

CAR & HIFI

INTERNATIONAL

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European Edition

Featured brands

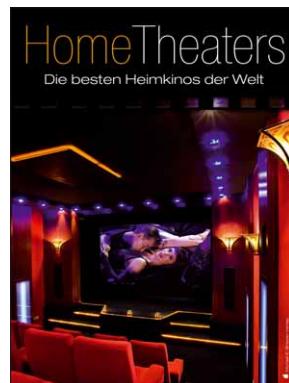
- Audio System Germany • Brax
- ESX • Eton • Ground Zero • Helix
- Kenwood • Match
- Musway • MTX • Zenec

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- Compact subwoofer



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Good times

Remember the good old times of car audio? Cars were fitted with multiple amplifiers and huge subwoofers, and optics got designed to make the biggest possible difference to factory look. There has been changes to almost everything.

Today's cars are as a matter of fact more complex, mechanically and electronically, so that today's car entertainment works differently than it did 10 years ago. Also the typical audio installation has changed. 'Less is more' says it all. Contemporary installations use less and smaller components while innovation and technology compensates extensive use of material.

Today's younger drivers still want to have fun in their cars as a hobby and the available equipment is better than ever. Meanwhile the older ones of us may have preserved their

audiophile streak over the years to come back to some sophisticated entertainment in their everyday car. There's good news for everybody!

We now have retrofit devices that integrate seamlessly into the vehicles factory electronics, we have comfortably usable smartphones that connect the rest of the world to every car. We have neatly developed audio components like vehicle specific speakers that fit effortlessly and bass solutions without wasting lots of space. We have devices for perfect signal processing with huge potential to improve sound matching in-car acoustics as well as the listener's

taste. This is good times, too. The good new times that could even be better than the good old times.

So welcome to CAR&HIFI, the new magazine that comes to your screen with the latest reviews of premium components that make in-car life more comfortable and more enjoyable.

Have fun
in your car!



Elmar Michels
Editor-in-chief





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Sound upgrade in the Benz p. 46



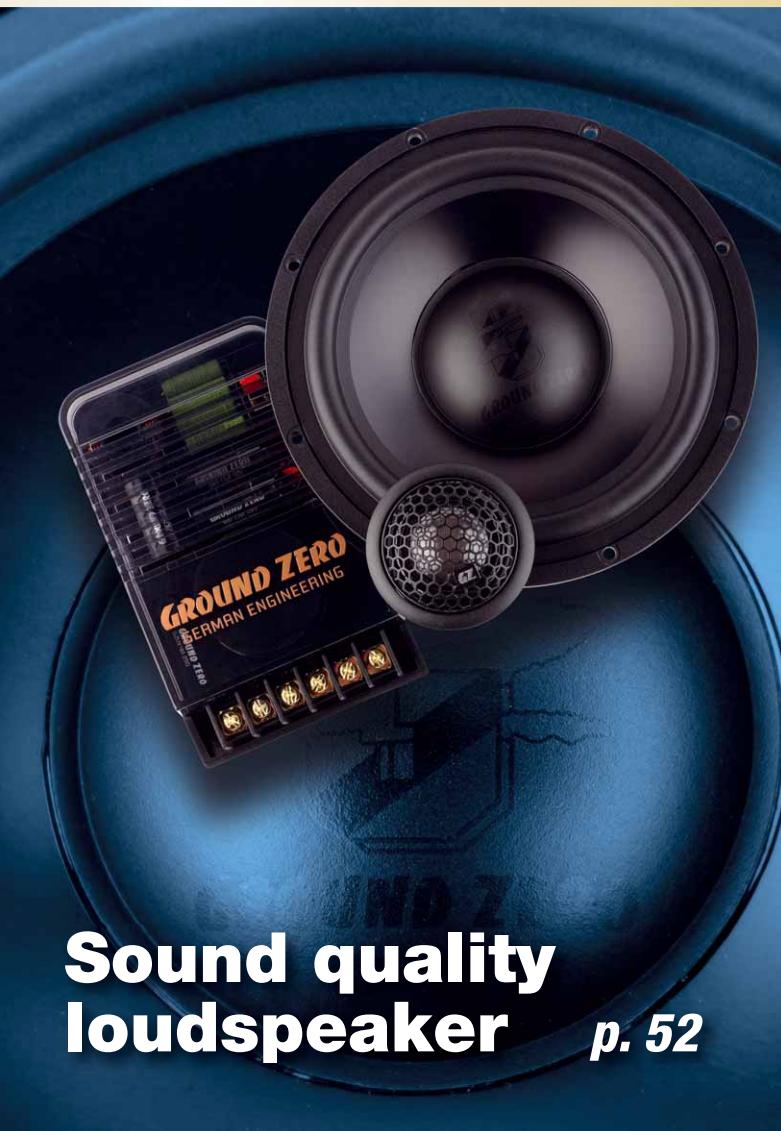
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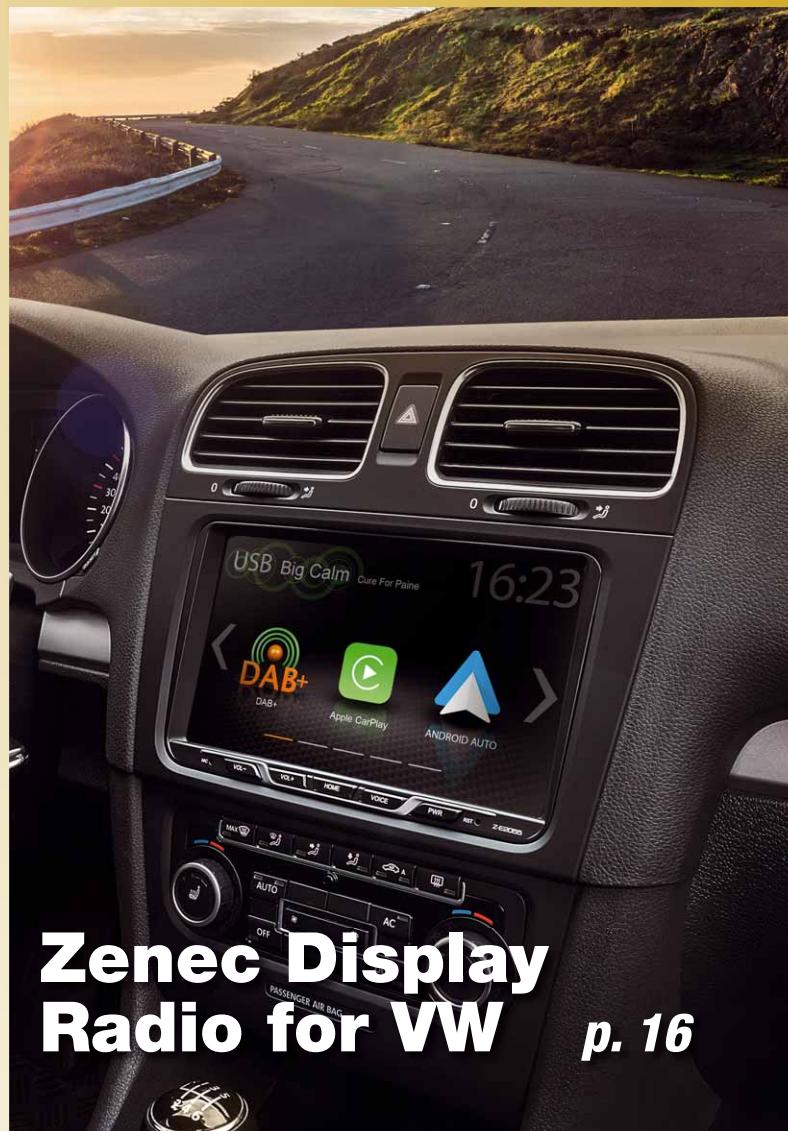
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► Switch to DAB inexpensively with Pioneer



external microphone.

● www.pioneer.eu

Not every radio listener with the desire for digital reception wants to switch to an extensively equipped screen device right away. For these customers, Pioneer now has the MVH-130DAB (89 euros) and MVH-330DAB (109 euros) in its product range. Equipped with DAB / FM and a USB interface, they concentrate on the core functions of a car radio and simplify installation thanks to their shortened chassis. The MVH-330DAB also offers an integrated Bluetooth hands-free system with an external microphone.

► ZEUS ZXS PREMIUM

Even fans of fat bass sometimes have to think a little slimmer when it comes to the enclosure. The subwoofers from Hifonics also play extremely well in very small, sealed boxes and in somewhat larger bass reflex systems. In the woofers, scooped paper cones with double-stitched beading are used, which have also been impregnated with a special coating. Optimized in this way, they can withstand the high pressure in small housings. The ZXS ZEUS woofers, which are available as 8, 10 and 15-inch models, can also be seen visually for their power: Large double magnets with pole core holes and ventilation ducts signal pure power. Matching 2 + 2 ohm dual voice coils are used.

● www.audiodesign.de



► Flat woofer from Audio System Germany

Under the names AX08 US and AX 10US, the Audio System dealer has two new specialists for tight spaces available. The subwoofers in the sizes 8 inches (20 centimeters) and 10 inches (25 centimeters) are suitable for use in small, sealed boxes and they are so flat that they also fit in under-seat housings. With an impedance of 2 ohms, they are also ideal for small digital amplifiers.

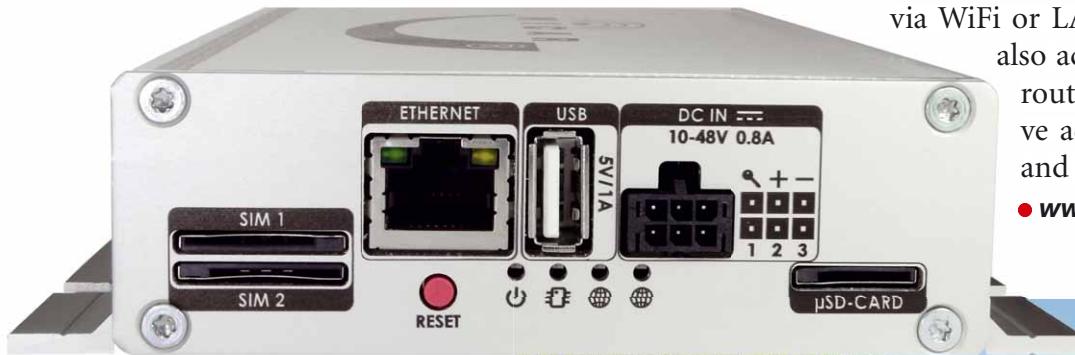
● www.audio-system.de

► Always well connected with WiCAR

With WiCAR, Antennentechnik Bad Blankenburg (ATTB) brings digital possibilities and the digital lifestyle to mobile homes. The small, compact LTE router is a real all-rounder. In combination with powerful antennas, it

not only enables extensive infotainment, internet access via WiFi or LAN cable and mobile work, but also access to the home network, GPS route tracking and SAT> IP. Extensive additional functions for comfort and safety round off the equipment.

● www.attb.de/en



► Sony ES speakers

Sony introduces the Mobile ES product line with in-car speakers and a subwoofer. The new line, consisting of the models XS-162ES, XS-160ES, XS-690ES, XS-680ES and XS-W104ES, is made with a number of technical innovations for authentic listening experiences in the car. The new ES product line includes the following devices: the 2-way component loudspeakers XS-162ES (16 cm), the 2-way coaxial loudspeakers XS-160ES (16 cm), the 2-way coaxial loudspeakers XS-690ES (16 x 24 cm), the 2-way coaxial speakers XS-680ES (16 x 20 cm) and the subwoofer XS-W104ES (25 cm).

● www.sony.net



Retrofitting all OEM Configurations

BMW Sound Upgrade

► Especially with the most recent premium vehicles, a music enthusiast is often left clueless in case he is not satisfied with the factory sound. The question "What else can be done here?" is usually answered with "Depends on the equipment". We show solutions for all models and equipment from BMW. Many things also apply to Mini's corporate sisters.





The bass reflex enclosures of the woofer are placed to the right and left of the V TWELVE DSP, they can be easily removed if necessary

Two 10-inch helix K 10W subwoofers are responsible for the low bass. The 2 x 2 Ohm dual voice coils harmonize beautifully with the V TWELVE DSP



Of course, the Clubman trunk remains fully usable.
There are a power amplifier and two bass cases under the floor.

The buildings shown in the pictures in this article are the facilities of Audiotec Fischer. We are on location in Schmallenberg/Germany in order to find out what can be done to improve the sound in recent BMW and Mini vehicles. Audiotec Fischer owns the brands Brax, that features only high end audio completely „Made in Germany“, Helix, where you can find a complete audio range for everyone and Match. The latter will be the most important this time, since Match products are designed for easy integration (mostly plug&play) into modern vehicles. Of course, there is lots of components for BMWs like speakers, subwoofers and, of course, DSP amplifiers. DSP products by Audiotec Fischer are famous for their sophisticated features provided by their proprietary software „DSP PC-Tool“, and we will learn how these products make it as easy as possible to integrate a new sound system into a BMW or Mini.

In fact, the retrofit strategy depends on the characteristics of the vehicle. This is not only true for BMWs, but also applies in general. The question is always how and where can an audio signal for the retrofit system be obtained. This system normally consists of one or more amplifiers, speakers and, optionally, subwoofers. Traditionally, a clean, linear stereo signal is expected, and this is still the ideal case today. If such a thing is available in the vehicle in question, for example as a cheap combination of factory radio and amplifier, you are in luck. If there is a MOST adapter for the vehicle, it is fine too, there will be a first-class signal while maintaining the original operation and functions. Even if the factory system provides a separate signal for front, low, center, etc., it can be used for equalizing, time alignment and all-pass filters from the factory. Fortunately, the car audio industry has not been missing out recently. In

the meantime, it produced devices that are either switched between the vehicle and the retrofit amplifier or directly include amplifiers that master vehicle integration. The Sauerland company Audiotec Fischer, which offers a wealth of solutions for all kinds of retrofit issues with its brands Match, Helix and Brax, has particularly distinguished itself in this discipline. The key to the vehicle is usually a digital signal processor paired with sophisticated circuits for adapting to the factory system. This works great, because nowadays such a DSP can not only manage the sound, but also adapting, compatibility, summation and measurement of signals, and together with the software features it can crack almost any vehicle. The retrofit options made possible with this are manifold, could be anything from a cheap and uncomplicated flash upgrade to a high-end audio system.



The brand new BMW speakers from Match offer installation solutions for any desired positioning

BMW Retrofit

As already mentioned, the possibility of retrofitting depends not only on the vehicle model, but also on the factory equipment. The latter is even crucial. Because there can be a „small“ or a „big“ entertainment system installed in the 2 series, or in the 5 series, or in the X6. The first step is finding out which factory package is there, for example, in case of a second-hand vehicle. Here we exa-

mine all the music equipment range from small to big.

