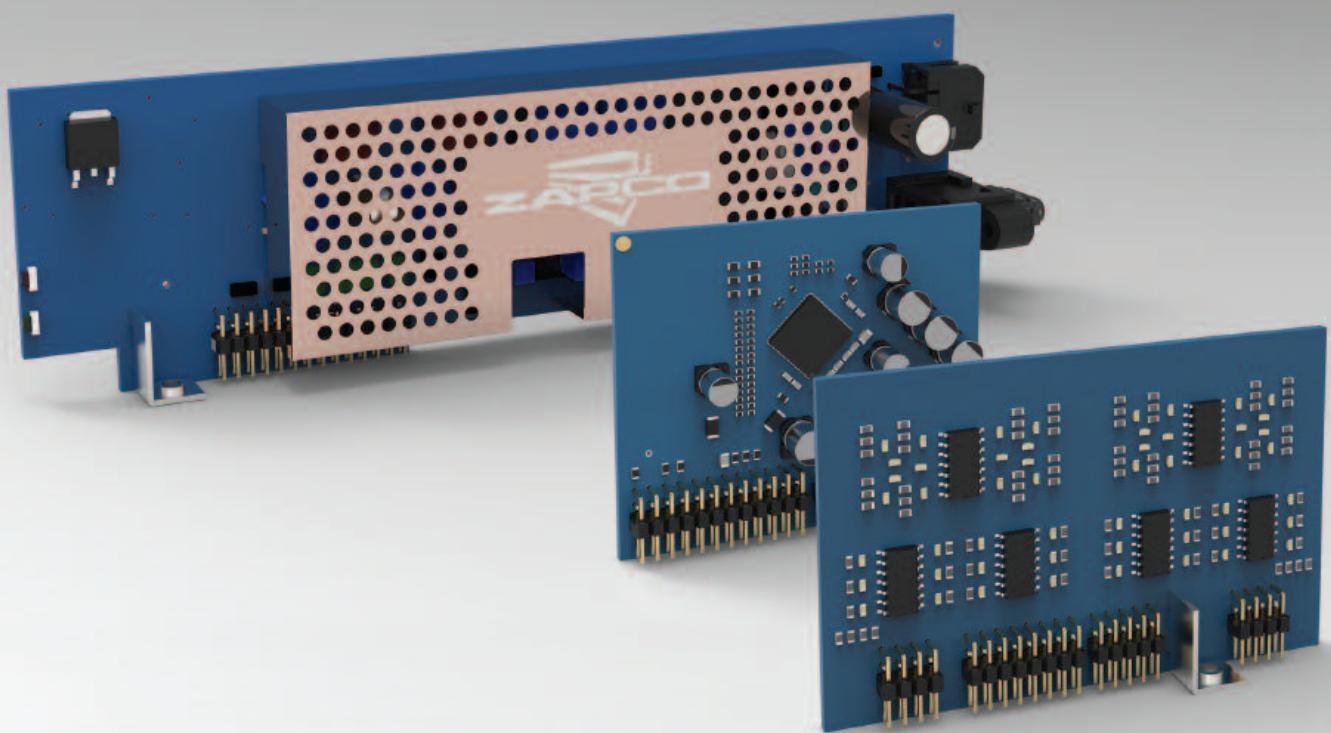


Two photos taken from the Audio Accuracy tool set used to create the HDSP-V datasheet. The measurements were taken from the prototype and the final production can be better. In any case, shown here are extraordinary data of **-140 dB of floor noise** with digital input (average over 100 Hz) and **115 dB of Crosstalk** in all frequencies from 300 Hz to 1 KHz (average of 16 channels).