Configuration 1: The Stereo system

For BMW, „stereo“ stands for the most affordable audio equipment available. A factory fitted simple radio unit without an additional factory amplifier. The speaker equipment is usually basic, which means one

full-range speaker per door and the typical BMW under seat woofers. Retrofitting is easy, because the factory radio has a common high-level signal. In order to enhance the sound quickly and cheaply, as



HK system housings were installed to accommodate the Match tweeters

The 10 cm bass-midrange drivers of the Match system are installed in the doors

first you install the Match M 5DSP. Thanks to a suitable wiring harness for easy signal access, this can be done quickly via plug&play. The small power amplifier can be placed in the radio bay, and DSP setups are already available. As an option, a power supply for the high-power mode of the M 5DSP can be installed in the trunk. Furthermore, a small subwoofer can be operated along with it, and can also be easily removed. As a third step, the factory speakers are replaced, here come the brand-new sets of Match. Even then, the specialist dealer only needs a few hours for a professional installation of this equipment worth about 1,200 euros

Retrofit of the “Stereo”

- Match M 5DSP
with a matching wire harness
- Optional subwoofer
Match PP 10EQ
- Optional front speaker Match UP C42BMW-FRT.2 with
the UP W8BMW-D woofer kit

Configuration 2: The HiFi 676 system

The second-most affordable BMW package “HiFi 676” has a pre-installed small 7-channel amplifier in addition to the factory radio. This is usually bypassed, but again, Match offers the right set of cables. In order to operate the entire factory speakers adequately, the seven-channel Match UP 7BMW will be retrofitted, which can be done again via plug&play and available DSP setups. Here, too, the Match speakers can dramatically improve the sound quality. Everything is possible with the DSP power amplifier.

Retrofit of the “HiFi 676”

- Match UP 7DSP
with a matching wiring harness.
- Optional front speaker Match UP C42BMW-FRT.2 with the UP W8BMW-D woofer kit,
rear speaker, center

Configuration 3: the RAM system

Since 2019, BMW has been using the “RAM” (Receiver Audio Module) for higher-quality equipment, in which the factory radio, amplifier and a number of vehicle functions are connected in a common unit, so at this point, you can not just get straight to the radio. Here is an integrated 7-channel amplifier, its outputs use a diagnostic function to monitor the factory speakers and must be used for retrofitting. The Match UP 7BMW is again recommended as an amplifier, which can be increased up to 6 inputs with the MEC Analog In add-on module. The available RAM cable set, like the Match power amplifier, serves the diagnostic function and is available as a bundle with UP 7DSP for € 979. For all factory speakers to work, a center signal is generated using the RealCenter algorithm. As always, the original speakers can be completely replaced by Match components.



A tailor-made connection cable is available for RAM systems installed after 2019, it includes the speaker diagnostics as well.



For a cost-effective sound upgrade, there is the tiny Match M 5DSP that fits in the radio bay. UP 7DSP offers 7 channels and more power



Retrofit of the “RAM” system

- Match UP UP 7DSP
+ MEC Analog In
with matching wiring harness
- Optional front speaker Match UP C42BMW-FRT.2 with the UP W8BMW-D woofer kit, rear speaker, center

Configuration 4: Harman Kardon Sound Package

The sound package by Harman Kardon is the top equipment on all BMWs. A fairly large 9-channel amplifier (1 and 2 series come with a smaller 7-channel amp) is installed

here, and there are also factory fitted premium speakers from Harman Kardon. A special feature of this one are the 8-ohm type under seat woofers. These should definitely be replaced during a retrofit, as the performance improves significantly with the 2-ohm type by Match. Midranges and tweeters of Harman Kardon can be left in place, because with the Match UP 10DSP, a power amplifier with a signal processor is added. The signal can be pulled out of the vehicle's MOST25 bus with the SDMI adapter and a matching cable set. The HK amplifier is

no longer needed. The retrofit costs comprise 1986 Euro equipment value plus approx. 6 hours of installation.

Retrofit of the HK sound package

- Helix SDMI
- Match UP 10DSP
with a wiring harness on SDMI
- Up W8BMW-S 2 Ohm Woofer Kit

Premium Sound for Mini

What has been said so far can also be applied to Mini, Minis usually have the same installation slots as BMW and there are comparable sound packages. In contrast to the previous upgrade with plug&play, we have a special Mini specimen here, which had a complete retrofit from Autohifistation Lemgo. This Mini is a special model F54 Clubman JCW 4All, a joy for its owner Ralf Dierkes in his everyday life and also on long distance trips. Ralf has been regarded as a Mini specialist for years and his company has earned an excellent reputation on the Mini stage. You can see that right away on this own Mini. The factory fitted equipment has been kept as scarce as possible in terms of retrofitting, it is the small Mini Hi-Fi system. Here, too, there is a set of cables, in our case on loose ends, since the Helix V TWELVE DSP uses a full-grown 12-channel power amplifier that is not powered by Molex plugs. The speakers have been replaced to use the brand new two-way system from Match at

Originally there are only broadbands in the doors. The Match loudspeakers for BMW are suitable for Mini as well



the front, while the passive crossovers remain in the box. The UP W8BMW-S 20 under seat woofers also come into the bass enclosures, where the factory fitted 16s used to be. Furthermore, a coax is installed as a rear system. For a rich deep bass, there are two helix K 10W in separate, custom-made bass reflex housings in the trunk floor, they can be removed if necessary. Each K 10W has 2 x 2 ohm voice coils that run on 4 channels of the V TWELVE DSP. Additional channel pairs are available for rear, front woofer, mid-range and tweeter, and the V TWELVE DSP can control everything actively. In order to easily dispense the subwoofers, a remote control is installed and the corresponding Bluetooth expansion module is located in the V TWELVE DSP for wireless music streaming. Since the vehicle did not have any tweeters from the factory, Ralf installed the original Harman Kardon cases, now sitting in their place on the A-pillar.

Soundcheck

Wow – the first beats we hear in the Mini Clubman already bring in

Who is Audiotec Fischer?

Founded in 1990 by Heinz Fischer in Schmallenberg, Germany, Audiotec Fischer has established the brands Brax, Helix and Match, shipping now to more than 50 countries. Having started in the analog domain, Audiotec Fischer products now cover everything from analog high end to cutting edge DSPs and DSP amplifiers. The main emphasis today is on the digital world - both hardware and software - led by Julian Fischer in the second generation. The company is also a direct supplier to the automotive industry, complying with highest industry standards. As a consequence, Audiotec Fisher products are completely developed in house and most of them manufactured directly in Schmallenberg, thus being „Made in Germany“.

more impact than just raised eyebrows. Considering that except the for noble V Twelve DSP (which has 12 channels too!) only affordable components are installed, this is almost unbelievable. But it sounds amazing! The entire soundscape reaches the ear in super crisp quality, it sprays with dynamics and is pure pleasure. From the very start, the system sweeps the listener along and puts him in the middle of the music. This is possible due to the spectacular staging that Ralf Dierkes has reached with the components. An insane stage actually piles up in front of the listener and the instruments are literally tangible. With electronic music, the whole thing works splendidly too, this is where the real fun begins. The same goes for level stability and bass power, no wishes remain unfulfilled, this system offers enough and more. Even quiet sounds or vocal inlays are a flawless delight. Voices and instruments sound in perfect timbres and you can hear and fully enjoy all the tones and quirks of singers and instruments. The whole thing plays together fantastically, so that you are perfectly equipped for a long drive. Spectacular and balanced at the same time - a true masterpiece.

Conclusion

There are always some improvement options, even for the most recent vehicles and for factory sound packages. The industry offers sophisti-

cated equipment for the integration of a hi-fi system, and the specialist dealer/installer can offer solutions from low cost to high-end, which can be easily brought into the vehicle without insane effort. So, nothing stands in the way of good sound.

Elmar Michels

Mini F54 Clubman JCW 4All

System price	2565 – 3365 Euro
Installer	Autohifistation, Germany
Hotline	05261 6600230
Internet	www.autohifistation.de

Rating

▶ Sound	70 %	★★★★★
Bass foundation	14 %	★★★★★
Neutrality	14 %	★★★★★
Transparency	14 %	★★★★★
Soundstage	14 %	★★★★★
Dynamics	14 %	★★★★★
▶ Practice	20 %	★★★★★
Installation	3,3 %	★★★★★
Features	3,3 %	★★★★★
Handling	3,3 %	★★★★★

Components

Headunit original	-
Amplifier Helix V TWELVE DSP	1,500 – 2,000 Euro
Front speaker Match UP C4BMW-FRT.2	220 – 270 Euro
Front woofer	
Match UP W8BMW-S	280 – 330 Euro
Rear speaker Match UP X4BMW-FRT.2	130 – 180 Euro
Subwoofer	
2 x Helix K 10W	27 – 320 Euro
Streaming module HEC BT - V	
TWELVE DSP	130 – 180 Euro
Remote Control URC.3	35 – 85 Euro

Top Class



CAR & HiFi
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Price/performance: excellent
“Top sound and manageable effort”

Perfect fit for VW Golf V/VI and many more

Zenec Z-E2055:
Vehicle-specific infotainer
for VW, Seat, and Skoda

Zenec Display Radio for VW

- The Zenec Z-E2055 brings state-of-the-art infotainment to the dashboard of the Golf V, VI, and many other used vehicles of the Volkswagen Group.





Source selection with large icons



Automatic climate control



The list of vehicles compatible with the Z-E2055 is long. It includes almost 50 VW, Seat, and Skoda models built between 2003 and 2019, many millions of which are still on the road and will be for years to come. However, the factory-fitted

RNS 210/310/315/510 and RCD 310/315/510 car radios from Volkswagen are now hopelessly outdated. The new Zenec Z-E2055 now brings modern infotainment to these vehicles.

Smartphone connectivity including Apple CarPlay and Android Auto

Connection to the Car

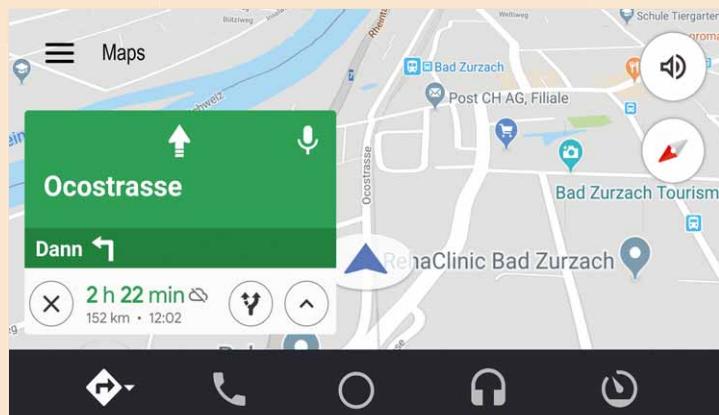
The Zenec Z-E2055 has the proper connections for VW models. It communicates with the vehicle electronics through the included CAN bus module and supports the factory functions. Thus, the control works via the buttons of the multifunction steering wheel, and station info and ID3 tags are shown on the VW display in the dashboards. Climatronic and the OPS optical parking distance system also remain functional. It even works with a factory-fitted Dynaudio sound system.

9" Monitor

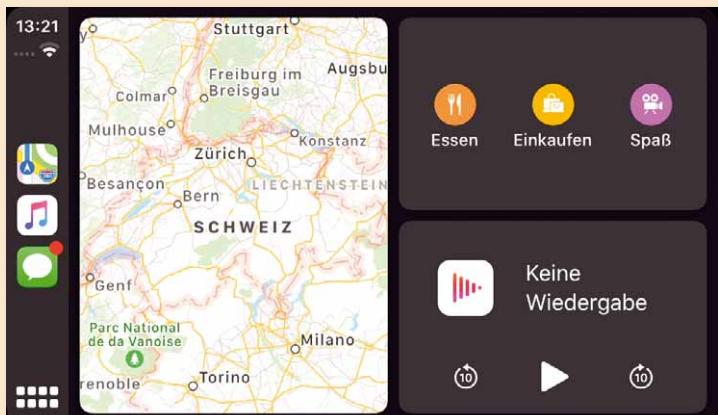
The Z-E2055 also makes ideal use of the VW dashboard's space. Its front



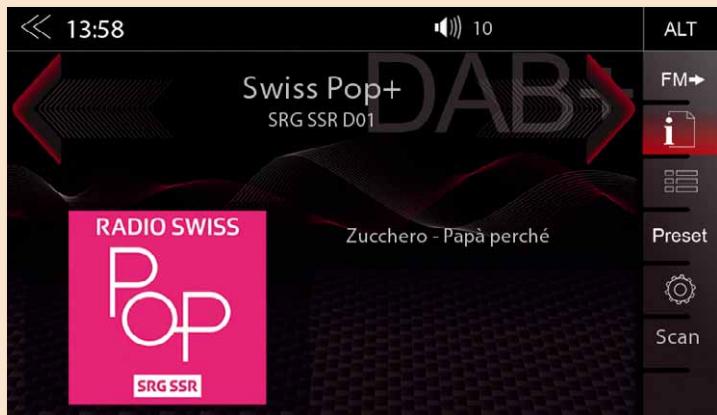
Parking distance system OPS



Navigation with Google Maps



Apple Car Play via USB



Digital radio DAB+ with large slide show display

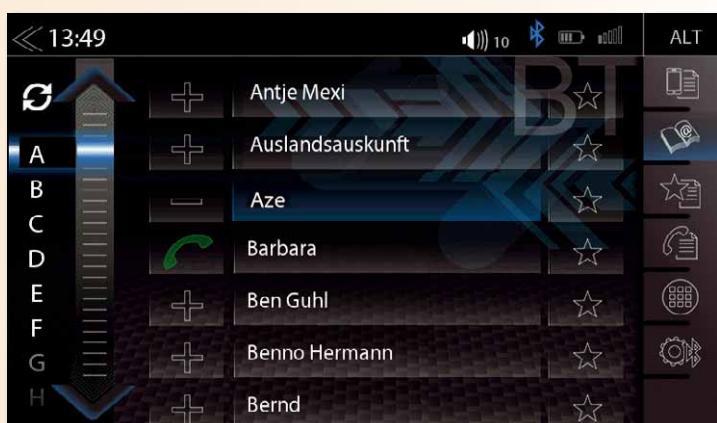
incorporates a generous 9-inch touchscreen (22.9 cm) and large touch buttons. Five buttons at the bottom edge make the Z-E2055's operation easier.

In addition to the volume buttons, a central home button allows you to access the main menu and select sources by simply pressing a button. Voice control is activated via „Voice“ in Android Auto and Car Play. A short press on „PWR“ mutes the Zenec; a long press completely turns it off. The illumination of the keys can be set to red or white.

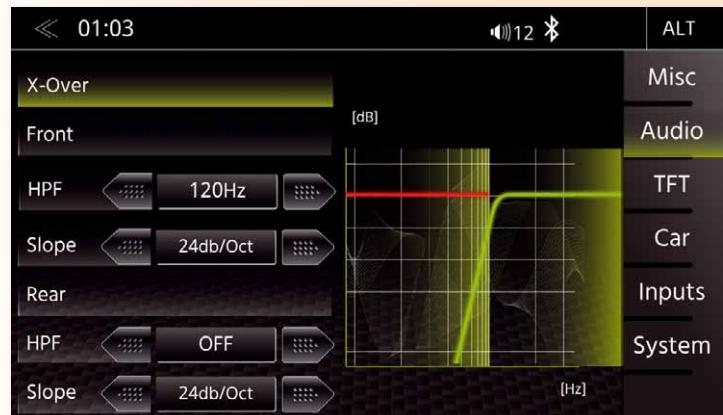
Connection to the multi-function steering wheel



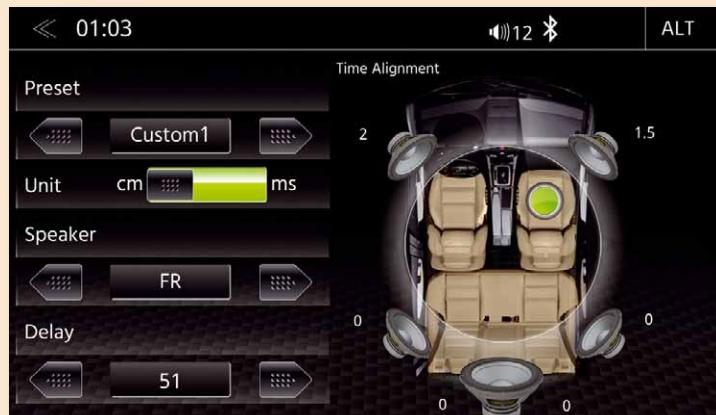
Analog radio reception via FM



Convenient hands-free operation



Crossover adjustment



Digital delay correction

Double USB

The back of the Z-E2055 provides two USB ports. For example, a stick with your music collection can be connected to USB 2, while USB 1 establishes contact with the smartphone. If you connect an iPhone (from iOS 7.1.X), Apple Car Play is available on the Zenec, and Android Auto is available for Android phones from Android 5.0 (Lollipop). Both systems are functionally comparable. They offer a well-organized user interface adapted to the application in the car and enable secure access to numerous phone apps. Control is via the touchscreen of the Zenec or

simply by voice input. Compatible apps include the media player, telephony, messenger services, navigation, and many more. In combination with a smartphone, the Zenec becomes a full-fledged receiver.

Digital Radio

The Zenec is also up to date in terms of radio reception. In addition to the tuner for receiving analog stations via FM, the Z-E2055 is also capable of DAB+ digital radio. By pressing „Scan“, the radio searches for all DAB stations available at the respective location. These can then be conveniently selected from the list

and listened to in noise-free quality. MOT slideshow and DLS text are displayed. If you change the broadcast area, the Zenec automatically stays with the station you just listened to, thanks to DAB<>DAB service following, as long as it is broadcast in both areas.

Bluetooth

In addition to the USB connection, you can pair phones wirelessly via Bluetooth. Thus, convenient hands-free talking and audio playback via A2DP is available via the car radio. You can make calls via the microphone integrated in the front or

Control of the MFA



Who is ACR?

Started in 1975 with a 28 m² shop for home loudspeaker kits in the heart of Zurich/Switzerland, ACR Braendli + Voegeli AG is today one of the largest distributors of car audio and car multimedia products in Europe. The ACR range comprises eight established brands, exclusively distributed by ACR: Axton, Emphaser, Eton, Focal, Radical, Spectron, Xzent, Zealum and Zenec. The company is certified according to DIN EN ISO 9001:2015 in the areas of engineering, import & export, logistics and sales & marketing since November 2009. There is a large dealer network with a three-digit number of shops in the DACH / Benelux region and numerous distributors in various EU and non-EU countries.



the external one included. Calls can be initiated conveniently from the phonebook or the calls list. Manual number entry is also possible via a ten-digit field. The large touch-screen offers plenty of space for this.

Audio

Music can be played from a USB stick or a phone connected to the device. The music can be sorted and played according to different playlists. This is done very conveniently;

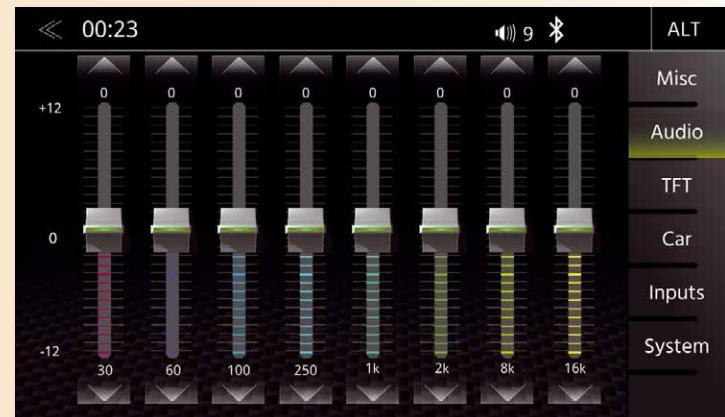
information about the artist, song title, album, genre, and the cover art is displayed. The same applies to videos, which can only be played when the car is stationary and the handbrake is pulled.

To ensure that everything sounds as good as possible, the Z-E2055 has a signal processor that allows precise sound adjustment in expert mode. The frequency distribution can be made for active systems via high-

pass and low-pass filters with adjustable frequencies and slopes. An eight-band equalizer handles tonal adjustment. And even a digital delay correction for perfect spatiality is on board. All settings are conveniently made in menus with a graphical display that is as beautiful as concise. You can deactivate the expert mode for quick audio settings on the go. In this case, some equalizer presets, balance, fader, subwoofer level, bass boost, and loudness are available.



Subwoofer control



8-band graphic equalizer



The Z-E2055 fits
exactly into the
VW radio bay

Connections

The Zenec makes contact with the vehicle via the supplied Quadlock II connector. For Quadlock III vehicles, Zenec offers the matching cable hub as an accessory. In addition to the two USB sockets, there is even an HDMI interface and a 4.2 preamp output for external amplifiers. You can control additional monitors via an RCA AV output and connect external AV feeds via RCA. Another input is meant for the rearview camera. The camera activates automatically when reverse gear is engaged or manually by pressing the camera icon in the main menu. It is also possible to set parking guidance lines.

Operation

Zenec places particular emphasis on the design of the user interface. Thus, the Z-E2055 has also succeeded very well in making the menus concise and user-friendly. At the same time, the graphics look sleek, so that operation is easy and a pleasure.

Zenec Z-E2055 vehicle compatibility

For many Volkswagen, Seat, Skoda with Golf V/VI platform. Comprehensive compatibility list: www.zenec.eu.

Conclusion

Perfect vehicle connectivity, modern functionality with DAB+, Bluetooth, Android Auto, and Car Play, excellent usability with a large touchscreen – the Zenec Z-E2055 is the ideal infotainment solution for VW Golf V, VI, and many other used cars from VW, Seat, and Skoda.

Dipl.-Phys. Guido Randerath

Specifications

Amplifier power	15
Output voltage/V	3.3
Output impedance/ohm	533
USB	
THD+N (%)	0.009
SNR (A)	89
Tuner	
THD+N (%)	0.039
SNR (A)	57
Crosstalk (dB)	43
Monitor size (cm)	22.9
Touchscreen	-
Dual Zone	-
Dolby Digital / Pro Logic decoder	-
Parametric/graph. EQ bands	- / 8
Crossovers	HP / TP
Delay correction	•
Pre-outs	6
AV-in / AV-out	• / •
Digital output	-
Connection camera / navigation	• / -
USB front / rear	- / 2
iPod control	•
Bluetooth HFP/A2DP	• / •
Other	CarPlay/Android Auto

Zenec Z-E2055

Price 560 Euro
Contact ACR, Switzerland
Internet www.zenec.com

Rating

▶ Sound	20 %	★★★★★
Bass	4 %	★★★★★
Neutrality	4 %	★★★★★
Transparency	4 %	★★★★★
Spatiality	4 %	★★★★★
Dynamics	4 %	★★★★★
▶ Image	20 %	★★★★★
Sharpness	3,3 %	★★★★★
Brightness	3,3 %	★★★★★
Contrast	3,3 %	★★★★★
Color reproduction	3,3 %	★★★★★
Viewing angle	3,3 %	★★★★★
Reflection	3,3 %	★★★★★
▶ Lab	15 %	★★★★★
• USB	7,5 %	★★★★★
Distortion	3,75 %	★★★★★
Signal to noise ratio	3,75 %	★★★★★
• Tuner	7,5 %	★★★★★
Frequency response	1,88 %	★★★★★
Crosstalk	1,88 %	★★★★★
Distortion	1,88 %	★★★★★
Signal to noise ratio	1,88 %	★★★★★
▶ Practice	45 %	★★★★★
Handling	10 %	★★★★★
Features	20 %	★★★★★
Reception test	10 %	★★★★★
Processing	5 %	★★★★★

Top Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

Price/performance: very good

„State-of-the-art infotainment for used VW, Seat, and Skoda“.

The equipment classes

In CAR&HIFI INTERNATIONAL, all products are classified into one of five performance classes:

Ratings only comparable within their class: ★ (worst) ... ★★★★ (best)

- **Absolute Top Class** – Uncompromising products with outstanding image and sound quality
- **Top Class** – Products for higher demands with excellent image, sound, and processing quality
- **Upper Class** – Products for quality-conscious connoisseurs who value good value for money
- **Middle Class** – Solid products that meet average requirements in all respects
- **Entry Level** – Qualitatively convincing products with an excellent price-performance ratio

The rating

Devices are tested and rated according to strict criteria and can reach up to five “stars”. Ratings are only comparable within a class and device type. To score four stars in the top class, the device must meet more demanding requirements than for a 4-star rating in the upper class. The model names, prices (RRP), and equipment specifications for the devices always refer to the German market at testing. For some devices, such as TVs, prices and features may differ in the individual countries.

The star rating provides comprehensive and concise orientation when searching for devices for your home theater. However, depending on your situation and application, the device with the best star rating is not automatically the best fit for you. For example, a projector may score very well overall but still produce quite a lot of fan noise. Depending on where the unit is placed, this either doesn't matter at all or can be seriously annoying in the worst case. Therefore, you should additionally consult the detailed information provided in the text of the test reports.

The test equipment of the CAR&HIFI INTERNATIONAL editorial team

For our tests, CAR&HIFI INTERNATIONAL uses – among others – the following special measuring instruments and reference devices for the comparison of image and sound quality:

- Audio Precision
- CLIO 12
- Kenwood CS-6030
- Microtech Gefell

Perfect fit for cars with double DIN slot

**Kenwood DMX8020DABS with wireless Car Play,
Android Auto and Mirroring**

WiFi-Moniceiver

With the DMX8020DABS, Kenwood presents probably THE head unit highlight of 2021. Both owners of Android phones and iPhones will find everything they could want in a moniceiver.

Apple Car Play and Android Auto are currently the best ways to use your smartphone in the car. Both systems are designed for intuitive and straightforward operation, which can also be done easily while driving. Even voice control via the respective voice assistant is possible. Both applications allow the use of numerous phone apps via the monitor car radio. In addition to the media player, telephony, and messenger services, this is primarily the respective navigation app, which turns the DMX8020DABS into a full-fledged naviceiver in combination with the smartphone. In the latest version iOS 12.0 and higher, Google Maps

is now also possible for iPhones. Car Play is available from iOS 7.1.X, Android Auto from Android 5.0 (Lollipop), and thus available free of charge in the App Store for most phones in use.

WiFi integrated

The DMX8020DABS has a WiFi module, so that Car Play even works entirely without a cable connection for compatible iPhones. To use Android Auto, the Android phone must be connected to the Kenwood via USB and Bluetooth. This has the advantage that the phone is charged simultaneously, and you don't need to worry about the battery even when

using Google Maps, for example, for an extended time. And for those who prefer the wireless connection even with Android, the DMX8020DABS provides mirroring via WiFi. The phone's screen is mirrored 1:1 on the car radio and can be operated via its capacitive touchscreen. In this way, all phone functions and apps can be used via the DMX8020DABS.

Digital radio

Kenwood also relies on DAB+ digital radio, which has become mandatory in 2021, for its new DMX8020DABS highlight. „Seamless blending“ provides for extra radio comfort. The Kenwood can switch seamlessly



Rich source selection



Audio streaming via Bluetooth



The pairing of multiple phones is possible



The EQ curve can be painted with the finger

between FM and DAB+ when reception conditions change if the station is broadcast on both ways. Although the transmission is somewhat delayed, the DMX8020DABS can switch almost inaudibly without interruption or volume change. This is made possible by a digital buffer.

Sources

For the playback of audio and, when stationary, video files, the Kenwood offers two USB ports, HDMI, and an analog AV input on the backside. Music streaming is also possible via Bluetooth, and the same applies to hands-free calling. The external microphone is included in the scope of delivery.

For safe all-round visibility when maneuvering, one can connect up to three cameras to the Kenwood. For example, the rearview camera, front camera, and dashcam can be used. And the combination of a rearview camera and two blind spot cameras is also possible.

Audio

Sound enthusiasts know the DMX8020DABS has a lot to offer. It supports Hi-Res FLAC files with a resolution of up to 192kHz/24bit. The integrated digital signal processor also allows for extensive audio adjustments. The highlight of the equipment is the digital delay correction. Here, the distance to

the speakers can be adjusted to the centimeter on five channels. The Kenwood then automatically calculates the resulting time delay in milliseconds. The operation of the thirteen-band equalizer is also well solved. Each channel can be set individually, or the desired target curve can simply be painted with the finger. Crossovers can be set with selectable frequency and slope, and various sound effects can be switched in several stages. Thanks to Dual Zone, a separate entertainment program can be selected for the passengers in the rear. For example, the kids can watch a movie on individual monitors while the driver listens to the digital radio.



Station selection for DAB+



Settings main menu

Operation

The glossy touchscreen of the DMX-8020DABS responds promptly to every tap of the finger. This, along with the five buttons at the bottom of the unit, makes operation intuitive and fluid. The readability of the large display is excellent, and the viewing angle can be adjusted in five steps. All menus are clear and well arranged. The graphics in the audio settings are particularly pleasing. Whether equalizer, crossovers, or runtime – you can see right away what you are doing and what effects the respective settings will have. In addition, the car radio can also be remote-controlled via smartphone. All you need is the Kenwood Remote S app, which is available free of charge for Android and Apple iOS.

Conclusion

The Kenwood DMX8020DABS sets standards in smartphone connectivity with wireless Car Play, Android Auto, and wireless Mirroring. And the camera functions, audio features, and top-notch digital radio receiver with seamless blending are also second to none.

Dipl.-Phys. Guido Randerath

Who is JVCKENWOOD?

JVCKENWOOD Corporation was formed in 2008 from the merger of Victor Company of Japan Limited, known under the brand name JVC, and Kenwood Corporation. Originally Japanese, the brands JVC and Kenwood are well known all around the globe, offering much more than car audio. Besides numerous audio products JVC's and Kenwood's portfolio covers video (including dashcams), communication, non consumer electronics products but also professional video solutions and health care.



Kenwood DMX8020DABS



Price 600 Euro
Contact JVCKENWOOD Deutschland,
Germany
Internet www.kenwood.de

Rating

▶ Sound	20 %	★★★★★
Bass	4 %	★★★★★
Neutrality	4 %	★★★★★
Transparency	4 %	★★★★★
Spatiality	4 %	★★★★★
Dynamics	4 %	★★★★★
▶ Image	20 %	★★★★★
Sharpness	3,3 %	★★★★★
Brightness	3,3 %	★★★★★
Contrast	3,3 %	★★★★★
Color reproduction	3,3 %	★★★★★
Viewing angle	3,3 %	★★★★★
Reflection	3,3 %	★★★★★
▶ Lab	15 %	★★★★★
• USB	7,5 %	★★★★★
Distortion	3,75 %	★★★★★
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▶ Practice	45 %	★★★★★
Handling	10 %	★★★★★
Features	20 %	★★★★★
Reception test	10 %	★★★★★
Processing	5 %	★★★★★

Top Class



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Price/performance: very good
„The benchmark in
smartphone connectivity“

A Digital Remote Control
for DSPs and DSP amplifiers

The Conductor: Volume Control 4.0

► While a remote control for your DSP or DSP amplifier is a standard add-on, if you have a device from the Audiotec Fischer brands Brax, Helix or Match, you can choose from a whole range of remote control units. First, there is the URC.3 with two potentiometers and buttons, and, if you want it all, there is the Director, being a top notch front end featuring a multi-colour display and a micro controller. And now, a middle class solution is added with the Conductor.