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## Audiophile use of the HDSP - Upgradable internal modules/components

This HDSP, with both HD Player and RTA functions, has such high performance and so many functions that one might think it would be just the right choice for home use as well. We believe this to be the first mobile DSP that can be introduced in home sound rooms without reducing the signal quality of an audio system. It is possible to improve dramatically the sound performance in the listening environment using crossover functions for the speakers, equalization and time delay for environmental compensation. Then with amplifiers dedicated to each specific speaker (controlled from the same DSP processor) and accurate RTA you can have the best sound for your environment. Zapco thinks to provide a perfect line of signal path to the speakers and through the listening area. For that reason hardware and software will be easily up-gradable with different modules that can be changed later as the situation requires. What's the best sounding capacitor for audio that money can buy? What's the best sounding analog digital converter money can buy? If there was only one answer to questions like these, we wouldn't have so many choices. The differences between the run-of-the-mill electronic components and the top-end specialty audio components is night and day. But the differences between the top audiophile components is much more subtle, and open to debate and personal preferences. The same is true of digital components. In building the DSP-Z16V and the other 5th Generation Zapco digital processors, we used the very best components we could find for a production product. But knowing that there would be high-end users out there with their personal favorite ADCs or DACs, we programmed the DSP chips to accept any number of different top-end components to provide the more fanatic audiophiles the ability to easily customize the units to their personal tastes.

### DAC Kit A14 V

#### DAC Module (optional)

BB 4ch. 24 Bit, 129 dB st. Dynamic Range

### DAC Kit B14 V

#### DAC Module (optional)

AKM 4ch. 32 Bit, 120 dB st. Dynamic Range

### DAC Kit C18 V

#### DAC Module (included)

AKM 8ch. 32 Bit, 115 dB st. Dynamic Range

### D.Inp Kit V

#### Digital Input Module

768 Khz, Toslink, SPDIF, 3 x I2S

### A.Inp Kit V

#### Analog Input Module

1 ADC mod. + 4 x Analog Preamp. mod.  
+ 2 x 4 RCA mod.

### HDSP-V R3

#### 3" LCD TS Remote Control

The Player is controlled by a 3"Touch Screen color display. It can also be used to control volume, fader, balance, tone, and to switch instantaneously, by touch screen, from different tuning presets (up to 10 memory presets).