The LEDs change their color depending on the function, the colors can be perfectly adjusted to the vehicle lighting

Of course, the Conductor is a volume control unit for convenient level management of all possible sources or zones in the hi-fi system. But, as can be expected from Audiotec Fischer, they added more smart features to the Conductor. With an

ARM processor and bus-controlled digital LEDs, the Conductor is well equipped for the task. First of all, we have a digital rotary knob with push function that controls all features. 12 LEDs are arranged in a circle around the controller and take over the dis-

play. The volume control includes 4 areas that are freely selectable. For example, master and subwoofer volume can be controlled just like that of the digital inputs, Bluetooth streaming or the rear zone. The configuration, as usual, is managed via



the DSP PC Tool. Control range and control steps can be set, e.g. 60 dB control range for digital sources or 12 dB for subwoofers with 1 or 0.5 dB increment. In addition to volume control, the Conductor can also choose between sources and switch between DSP setups. Brightness and color of the 10 dedicated LEDs indicate which of the 10 setups is currently active, which is occupied and which is empty. The third "additio-

nal function" is the control mode for Bluetooth music streaming, where pairing, play/pause and skip title can be controlled.

Look and Feel

Audiotec Fischer placed great emphasis on the perfect usability in the Conductor. This, of course, also means smooth and handy operation in the car and while driving. The Conductor can be operated intuitively and almost without looking. There is also a kind of shortcut for the skip title function in Bluetooth playback. Double-click for forward skip, triple-click for reverse skip, even while the Conductor is in volume control menu. So you don't have to return to the playback control menu. For volume control, the 12 LEDs work as an LED chain, but also status information can be summarized in a comprehensive way. Thanks to the modern LEDs and processor, the Conductor settings can be freely adjusted by the user. One of the 16 million colors is sure to match the vehicle lighting, and the four volumes can be freely assigned their

own colors, so you can classify them neatly. And after all, the Conductor fits smoothly into the vehicle, e.g. in the central console. This requires a depth of 17 mm and a mounting hole of 40 mm. If you are not eager to drill a 40mm hole, you are going to need some patience. Help is on the way: the successor Conductor with an installation housing is already in progress.

Conclusion

Did the world need another remote level control unit? Hell yes, if it is as innovative and smart as the Conductor!

Elmar Michels

Who is Audiotec Fischer?

Founded in 1990 by Heinz Fischer in Schmallenberg, Germany, Audiotec Fischer has established the brands Brax, Helix and Match, shipping now to more than 50 countries. Having started in the analog domain, Audiotec Fischer products now cover everything from analog high end to cutting edge DSPs and DSP amplifiers. The main emphasis today is on the digital world – both hardware and software – led by Julian Fischer in the second generation. The company is also a direct supplier to the automotive industry, complying with highest industry standards. As a consequence, Audiotec Fisher products are completely developed in house and most of them manufactured directly in Schmallenberg, thus being „Made in Germany“.

Conductor by Audiotec Fischer

Price	130 – 180 Euro
Contact	Audiotec Fischer, Germany
Internet	www.audiotec-fischer.com

Specifications

Remote control for Brax, Helix and Match DSP products

Outputs	Control-Port
---------	--------------

Dimensions

• Outer diameter	46 mm
• Mounting diameter	40 mm
• Mounting depth	17 mm

Features

- Compatible with all Helix and Match DSP products with ACO platform (2018 onwards)
- 12 LEDs for status display with adjustable color and brightness
- 4 adjustable volume levels (e.g. master, sub, AUX, rear, Bluetooth, etc.)
- Configurable control scope and increment settings
- Controllable DSP setups, source selection and Bluetooth playback
- Quick playback control with double and triple click



The Conductor can be operated highly intuitively. Turns, pushes, double and triple clicks do the job

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„Innovative remote control,
a perfect tool to operate in the car.“

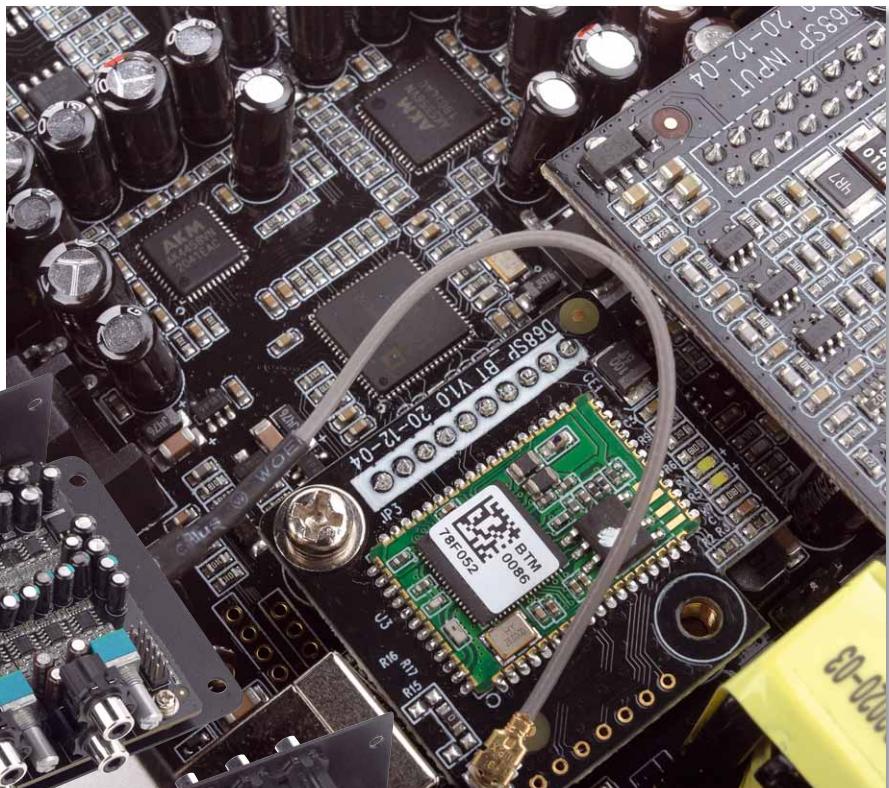


ESX D66SP + D68SP - 6- and 8-channel DSPs for sound freaks

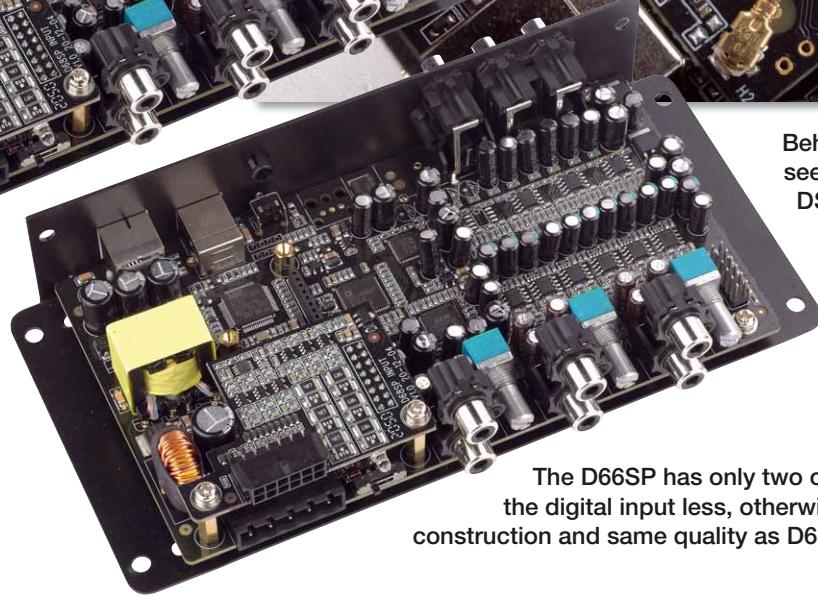
New ESX DSP generation

Now that the ESX DSP and DSP power amplifiers have a few years under their belt, ESX has relaunched its DSP lineup. The first two are the small stand-alone D66SP and D68SP processors.

The D68SP has an additional digital input; furthermore, here is the Bluetooth board (green) retrofitted



Behind the BT module, you can see the three main players: The DSP from Analog Devices and the two 32-bit converters from AKM



The D66SP has only two outputs and the digital input less, otherwise same construction and same quality as D68SP



Equalizers and crossovers are set on the main screen. Master and channel levels are available, and absolute or relative linking of channels is possible



ESX was one of the pioneers in the market with compact and powerful multichannel amplifiers with integrated DSP. Now the developers saw the time come to approach the topic DSP anew. The new DSPs are upgraded successors of the existing products and new DSPs developed from scratch with the latest hardware and completely reprogrammed software. The D66SP and D68SP are the forerunners of a new generation of DSP products currently under development. Master of the initially white sheet of paper is Dominic Langenberg, for two years in the service of the ESX mother Audodesign, busy with the DSPs for one and a half years, and a proven expert in his field. Among other things, he was able to gain experience in the OEM sector (e.g., Harman) and is now applying it in the aftermarket sector at ESX. During the development of the ESX DSPs, the highest priority was given to sound quality so that no savings had to be made on the components. Even the exact typing and the use of the individual components were allowed to follow purely sonic criteria. Therefore these two small DSPs are no entry-level

devices, despite the favorable prices of only 330 and 370 Euro respectively, but constructions that must be taken seriously. By the way, the only essential difference between the D66SP and the D68SP is the number of output channels. Everything else shares the same technical level. The D66SP aims at those who can get by with six channels, e.g., for a sound upgrade for BMW or Mercedes, as cheap as possible. The D68SP with digital input and eight channels is a suitable solution for sound freaks who want a complete retrofit system.

Hardware

Looking at the inner workings reveals only the finest components and shows how high the tech level is. A modern 32-bit ARM processor takes

over as the control center of the DSP. The DSP chip itself is none other than Analog Devices' ADAU1452, the drug of choice at the moment and in use in many high-class DSPs. The converters are top AKM types of the

555x and 445x series. At the input, we find the ADC AK5556 with six input channels; behind the signal conversion, the AK4456 or AK4458 DACs with six and eight channels, respectively, are waiting. All converters belong to the best that can be found in the car audio world. They are 32-bit converters with enormously high dynamic capabilities. The power supply and the operational amplifiers are no slouches either - nothing entry-level, everything is of the finest and on the level of the best DSPs on the market.



Here the delay time of the outputs is adjusted. The loudspeakers are placed nicely in the car – here Mercedes with footwell woofers

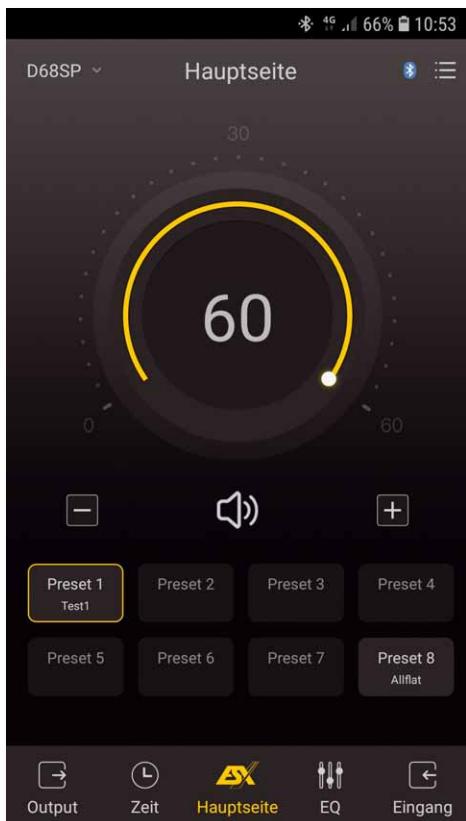
Equipment

Both D66SP and D68SP have six inputs, which are available as RCA and high level. The high-level inputs can be optimized for the range up to 15 V or 15 - 45 V, which serves the fine-tuning of the sound; regardless of

this setting, everything always works. Still, if the circuit feels most comfortable in terms of input and output impedance, it just sounds a little better. The eight-channel D68SP was given a digital input, which was omitted from the six-channel version. Both offer the option of retrofitting Bluetooth, for which there is a small board that docks inside, so no ugly USB dongle. Furthermore, a wired remote control with a display is available for an additional charge, which controls volumes, sources, and setups. Speaking of setups, ESX also has the „convertible pin“ that switches to a selected one of the



BMW and Mercedes also offer the app as system suggestions. Otherwise, the individual speakers can be freely selected



Main volume in the app. Below are the eight presets, with one marked as active and one as occupied



The digital inputs can be prioritized so that they are switched over when a signal is received. Here Bluetooth gets priority; after 5 seconds of silence, it will be switched back to analog



Both DSPs have six inputs as RCA and high level. In the power connector, the mode pin is integrated

D68SP with eight outputs, S/PDIF, and Bluetooth antenna output. The remote control connector on the right is a proper interface for future expansions

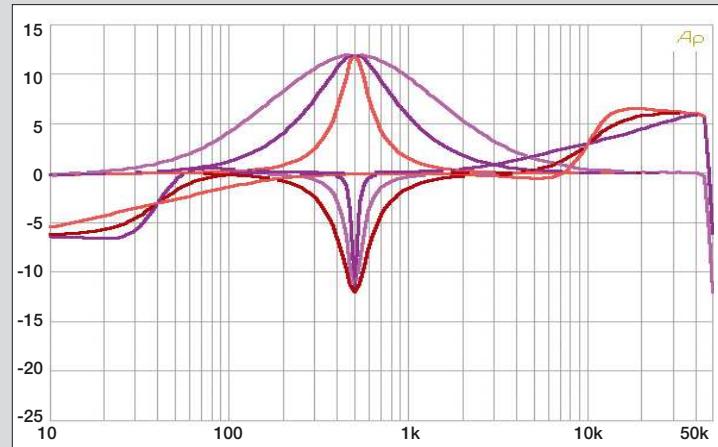


Bluetooth board is installed, an app for Android and Apple that masters all functions also helps. The software is programmed from scratch and in-house. You immediately feel at home on the user interface. Everything is logically arranged and largely self-explanatory. The settings are arranged in three windows, so it doesn't get too crowded in each. In the I/O panel, inputs and outputs are managed, of course with flexible routing. Names can be assigned to the inputs and outputs, e.g., Tweeter Front Left. These names are then found in other places, and in the auto diagram, the speakers are even placed correctly. This also applies to the predefined BMW and Mercedes setups with the corresponding under-seat and footwell woofers.

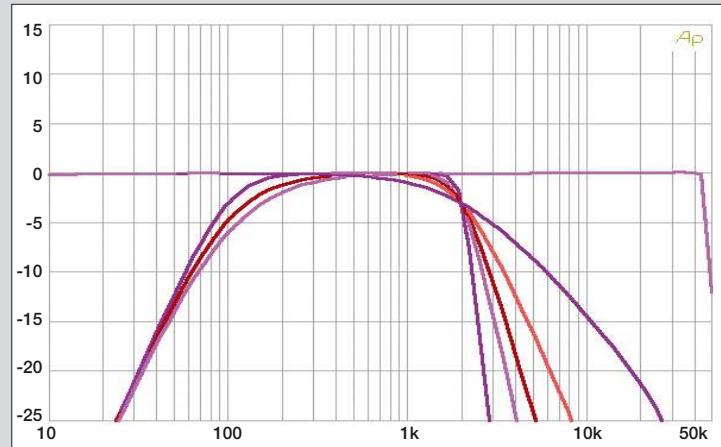
In general, there are several niceties besides the standard functions. For example, the channels designated as subwoofers (regardless of which ones) are automatically assigned to the subwoofer level of the remote control. In the setups, you can see which ones are active, full or empty, and you can also set a startup setup that is always active after switching on. The marker active/used/unused also runs through the main window, e.g., with the EQ bands, of which

there are 31 per output and can be either shelf or parametric EQ. As for the inputs, there is the „expert mode“ as a special feature. In standard mode, there are six inputs with fifteen EQ bands each. In Expert, there are thirty bands, but only for two usable inputs. This is very cleverly done to manage the DSP's resources as needed, as the DSPs have good work to do: Both ESX run at 96 kHz sampling rate, which gives them a HiRes frequency range up to

CAR&HIFI Laboratory



Each EQ band can also be assigned a shelf, and the adjustment range is +/- 12 dB



HiRes frequency range up to 44 kHz. Low pass Butterworth with 6-48 dB/oct. high pass Butterworth, Bessel and Linkwitz



Conclusion

The ESX processors D66SP and D68SP make the beginning for an extremely promising concept. They are trimmed for sound and offer some of the best features on the

market. With the development entirely in Germany and a favorable production in the Far East, they are so sharply calculated that one must speak of combat prices.

Elmar Michels

ESX D66SP/D68SP

Price	330/370 Euro
Contact	Audio Design, Germany
Internet	www.audiodesign.de

Specifications

Dimensions

Inputs

- 6-channel high-level with autosense
- 6-channel RCA, gain control, paired gain control
- Sensitivity 6 V (RCA), 45 V (high level)
- 1 x digital S/PDIF optical (D68SP only)
- 1 x mode („convertible pin“) outputs

Outputs

- 6/8-channel RCA
- remote-out

DSP software (V 0.0.19 in test)

Equalizer

Inputs

- param., 15 bands per channel, 6-channel (Standard)
- param., 30 bands per channel, 2-channel only (Expert)

Outputs

- parametric, 31 band per channel, +12 – -12 dB
- 20 – 20k Hz, 1 Hz steps, Q 0.3 – 15
- optional shelf 25-10k Hz, Q 0.3-2

Crossovers

- 20 – 20k Hz, 1 Hz steps
- Bessel, Butterworth, Linkwitz, 6 – 48 dB/oct.

Time and level

- Sample rate 96 kHz, 3.5 mm steps (0.01 ms)

Outputs

- 0 – 680 cm (20.00 ms), 2048 samples
- Level steps 0.5 dB, Main: 1 dB
- Features
- 8 presets
- Inputs and outputs arbitrarily routable
- Start-stop capability up to 7.2 V
- EPS (Error Protection System) for diagnostic function
- Signal dependent switching to Bluetooth or S/PDIF
- Coupling of channels (gain and EQ) absolute and relative possible
- Ground switch against hum interference
- Setup change via mode pin
- input sensitivity adjustable via jumper

Optional accessories

- Bluetooth module BT-DQ (audio streaming and app control of all functions)
- Remote controller RC-DQ (volume, bass level, sources, setups)

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„Excellent hardware with 32-bit signal path and HiRes frequency range, plus outstanding usability in software, and all at an attractive price.“

44 kHz. This also allows for 3.5-millimeter steps or 0.01 milliseconds in runtime. The crossovers can do Butterworth, Bessel, and Linkwitz up to 48 dB/octave, which is all anyone ever needs. The digital input on the D68SP and the Bluetooth inputs can be prioritized in the software, which means that it is automatically switched to S/PDIF or Bluetooth when music is played. If you don't want to do without car sounds, they can be added in the mixer, meaning digital and analog sources can be integrated. Several additional functions (and devices) have been announced for the future and are currently under development. So this first release is just the beginning, the starting signal for a project that will be constantly expanded.

Who is Audio Design?

Founded 1984 in Kronau (Germany) as a speaker manufacturer, Audio Design GmbH has turned into an international distributor and developer of any kind of car audio aftermarket products. Audio Design is the owner of the HiFonics and Crunch brands in Germany, Austria and Switzerland as well as the ESX and Renegade brands worldwide. Distribution includes famous brands like Rockford Fosgate, Kicker, Autotek and MB Quart. The newest brand in Audio Design's portfolio is Musway, established 2018 and specialized in plug'n'play sound solutions and DSP products.

Helix M FOUR DSP + M ONE X – M Amplifier Series Expanded



The expansion strategy

► Helix's M series should be compact and affordable. This worked out so well that the series is now being expanded with two new models.

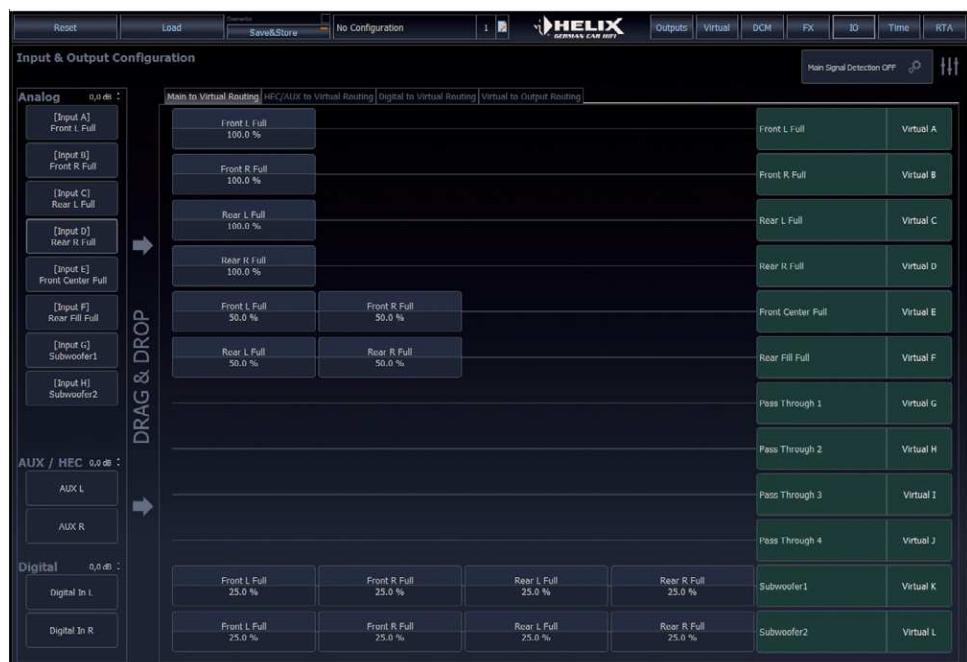
Besides Brax and Match, Helix is one of the three brands by German company Audiotec Fischer, featuring a full range of car audio products including DSPs, amplifiers, speakers, subwoofers and accessories.

In the Helix amplifier range, we find analog and digital high-end with the noble C and P amplifiers at the top. In the affordable range, on the other hand, normal analog amplifiers of the D and G series await price conscious customers. In the middle lies the M-Series, which is perfectly placed in an affordable frame, but thanks to modern Class-D technology and the associated efficiency, this is quite compact and therefore very trendy. Until now, there were universal six-channel and four-channel power amplifiers with M SIX and M FOUR and a bass amplifier with the M ONE in the same handy aluminium housing. The two new models are now added, namely the M ONE X, which brings in some extra power in the extended housing compared to the M ONE, and the M FOUR

DSP. With the latter, Helix is in the trend again, as more and more manufacturers are going to equip even cheaper amplifiers with a signal processor. And who can do that better than Helix — the factory in Sauerland has probably the most extensive and sophisticated range of DSP products on the market, if you add the sister brands Brax and Match.

M FOUR DSP

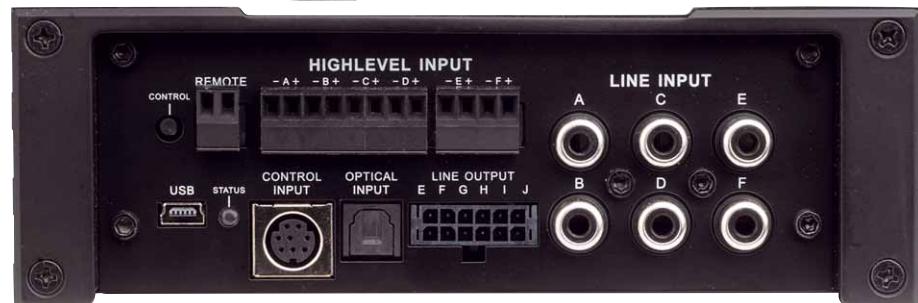
Let's stay with the new DSP level, which is priced at 550 euros. As for the four-channel amplification, naturally, we are looking an M FOUR. The board is neatly constructed with a fairly compact power supply and an absolutely modern amplification. Especially with Helix, it is not surprising that amplifier ICs are used in the final amplification instead of regular transistors. Under the board there are two two-channel specimens, which are even bridgeable. The power amplifier also got a lot of electronics on



Routing Step 1: The inputs are routed to the virtual channels, as usual for main/analog, HEC and digital inputs. The virtual channels are subtly highlighted in green



The M ONE X (shown on top) offers plenty of adjustable filters. The M FOUR DSP is fully packed with inputs and outputs



board, as it performs equally at 4 and 2 ohms. For example, the performance was already exhausted at 4 ohms and no longer increased in favor of a compact housing at 2 ohms. The new feature of the M FOUR DSP is, of course, the digital board that replaces its analogue counterpart in the M FOUR. There we find all the typical ingredients from Helix that we are used to. The powerful 32-bit controller ensures that the in-house ACO platform is also integrated into the M FOUR DSP, so that even the affordable M FOUR DSP can implement all the goodies of the DSP software. The core is the ADAU1452 DSP chip from Analog Devices, which also drives most of the company's other DSP products. And also with the converters eve-

rything is at its best. Both ADC and DAC are noble 32-bit types, so all signal processing can be done at 32 bit depth. The only smear that the M FOUR DSP user has to take is the lack of Hi-Res capability. Though the amplification of the M FOUR still made it to the 40 kHz mark, the DSP is locked off by 48 kHz sampling rate, so that the audio frequency response is limited to 22 kHz. On the other hand, it creates space for the various features of the DSP

channels, and that's quite a lot. The M FOUR DSP has no less than 10 DSP channels, so that in addition to the 4 amplifier channels, 6 processed outputs are available. The M FOUR DSP is therefore highly recommended as a control centre for extensive sound systems. For example, enhanced by a normal M FOUR and one or two M-Monos, it controls a full-fledged HiFi chain, which also does not shy away from full active operation, center, rear and ambient, etc.

Who is Audiotec Fischer?

Founded in 1990 by Heinz Fischer in Schmallenberg, Germany, Audiotec Fischer has established the brands Brax, Helix and Match, shipping now to more than 50 countries. Having started in the analog domain, Audiotec Fischer products now cover everything from analog high end to cutting edge DSPs and DSP amplifiers. The main emphasis today is on the digital world – both hardware and software – led by Julian Fischer in the second generation. The company is also a direct supplier to the automotive industry, complying with highest industry standards. As a consequence, Audiotec Fisher products are completely developed in house and most of them manufactured directly in Schmallenberg, thus being „Made in Germany“.



The setup of the virtual channels is similar to that of the output channels, only without crossovers. The virtual front EQ and FX front processing then affect all output channels routed from there



In the ISA, any inputs and their sums can be measured. EQ (with allpass) and time alignment are adjusting the incoming signal

all' with the virtual front channels, for the entire front system and across all crossover frequencies. The virtual channel can also be used to "move" the entire three-way side with time alignment or with gain controller. The FX sound effects now also affect the virtual front, center and rear channels, which can also be used to control two-way centers perfectly. The algorithms for optimizing center, front and bass can be activated in the FX(Effects) section. First of all, the RealCenter is a blessing by its existence, a center channel signal is calculated here by real audio processing. Thus, the RealCenter

Software

The DSP functions are of course controlled via the in-house "DSP PC tool", which is the most comprehensive and powerful tool available on the market. In no way is the M FOUR DSP slimmed down with the functions, it has a full program with all the features of the more expensive DSPs and DSP amplifiers. In addition to 30 EQs per channel, time alignment of both inputs and outputs and of course freely programmable crossovers, VCP (Virtual Channel Processing) is available with the possibility to process channel groups as virtual channels between inputs and output channels. For example, a three-way front system with six output channels for right and left sides can be managed from the virtual channels on front left and right. The time alignment of the individual speakers, the crossing of tweeter, midrange and woofer are performed at the output channels, the peculiarities of the installation situations are also corrected here. However, the sound decisive equalizing can be done conveniently 'over

Helix M FOUR DSP

Inputs

- 6-channel high level
- 6-channel RCA
- 1 x digital S/PDIF (optical)
- Sensitivity 8 V (RCA), 32 V (high in)

Outputs

- 6-channel RCA (8 V)
- Remote-out

DSP-Software (V 4.71)

Equalizer

Inputs:

- param., 5 bands per channel

Virtual channels:

- param., 30 bands per channel

Outputs:

- param., 30 bands per channel, +6 – 15 dB
- 20 – 20k Hz, 1 Hz increments, Q 0,5 – 15
- Shelf 25-10k Hz, Q 0,1-2
- Allpass filters 1st or 2nd order, f and Q adjustable

Crossovers

Outputs:

- 20 – 20k Hz, 1 Hz increments
- Bessel, Butterworth, Chebychev, Linkwitz, User, 6-42 dB/Okt.

Time and level

- Samplerate 48 kHz, 7 mm increments (0,02 ms)

Inputs:

- 0 – 5,19 ms, 256 samples

Virtual channels:

- 0 – 354 cm (10,40 ms), 512 Samples
- Phase 0, 180° (fullrange), 0 – 360° (22,5° increments)
- Adjustable level increments 0,1 – 1 dB

Outputs:

- 0 – 708 cm (20,82 ms), 1024 Samples
- Phase 0, 180° (fullrange), 0 – 360° (22,5° increments)
- Adjustable level increments 0,1 – 1 dB

Features

- 10 Setups with fast switchover
- User-defined routing of in- and output ports
- Control connector for programmable remote controls and accessories
- Start-stop capability up to 6V
- Signal-dependent switching to digital or Aux inputs
- Automatic putting through of all vehicle tones
- Power save mode (configurable) ADEP.3 error protection circuit for factory radios with speaker recognition
- RTA real-time frequency curve measurement (with optional microphone)
- FX menu with dynamic bass, center and front processing
- ISA for measuring, summing and correcting inputs
- Time Machine for taking back and restoring adjustments
- Standard programming or VCP, 8 virtual channels, user-defined routing, EQ, time alignment and FX-Processing

Optional accessories

- Wired remote control (programmable)
- Display remote control director with memory, USB, etc.
- WIFI Control for wireless programming
- Measurement microphone MTK1

is not a makeshift solution such as a monosum or a reversed sum of left and right. For center and front, there is a Clarity Expander, which affects center playback, for example, the voices. The front can also be “pulled apart” to broaden the stage imaging. The bass processing includes a SubXpander, which adds deep tones to the music by creating sub-harmonics to existing frequencies. There is also a dynamic bass boost, which raises the bass depending on the playback volume. This works great with factory woofers and subwoofers with limited power handling. For all FX functions there are adjustment sliders that can be used to influence the extent and function in a targeted manner. Furthermore, the M FOUR DSP supports the latest measurement functions of the PC tool. In addition to the well-known RTA (real-time frequency response measurement with optional microphone), the ISA (Input Signal Analyzer) is an electrical measurement function for the analog inputs.