Display Size: 3" Touch Screen

Input Select: HD Player/Aux

Player Selection by: Title / Artist / Folder

Audio Funct.: Vol/Bal/Fader/Treble/Mid/Bass

### HDSP-V R1

#### 1" LCD Remote Control

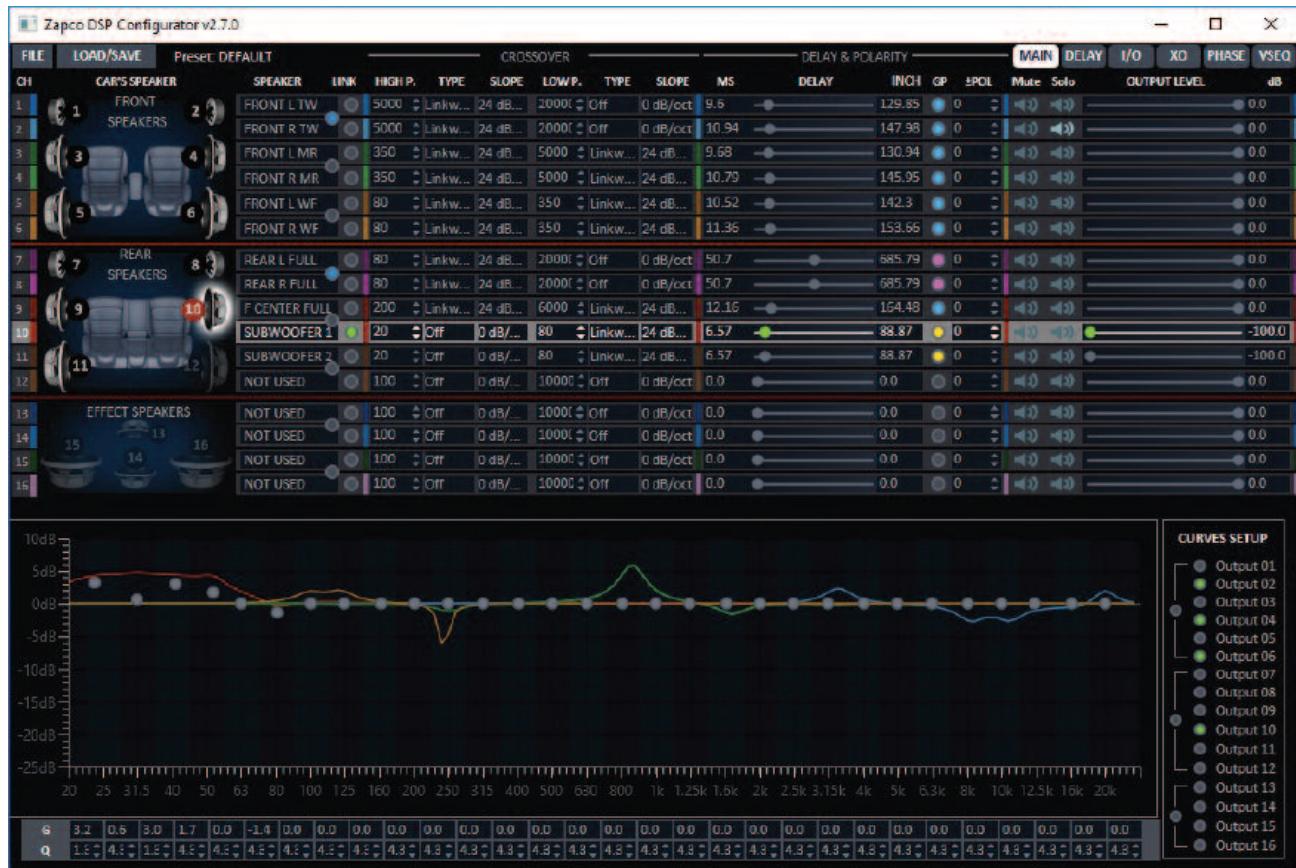
1" LCD Remote Control, Knob,  
10 Preset



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## HDSP-V Digital Control Program

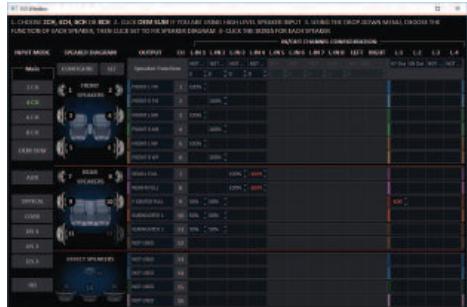
The GUI of the DSP-V has been designed to be simple and intuitive for everyone. But that does not mean it's less sophisticated. It is divided into three main sections which are the front, the rear and the effects. The tuning of the sound of the front seats and the sound of the rear seats provides two different and independent autotuning as well as the tuning of the effects. The main screen provides simultaneous viewing of all 16 channels with all adjustments. It is a summary screen for fine adjustments made channel by channel, while dedicated pages for each major function allow you to focus on one function and conveniently set all the channels together. Auto-tuning guides the different phases starting from the correct connection of all the components, the adjustment of the levels of the amplifiers and of the DSP all to obtain the best performances in terms of sound quality. For experienced tuners there is also manual adjustment of all functions with maximum adjustment resolution.



Still other pages will allow you to make true phase adjustments to a channel when needed, using all-pass filters, and to compensate for active equalization in OEM systems for seamless sound at all volume levels using volume sensitive equalization. This is especially useful in many cars that reduce the level of bass frequencies at higher volume.



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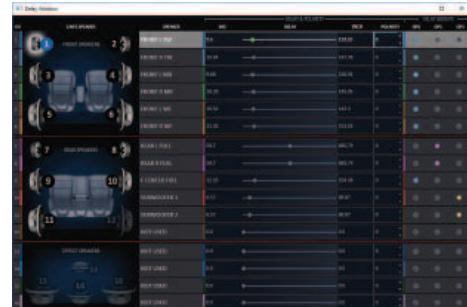
## I/O Matrix

The Input/output (I/O) matrix allows the manual tuner to determine which input will be used for each output. A default matrix, of course, will be entered based on entries when you first open the program. Access to this matrix though, allows you to map out your own system by simply clicking into the box where the desired input meets the desired output. It also allows you to use multiple inputs for the same channel and to create special effects by using the sums and differences of multiple inputs for a single channel. Clicking in multiple inputs will automatically adjust the total input to remain at 100% but you can change that by typing in the desired percentage of each input to be used.



## Crossover

The crossover page of the Series V DSP makes crossover setting easy and clear. You can choose the filter style you want and the slope (from 6dB~48dB) by simply clicking into their boxes. You can choose the frequencies by typing into the boxes or by using the up/down arrows. The graphs at the right will always show all the crossovers for each section, and the large graph below will always show the active channel's crossover. You can use the "Curves Setup" buttons to bring down the curves of other channels to see how they interact more clearly. Right/Left channels are paired by default but can be separated as needed.



## Delay & Polarity

The page allows you to set the signal delay for each channel. You can also set the polarity of each speaker to make sure they are all in phase with each other. Phase must be correct before setting delay as they are two aspects of the same function. After the polarity of each speaker is confirmed, the distance from the listening position to each speaker is measured in either centimeters or inches and entered. The DSP will then calculate the delay for that speaker in milliseconds. Each channel can be assigned to one of three delay groups so a group of speakers can be moved (in time) together during fine tuning.



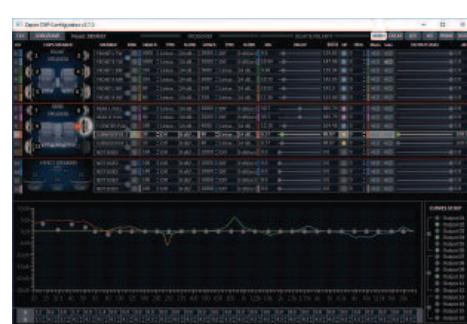
## All Pass/Phase

The HDSP V GUI uses all pass filters to give you complete control of phase. There is one all pass filter for each channel that allows you to choose the target frequency for a phase shift and to choose the amount of phase shift from 1° to 359°. While the most common use of the phase control is to compensate for the phase changes caused by a crossover, it can also be used to eliminate an acoustic null in the in-car response caused by a 180° phase difference between the right and left channels at a given frequency. NOTE: Phase can be very useful, but it can also be dangerous to a sound stage but creating new problems when over used. We recommend it be used sparingly and by experienced tuners.



## VSEQ

Over these past 10 years car makers have made it more difficult to change out the factory stereo. Unfortunately, the factory stereos leave much to be desired and drivers want to improve the sound systems with new amps and speakers. But even after adding new amps and speakers problems exist because the car makers often equalize the stereos. The most common issue is that car makers roll off the bass frequencies at high volume to protect their equipment. The VSEQ allows you the correct for that factory bass roll-off seamlessly with a graduated change. The VSEQ puts the frequencies back at the same volume the factory has removed them by digitally reading when the change starts and when it stops.



## Equalizer

The main page holds the Equalizer Graph. Each of the channels 1~12 has 30 parametric filters, and the channels 13~16 have 6 parametric filters each. The filters can be put at any frequency and the Q of each is variable from 0.5 to 15. The filters allow the gain to be applied from +6dB to -15dB. When a channel is chosen the graph of that channel is always displayed. You can also pick any other channels to be displayed along with the active channel. If during the process you need to undo any changes you can reset the channel to Default or you can reset it to the last saved preset. Adjustments can be made quickly using the keyboard arrows or in steps of only one frequency or 0.1db of gain can be made by tapping the arrow keys.