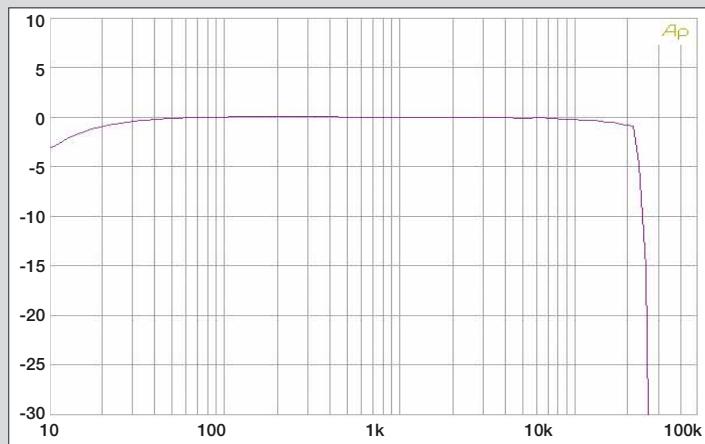


With the M ONE X, lots of copper provide a full kilowatt of power

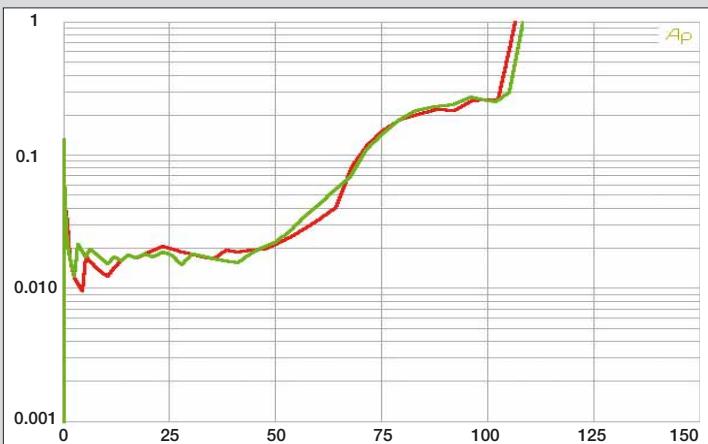


The M FOUR DSP, on the contrary, works with two small amplifier ICs

CAR&HIFI Laboratory



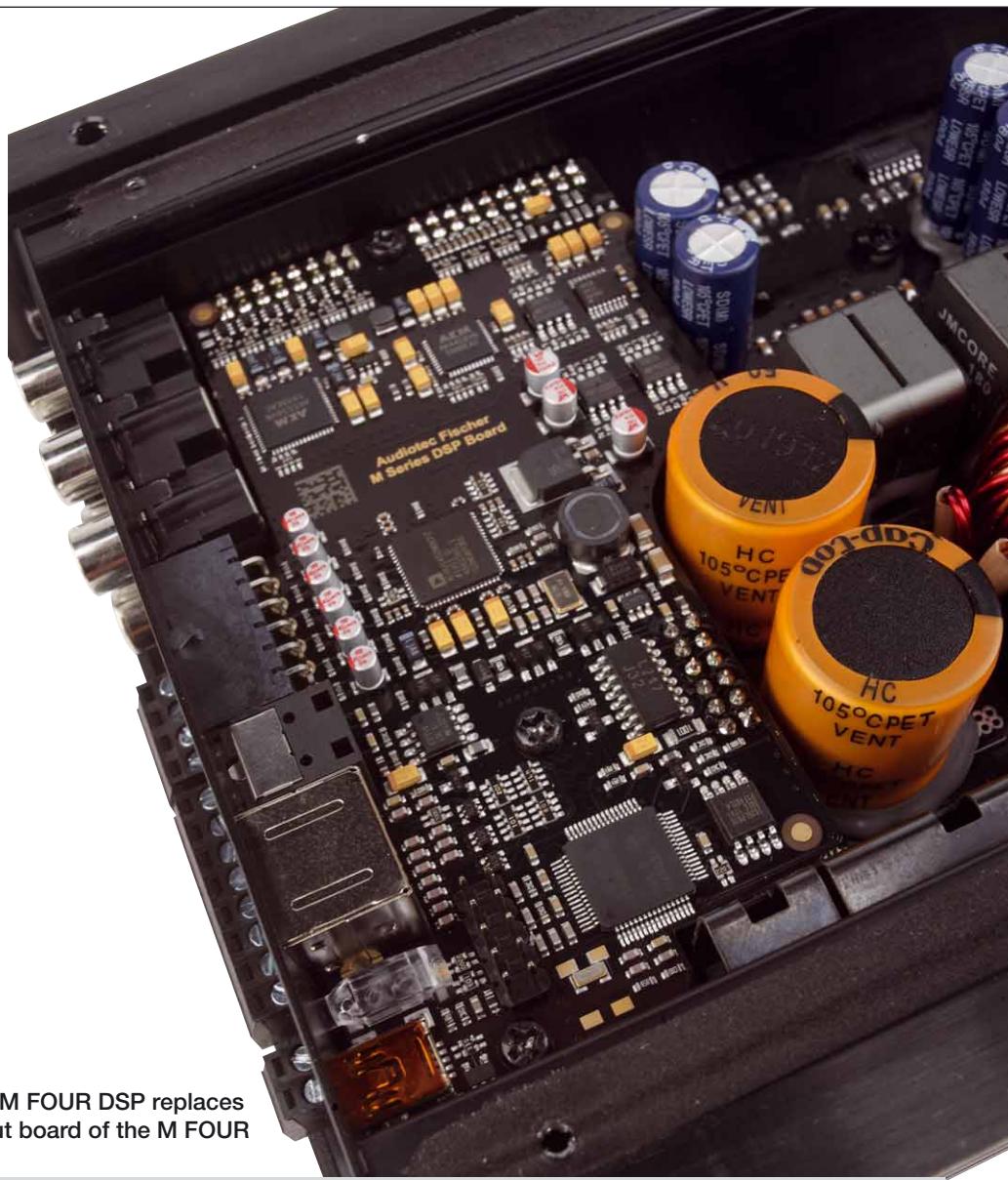
The DSP in M FOUR DSP works with a sampling rate of 48 kHz, therefore the usable audio frequency range is theoretically up to 24 kHz; in reality, because of the low pass filter, we get to 22 kHz at best.



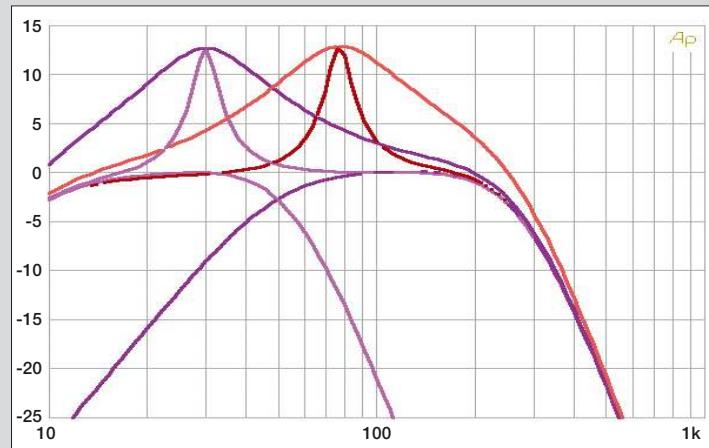
Whether at 4 or at 2 ohms, the M FOUR DSP delivers 100 watts per channel. This is achieved with very low distortion

If, for example, the speaker lines of the vehicle are connected to the inputs of the DSP, you can determine the nature of incoming signals. The PC Tool offers a frequency response measurement of all input channels, so that you can immediately see if a usable full-range signal is present. In addition to the above, sums of several inputs can be measured, so you can find hidden all-pass filters that remain inconspicuous in the individual measurement. This electrical measurement of the inputs saves the installer a lot of time in troubleshooting and tuning of the DSP, because at the same time with the measurement the input EQs (and the input time) can be set, with immediate success check. Finally, in the current version of the PC tool we have ATM (Automatic Time Measurement), which allows a fully automatic time alignment of the entire system. The advantage here is that the measurement signal is played

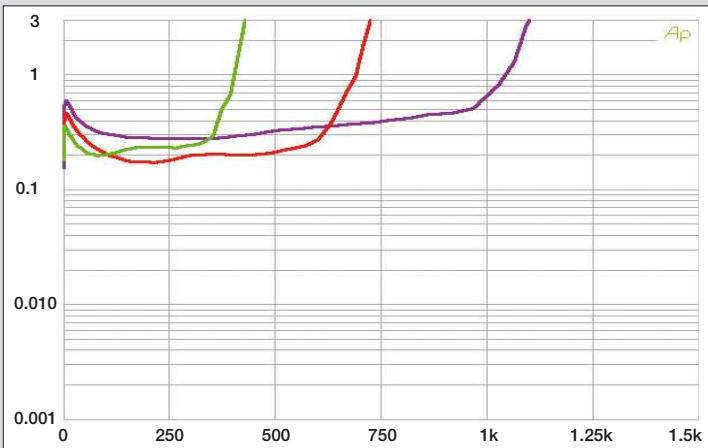
The DSP board of the M FOUR DSP replaces the analog input board of the M FOUR



CAR&HIFI Laboratory



The M ONE X is sporting a complete filter equipment. Bass boost, frequency and Q can be controlled



At 1 ohm, the M ONE X easily cracks the kilowatt. The distortion is still low at 0.2 - 0.5% regardless of the load

as a sound file like a piece of music via the head unit, which is possible in all vehicles. The measurement is then carried out with measurement signals programmed by Helix and a lot of audio processing, whereby the runtime of all loudspeakers in the system is compared with a reference loudspeaker and then calculated. Finally, the M FOUR DSP benefits from the numerous integration features such as power-save mode for CAN vehicles or bypass circuits for diagnostic programs of some factory radios and a freely configurable source management with automatic switching of sources and vehicle tones. The in-house ADEP.3 system is able to bypass the loudspeaker diagnosis of some vehicles, bypassing error codes or even the shutdown of channels. Overall, the M FOUR DSP is a powerful control center whose DSP functions are in no way inferior to the top range models.

M ONE X

In order to satisfy the desire for more power on the subwoofer, Helix introduces the M ONE X along with the M ONE. The extended version has become 9 centimeters longer and, in turn, offers the full kilowatt compared to the 600 watts of its little sister. For this purpose, the X was thoroughly upgraded inside. Everything is much thicker than with the compact M ONE, so we find a very powerful mains transformer plus a buffering of 4 x 2200 microfarads in a generous 100 V version. The final amplification is a classic Class-D design and does not pose any puzzles for the user. Helix didn't save money on the equipment of the M ONE X. Both low pass and subsonic are on board as well as a bass boost. This can be controlled

not only in the level, but also in the frequency and even in the quality. Finally, a phase controller completes the filters and the cable remote control is part of the standard scope.

High level inputs including ADEP for diagnostic functions and an automatic switch-on ensure best cooperation with factory systems.



Helix M ONE X

Price	350 – 400 Euro
Contact	Audiotec Fischer, Germany
Internet	www.audiotec-fischer.com

Rating

▶ Sound	20 %	★★★★★
Bass foundation	5 %	★★★★★
Bass pressure	5 %	★★★★★
Accuracy	5 %	★★★★★
Dynamics	5 %	★★★★★
▶ Lab	55 %	★★★★★
Power	40 %	★★★★★
Damping factor	5 %	★★★★★
Signal-to-noise ratio	5 %	★★★★★
Distortion	5 %	★★★★★
▶ Practice	25 %	★★★★★
Features	15 %	★★★★★
Build quality electronics	5 %	★★★★★
Build quality mechanics	5 %	★★★★★

Specifications Helix M ONE X

Channels	1
Power 4 ohms	407
Power 2 ohms	694
Power 1 ohms	1054
Sensitivity max. mV	520
Sensitivity min. V	6,3
THD+N (<22 kHz) 5 W	0,375
THD+N (<22 kHz) Half Power	0,252
Signal-to-noise ratio dB(A)	58
Damping factor 20 Hz	145
Damping factor 40 Hz	160
Damping factor 60 Hz	160
Damping factor 80 Hz	160
Damping factor 100 Hz	166
Damping factor 120 Hz	160

Features

Low pass	50 – 250 Hz
High pass	–
Band pass	10 – 250 Hz
Bass boost	0 – 12 dB/30 – 80 Hz
Subsonic filter	10 – 50 Hz/12 dB
Phase shift	0 – 180°
High-level inputs	•
Automatic switchon (Autosense)	• DC
RCA output	• (master/slave)
Start/stop capable	• (6 V)
Dimensions (L x W x H in mm)	320 x 145 x 50
Others	Remote control

Top Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

Price/performance: excellent
“Full performance
in a compact form.”

Measurements and sound

We already know the laboratory performance of the M FOUR DSP from the M FOUR. Already at 4 ohms there are a full 4 x 110 watts, which is quite admirable considering the compact housing size. At 2 ohms it is significantly higher (around 150), until the power amplifier runs into the limiter. Then the power is also limited to 100 W at 2 ohms until it is switched off. The chips deliver very clean performance, just 0.013% THD+N at 5 watts and only 0.033% at half load are excellent numbers. Of course, the M ONE X can only laugh about such power numbers. Already at 4 ohms are more than 400 watts, at 2 ohms the load resistors moan over just under 700 watts. And at 1 ohms the kilowatt mark falls with 1054 watts — goal achieved! The distortion does not look quite as rosy as with the M FOUR DSP, but this is not a crucial requirement for a subwoofer amplifier. THD+N is between 0.2 and 0.4%, so it is still in the zone.

In terms of sound, the M FOUR DSP shows very decent performance. It shines with joy and dynamics, and the slapped bass plays accordingly. Even with quieter tones, it still convinces with the adequate sensitivity and balanced sound. Despite the chips and the compact case, it delivers a confident performance in the bass range, here it draws a lot of pressure from any compo system. The pressure underneath is then the motto for the performance of the M ONE X, because it presents a generous portion here. Even the control over heavy subwoofer membranes is no problem for it. I'm down to 1 ohm, the control is perfectly retained, no blurring. Lastly, it processes ultra-deep sound just as well, so that its playback is limited by the subwoofer — not by the M ONE X.

Conclusion

The two newcomers are a perfect addition to the M-Series. With the M FOUR DSP there is now the complete set of DSP features of the house with their immense possibilities. And in

the M ONE X we received a proficient market driver for power-hungry subwoofers.

Elmar Michels



Helix M FOUR DSP

Price	550 – 600 Euro
Contact	Audiotec Fischer, Germany
Internet	www.audiotec-fischer.com

Rating

▶ Sound	40 %	★★★★★
Bass	8 %	★★★★★
Neutrality	8 %	★★★★★
Transparency	8 %	★★★★★
Spatial imaging	8 %	★★★★★
Dynamics	8 %	★★★★★
▶ Lab	35 %	★★★★★
Power	20 %	★★★★★
Damping factor	5 %	★★★★★
Signal-to-noise ratio	5 %	★★★★★
Distortion	5 %	★★★★★
▶ Practice	25 %	★★★★★
Features	15 %	★★★★★
Build quality electronics	5 %	★★★★★
Build quality mechanics	5 %	★★★★★

Specifications Helix M FOUR DSP

Channels	4
Power 4 ohms	110
Power 2 ohms	107
Power 1 ohms	0
Bridged Power 4 ohms	214
Bridged Power 2 ohms	0
Sensitivity max. mV	var.
Sensitivity min. V	var.
THD+N (<22 kHz) 5 W	0,013
THD+N (<22 kHz) Half Power	0,033
Signal-to-noise ratio dB(A)	87
Damping factor 20 Hz	149
Damping factor 80 Hz	149
Damping factor 400 Hz	144
Damping factor 1 kHz	135
Damping factor 8 kHz	19
Damping factor 16 kHz	5

Features

Low pass	10 – 20k Hz
High pass	10 – 20k Hz
Band pass	10 – 20k Hz
Bass boost	-12 – 12 dB/10 – 20k Hz
Subsonic filter	via HP
Phase shift	0 – 180°/LZK via DSP
High-level inputs	•
Automatic switchon (Autosense)	• DC
RCA output	•, 6 CH processed
Start/stop capable	• (6 V)
Dimensions (L x W x H in mm)	230 x 154 x 50
Others	DSP, digital input

Absolute Top Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

Price/performance: excellent

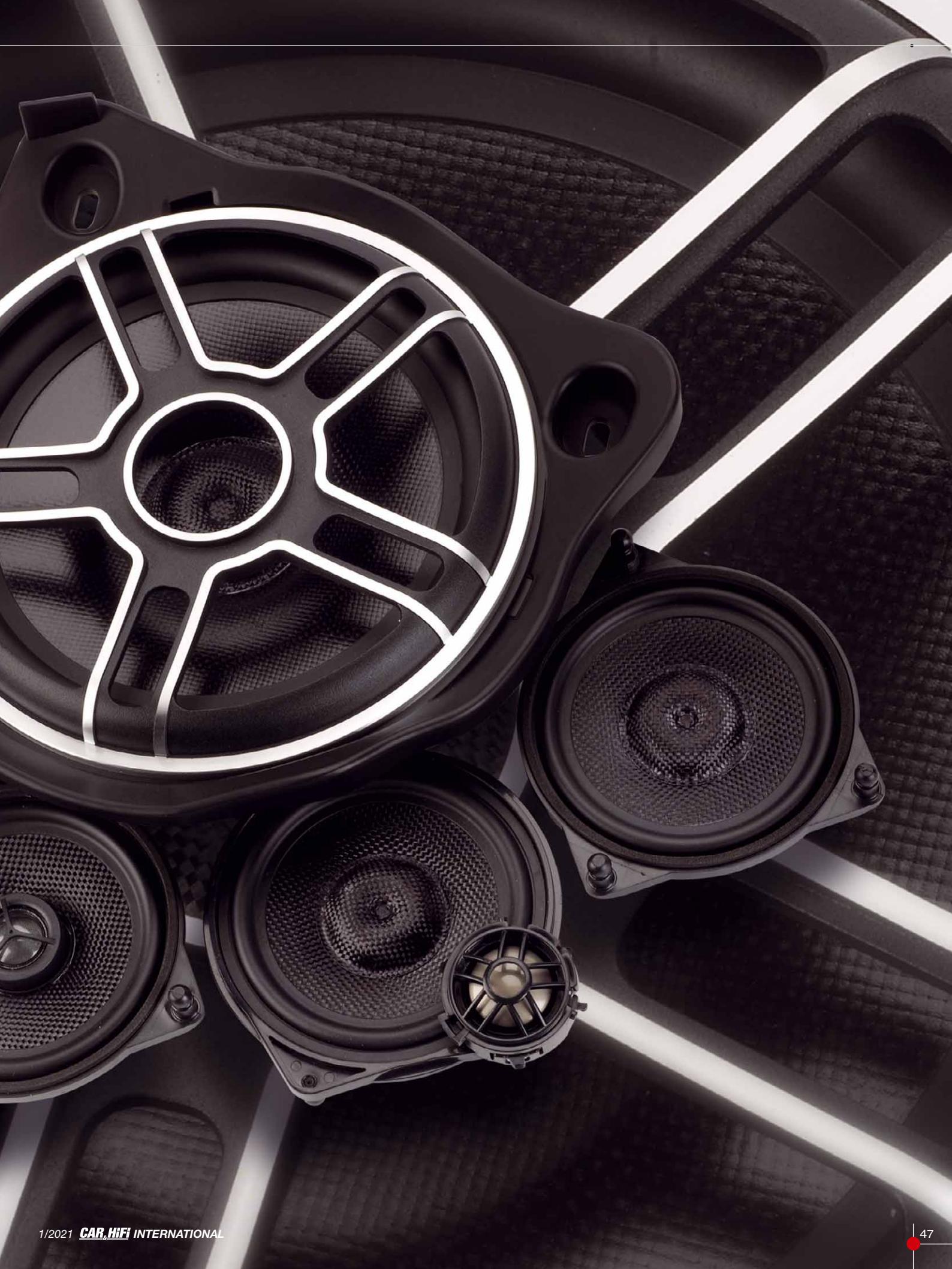
"Powerful control center."

Musway CSM42X + CSM4.2C
– new Mercedes speakers

Sound upgrade in the Benz

From Musway comes an entirely new speaker series tailored for use in Mercedes vehicles. We present the complete range and test the door speakers.





The coax is designed so that the tweeter barely protrudes from the basket, so it fits under the original grille



Having had retrofit speakers for the BMW kit for years, the industry has now also discovered Mercedes. The C- and E-Class and the GLC are equipped ex-works with standardized installation openings

for loudspeakers so that the development of custom loudspeakers is worthwhile here. And just as with BMW, a few special features make it challenging to use the standard DIN speakers. In the C- and E-Class,

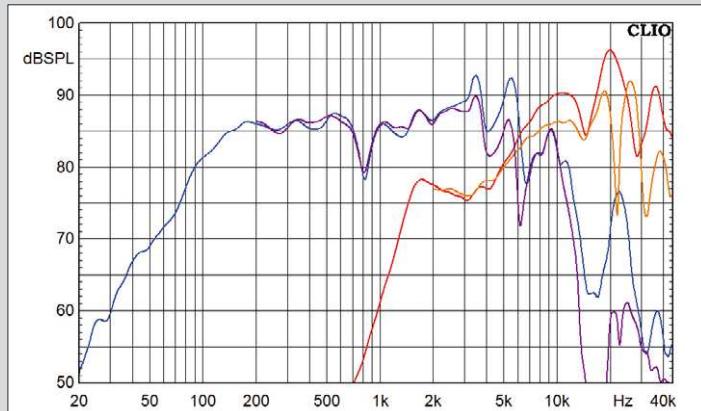
we find a 10-centimeter two-way system in the front doors while a 10-centimeter coaxial speaker is installed in the rear doors. Both can be recognized by the characteristic three ball heads for mounting, which point to the diaphragm side.

The center is built similarly; only its ball heads protrude from the basket toward the magnet side. As with some newer center speakers, the center also includes the eCall emergency call system, which must operate independently of the audio entertainment via its voice

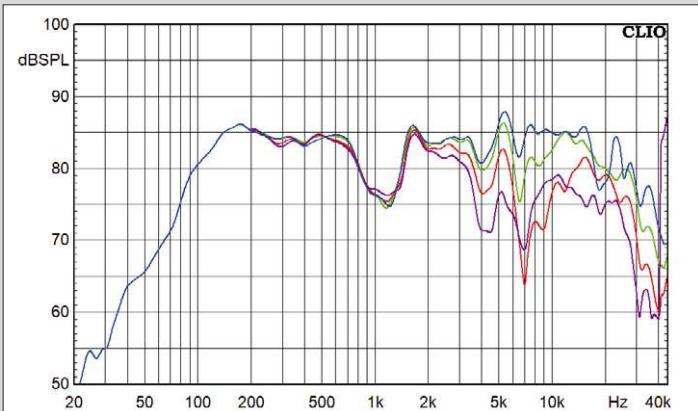
Who is Audio Design?

Founded 1984 in Kronau (Germany) as a speaker manufacturer, Audio Design GmbH has turned into an international distributor and developer of any kind of car audio aftermarket products. Audio Design is the owner of the HiFonics and Crunch brands in Germany, Austria and Switzerland as well as the ESX and Renegade brands worldwide. Distribution includes famous brands like Rockford Fosgate, Kicker, Autotek and MB Quart. The newest brand in Audio Design's portfolio is Musway, established 2018 and specialized in plug'n'play sound solutions and DSP products.

CAR&HIFI Laboratory



The midrange and treble of the CSM4.2C are quite unsteady. The narrowband impact at 800 Hz is completely harmless



Overall, the coax CSM42X runs very nicely balanced. Here, the broadband dip between 800 and 1500 Hz disturbs the positive picture, but it is not unpleasant compared to an exaggeration

Here at the right footwell woofer, the asymmetric mounts are visible. The speaker is not even centered in the mounting hole

coil. However, the most prominent feature in Mercedes is the woofers/subwoofers, which are housed in the driver and front passenger footwells. The speakers sit in the bulkhead, so they are located between the engine compartment and the footwell. This works splendidly but is accompanied by very special mounts for the speaker baskets, which are different on the right and left to worsen matters.

Let's move on to our candidates, the CSM series from Musway. Consequently, there is a combo CSM4.2C, a coax CSM42X, right and left woofer CSM8WR (L), and a tweeter replacement CSM1T. All chassis have a very high-quality impression in common. There are exclusively precious neodymium drives, which are very pleasingly chrome-plated. The plastic baskets fit in perfectly. The membranes made of black fiberglass



mesh, closed with characteristic dust caps, also look sophisticated. All diaphragms have a rather flat profile, which goes hand in hand with the not exactly lush space conditions of the original mountings. Thus, the door woofers afford only 30 millimeters of installation depth;

the center is even 3 millimeters less. There is also not much space to the front because the original grilles, which are still used, are pretty close to the diaphragms. This is especially true for the coax for the rear doors, which has a tweeter in the center of each cone. Here, Musway has cle-



The door speakers of combo and coax have powerful neodymium drives with only 30 mm installation depth. The center (right) is even flatter and has two connection sockets



verly ensured that the tweeter protrudes only minimally. Instead of mounting the tweeter on a cylinder that emerges from inside the voice coil, as is the case with conventional coaxials, the Musway tweeter sits in the coil former instead of the cylinder. To do this, the tweeter must be small in diameter, just enough to fit inside the coil former. For this purpose, Musway has equipped the woofers with extra-large coil diameters of 32 millimeters, which is quite stately for a 10-woofer.

On the other hand, the small tweeter uses a 16 mm voice coil fitted with a high-quality fabric dome - an unusual size below the typical 3/4" (19 mm) tweeters. The tweeter of the component system for the front does not have such space problems. A full-size 25-millimeter dome can be accommodated without problems in its 40-millimeter housing, which naturally fits into the original clips. Musway chose titanium as the material, which is somewhat „mitigated“ by the suspension in a rubber surround. As already mentioned, the

center speaker turns out even flatter than the 10-cm-woofer. A different drive unit was installed to achieve this, which requires extremely little

Specifications Musway CSM4.2C

Diameter woofer	101 mm
Installation depth with ring	30 mm
Magnet diameter	66 mm
Tweeter diaphragm	25 mm
Housing Tweeter	40 mm
Slope Woofer/Tweeter	-/6 dB
Tweeter protection	-
level adjustment tweeter	-
suitable for*	C-, E-Class, GLC
Other	-
Nominal impedance	4 Ohm
DC resistance Rdc	3,26 Ohm
Voice coil inductance Le	0,16 mH
Voice coil diameter	32 mm
Diaphragm area Sd	54 cm ²
resonant frequency fs	121 Hz
mechanical quality Qms	4,67
electrical quality Qes	0,67
total quality Qt	0,58
equivalent volume Vas	1,3 l
Moving mass Mms	5,4 g
Rms	0,88 kg/s
Cms	0,32 mm/N
B*I	4,47 Tm
Sound pressure 2 V, 1 m	86 dB
Power recommendation	20 – 75 W

Musway CSM4.2C

Price	250 Euro
Contact	Audio Design, Germany
Internet	www.esxaudio.de

Rating

▶ Sound	55 %	★★★★★
Bass foundation	11 %	★★★★★
Neutrality	11 %	★★★★★
Transparency	11 %	★★★★★
Spatiality	11 %	★★★★★
Dynamics	11 %	★★★★★
▶ Lab	30 %	★★★★★
Frequency response	10 %	★★★★★
Maximum level	10 %	★★★★★
Distortion	10 %	★★★★★
▶ Practice	15 %	★★★★★
Installation	5 %	★★★★★
Crossover	5 %	★★★★★
Processing	5 %	★★★★★

Upper Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

Price/performance: very good
„Well-made coax for Mercedes.“

space with an internal neodymium pellet. The diaphragm and dust cap are similar to the bass-midrange woofer, and an extra tweeter is unnecessary for the center channel. Following eCall requirements, the small driver has a dual voice coil with two taps, which are Mercedes system sockets like the original. This applies to all Musway Mercedes speakers without exception, so all speakers are 100 % plug&play. The woofers in the footwells are built asymmetrically and are different for the driver and passenger side (not even mirror symmetrical). Musway installs 8-inch round diaphragms, which are fired by neodymium drives, just like the small woofers. The baskets are made proportionally of sheet metal and plastic; the basic frame of sheet metal provides stability while two injection molded parts adapt to the complicated shaped vehicle mounts. The impedance is 2 ohms for an aftermarket power amplifier, as it can be assumed that the Musway systems are partially active. So for the front, four power amp channels are used, two for the 10-centimeter compo and two for the 8-inch footwell woofers.

Measurements and sound

At first glance, the Musway speakers show unsteady frequency responses in front of our measurement microphone. This can certainly happen and be intentional with vehicle-specific speakers because, in contrast to universal speakers, the developer can and must consider the conditions of the installation locations. The 10 cm bass-midrange driver of the CSM4.2C composite system is made to run without a crossover. After relatively harmless resonance peaks at 3.5 and 5.5 kHz, it shows a natural sound pressure drop. The tweeter

becomes relevant at about 3.5 kHz, playing with interruptions up to almost 40 kHz. The coax CSM42X shows that the transition from the mid-bass driver to the tweeter has been optimally achieved. However, the frequency response shows a hole around 1 kHz, which affects the tonality. In the listening check, the combo also hangs off the coax in the vocal range, although the coax doesn't sound unpleasant at all. Both also play crisply so that boredom never arises. The bass reproduction is exact, although without the woofer/subwoofer relatively thin so that its retrofitting is highly recommended. In the high frequencies, the combo provides fresh insight with fine details. The coax also masters this, just a bit more discreetly.

Specifications Musway CSM4.2X

Diameter woofer	101 mm
Installation depth with ring	30 mm
Magnet diameter	66 mm
Tweeter diaphragm	16 mm
Housing Tweeter	–
Slope Woofer/Tweeter	-/6 dB
Tweeter protection	–
level adjustment tweeter	–
suitable for*	C-, E-Class, GLC
Other	–
Nominal impedance	4 Ohm
DC resistance Rdc	3,34 Ohm
Voice coil inductance Le	0,13 mH
Voice coil diameter	32 mm
Diaphragm area Sd	54 cm ²
resonant frequency fs	129 Hz
mechanical quality Qms	6,09
electrical quality Qes	0,96
total quality Qt	0,83
equivalent volume Vas	1,5 l
Moving mass Mms	4,2 g
Rms	0,56 kg/s
Cms	0,37 mm/N
B*I	3,43 Tm
Sound pressure 2 V, 1 m	84 dB
Power recommendation	20 – 75 W

Conclusion

The Mercedes speakers from Musway offer very good value for money. The prices are not exorbitant, but the build quality is right across the board. They also do not disappoint in terms of sound, allowing for a substantial improvement of the car's sound.

Elmar Michels



Musway CSM4.2X

Price	180 Euro
Contact	Audio Design, Germany
Internet	www.esxaudio.de

Rating

▶ Sound	55 %	★★★★★
Bass foundation	11 %	★★★★★
Neutrality	11 %	★★★★★
Transparency	11 %	★★★★★
Spatiality	11 %	★★★★★
Dynamics	11 %	★★★★★
▶ Lab	30 %	★★★★★
Frequency response	10 %	★★★★★
Maximum level	10 %	★★★★★
Distortion	10 %	★★★★★
▶ Practice	15 %	★★★★★
Installation	5 %	★★★★★
Crossover	5 %	★★★★★
Processing	5 %	★★★★★

Upper Class



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Germany 1/21

Price/performance: very good
„Solidly done and with crisp sound.“

Ground Zero GZUC 165.2SQ – affordable high-end compo

Sound Quality Loudspeaker

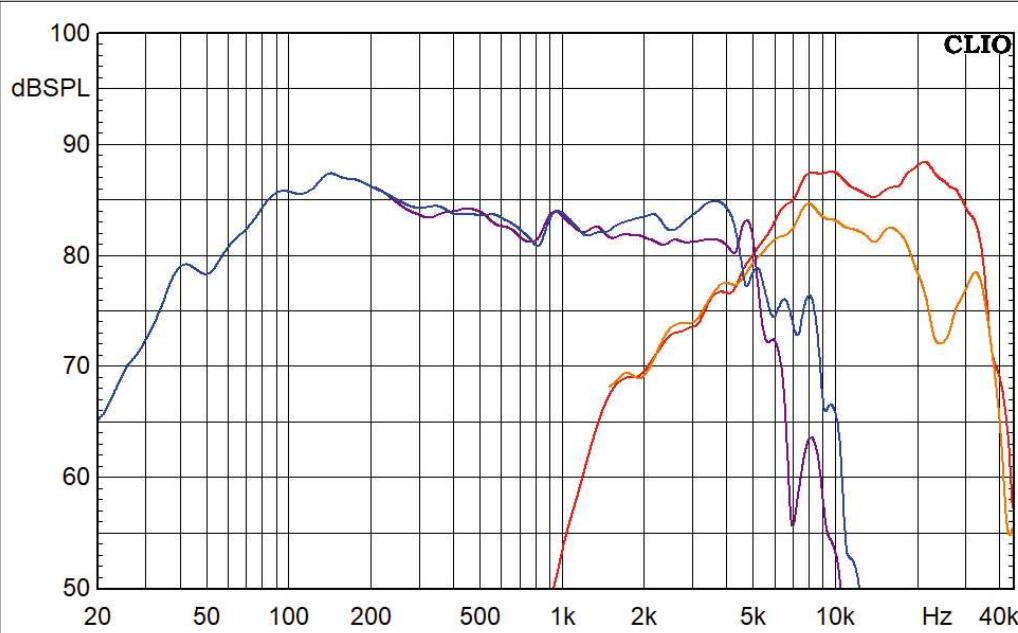
► Ground Zero has dedicated itself entirely to good sound with its new line of speakers. Let's see what the outcome is.





The woofer's motor is a technical tidbit: A large 50-millimeter coil with an internal push-pull drive

CAR&HIFI Laboratory



The midbass driver runs exemplary and with a very balanced midrange. The cone resonance at 8 kHz is well damped. The tweeter shines with a very extended frequency range exceeding 30 kHz

Ground Zero's upscale product lines include a lot of highly desirable speakers. However, those who flirt with high-end sound and want to go all the way to the top will have to dig a little deeper into their pockets. For a two-way combo of the Nuclear series „Made in Germany“, GZ call at least 800 Euro. But now, one level below that, beautiful speakers are coming to dealers with a somewhat more tolerable price tag at least: the Uranium series. The two-way combo GZUC 165.2SQ is listed at 500 Euros. For DSP users, the speakers are also available without a passive crossover at a correspondingly lower price. Later on, three more drivers will complete the series, so there is something for everyone. A 60-millimeter full-range driver can

replace the tweeter, and for three-way fans, even two different mid-range drivers are planned. The 80-millimeter cone midrange driver promises surface area and sound pressure, and the GZUM 55SQ offers something extraordinary, namely a large midrange fabric dome with a 55-millimeter coil!

Both drivers immediately make a very high-quality impression. The mid-bass driver has a sturdy die-cast frame that provides ample surface area for perfect ventilation. The cone is made of black anodized aluminum and has a true conical shape, so we have a true conical shape in front of us. It is closed with a large dust cap made from polypropylene. The dust cap has to be so large

The tweeter is protected with a hexagonal grille, for the woofers grilles in the same design are included

because the voice coil also boasts a 50-mm diameter. Not only does this give it a large surface area for heat dissipation, but it is also backed up by a very high-end design. Ground Zero have developed an underhang



The die-cast frame has become beautiful and stable. Precious neodymium is used for the motor

The crossover is equipped with high-quality components. The Slope and level of the tweeter are adjustable

drive for the woofer, in which the air gap height (pole plate thickness) is greater than the winding height of the voice coil. As a result, the voice coil always moves entirely in the air gap – a very low-distortion but costly design. Because the coil does not have to work in the stray field outside the air gap, it only faces the linear magnetic field in the gap and thus produces minimal distortion. The tweeter also has a trick up its sleeve. With its compact design, it can also be installed in original slots. Nevertheless, it should be crossable at the lowest possible frequen-



cy. To do this, a coupling volume is usually attached behind the membrane, which increases the installation depth. Ground Zero does it differently. First of all, the tweeter has a sizeable 28-millimeter dome, and it has a heavily damped

pole-core bore with access to the outside instead of the coupling enclosure, which ensures a low resonant frequency. The passive crossover is just as impressive as the drivers. It's not exactly small, and with generous air coils wound from thick wire, it offers excellent sound reserves. The two capacitors in front of the tweeter are high-quality MKP types and can be connected to select the crossover frequency. This is done, as well as the level adjustment, with solid, contact-safe jumpers.



The 28-mm silk dome has a damped pole vent on the backside

Who is Ground Zero?

Ground Zero GmbH has been founded in 1995 by Karl Felix Lautner, distributing car audio products „Made in USA“. After taking over the European trademark rights and finally the global trademark in 2003 from the discontinued US company, Ground Zero now offers 400+ products all developed and designed in house in Egmatting/Germany. The portfolio includes amplifiers, speakers, subwoofers, electronics and accessories which are distributed in more than 65 countries.

Measurements and sound

The classic 12 dB crossover has both drivers well under control. Remnants of the diaphragm resonance can be seen in the mid-bass driver at 8 kHz. Apart from that, the woofers run exemplary. The tweeter measures up quite excellently. Despite the large 28 millimeter cone, it plays to over 30 kHz – well done. With the woofer, the low distortion drive pays off, especially at low frequencies. Down to the bass and up to very high levels, the woofer plays crystal-clear. As expected, distortion measurement is an easy task for the silk tweeter. Sonically, the journey goes towards clarity and transparency. The tweeter spoils the ear with gossamer details, wind noise, or the creaking of strings come to the fore. The room also literally breathes atmosphere, especially during live recordings. There is never an overdose of high frequencies, so the system always sounds pleasant. Precision never falls by the wayside with voices and instruments, either. Despite the „round“ sound, the Ground Zero can bite and let brass sections blare powerfully. The bass range joins in with an extremely precise kick and a creamy, pleasant low end. Bass sounds are full and rich, and here, too, the system works out the subtleties very well. Overall, a very sophisticated sound that will undoubtedly make even demanding listeners happy.

Conclusion

With the GZUC 165.2SQ, Ground Zero has successfully created a compo that is immediately one of the best in its class. Great sound, technically sophisticated, and more than reasonable in price.

Elmar Michels

Specifications

Basket diameter	165 mm
Installation diameter	144 mm
Installation depth	64 mm
Magnet diameter	80 mm
Tweeter diaphragm	28 mm
Tweeter cabinet	48 mm
slope woofer/tweeter	12/12 dB
Tweeter protection	PTC
Tweeter level adjustment	+2, 0, -2 dB
Grille	•
Other	-
Nominal impedance	4 Ohm
DC resistance Rdc	3,19 Ohm
Voice coil inductance Le	0,37 mH
Voice coil diameter	50 mm
Cone area Sd	127 cm ²
Resonance frequency fs	57 Hz
Mechanical Q Qms	3,65
Electrical Q Qes	0,82
Total Q Qts	0,67
Equivalent volume Vas	11,1 l
Moving mass Mms	15,7 g
Rms	1,54 kg/s
Cms	0,49 mm/N
B*I	4,68 Tm
SPL 2v, 1m	86 dB
Amplifier power recommendation	30 – 150 W



Ground Zero GZUC 165.2SQ

Price 500 Euro
Contact Ground Zero GmbH, Germany
Internet www.ground-zero-audio.com

Rating

▶ Sound	55 %	★★★★★
Bass foundation	11 %	★★★★★
Neutrality	11 %	★★★★★
Sound stage	11 %	★★★★★
Spatiality	11 %	★★★★★
Dynamics	11 %	★★★★★
▶ Lab	30 %	★★★★★
Frequency response	10 %	★★★★★
Max. SPL	10 %	★★★★★
Distortion	10 %	★★★★★
▶ Practice	15 %	★★★★★
Crossover	10 %	★★★★★
Build quality	5 %	★★★★★

Top Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

Price/performance: very good
„Top technology for top sound.“

Eton Onyx 16/80/28 – High-End Loudspeakers
Made in Germany

Gems

► It wasn't so long ago that Eton caused a sensation with its Core loudspeakers. And yet, just two years later, there are high-end speakers again: the Onyx series.







Eton uses paper cones reinforced with embossing for Onyx 16 and Onyx 80

Fear not! Eton is by no means planning to replace the Core series. The Onyx speakers are not Core successors but represent their own series. Also placed in the top segment of the market, the Onyx drivers are aimed at the owners of a sophisticated audio system with a signal processor and multiple power amplifiers. Therefore, there will be exclu-

sively the three drivers presented here, namely the bass-midrange Onyx 16, the midrange Onyx 80, and the tweeter Onyx 28.

A passive crossover is not provided – just remember the DSP. All three drivers impress with the very highest manufacturing quality. As usual with Eton, they are manufactured in the factory in Neu-Ulm.

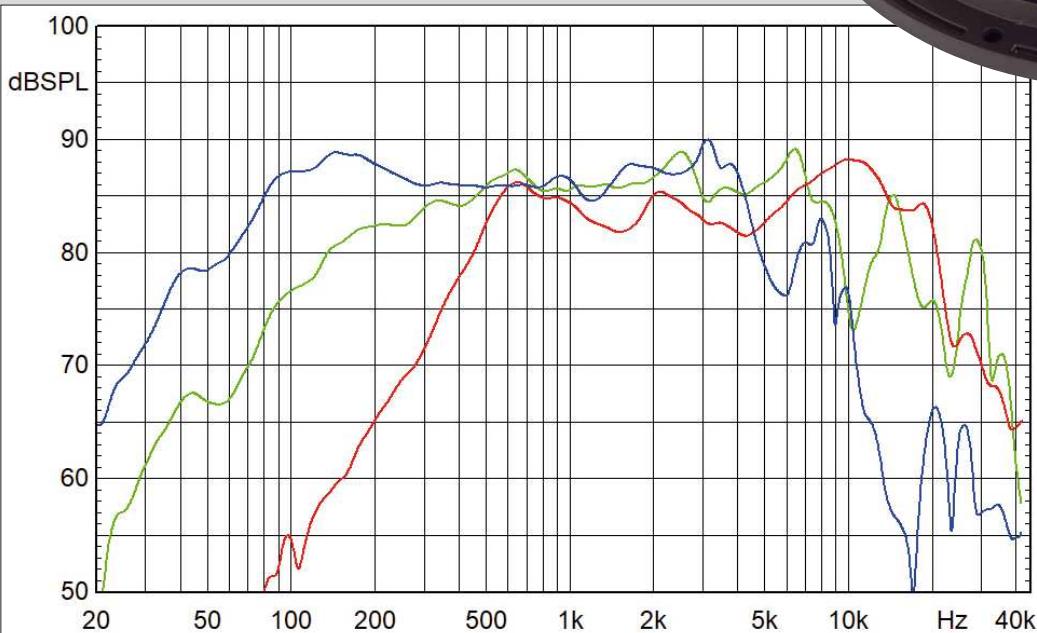
The series comes in all black, which further enhances the noble impression. We are dealing with aluminum die-cast baskets on woofer and mid-range, beautifully made and highly functional.

All areas are perfectly ventilated, and the baskets leave plenty of space for the transducer units to work perfectly. For the diaphragms, Eton uses paper, a material that doesn't need to fear any comparison, even in the high-end sector. Depending on the composition and treatment, paper is versatile and still offers an excel-



Onyx 16 and Onyx 80 are equipped with matt lacquered aluminum baskets, which are not only beautiful but also functional

CAR&HIFI Laboratory



The frequency responses of the three drivers show broad overlaps. This allows freedom in the choice of crossover frequencies and makes the Onyx flexible to use

lent compromise between stiffness and damping. The Eton cones are not smooth but have a ribbed structure. With the midrange driver, we find radially spreading grooves; with the woofer, there are smaller, shorter ones between the long grooves, too. Both membranes are guided by centering spiders and beads, which are also of German manufacture. While an impregnated fabric dome seals the woofer cone, we find an inverse aluminum cap in the center of the midrange cone, which sits directly on the coil former to support the upper midrange frequencies. For the motors of course, it has to be neodymium, which Eton prefers over the less expensive ferrite. This is also the case with the tweeter, housed in an aluminum enclosure that is as solid as it is high-quality. Alternatively, there is an aluminum housing for the dashboard – just as standard as the grilles and aluminum rings for the Onyx 80 and Onyx 16. The tweeter has a coupled rear chamber and emits the sound via a specially coated fabric dome with a 28-millimeter diameter.

Sound

From the first note, the Eton Onyx system's sound fascinates, embraces, and entralls us. It sounds perfectly balanced, with beautifully rendered voices and an excellent tonal balance. The 16-cm woofer reproduces bass sounds ultra-cleanly, and bass drums and double bass are catapulted completely effortlessly into the listening room. Also very harmonious and without effort, details of instruments or the fine melting in the treble are reproduced. This sound is 100% suitable for long distances, and despite all the harmony, it fascinates and never gets boring. If one sits down and consciously pricks

Grille and rings are included with the cone drivers; the tweeter comes with installation and surface-mount housing



up one's ears, unimagined worlds of sound open up - provided the appropriate recordings are made - full of the most delicate minute details that are present but do not impose themselves. What Eton serves up here is of the very highest quality. Perfect for lovers of an unobtrusive sound that nevertheless has it all.

Specifications

Basket diameter	165 mm
Installation diameter	147 mm
Installation depth	79 mm
Magnet diameter	68 mm
Basket M	94 mm
Installation depth M	43 mm
Tweeter diaphragm	28 mm
Tweeter housing	51 mm
Highest crossover frequency. B/M	3,5k/7 k Hz
Lowest crossover frequency. M/H	300/2k Hz
Crossover frequency under test	300/2,8k Hz
EQ during test	B (8,5 kHz/-6 dB/Q4)
Grille	•/•/•
Other	Aufbaugeh. HT
Nominal impedance	4 Ohm
DC resistance Rdc	3,33 Ohm
Voice coil inductance Le	0,13 mH
Voice coil diameter	38 mm
Diaphragm area Sd	137 cm ²
Resonance frequency fs	120,6 Hz
Mechanical Q factor Qms	8,32
Electrical Q factor Qes	0,35
Total quality Qts	0,34
Equivalent volume Vas	4,98 l
Moving mass Mms	9,2 g
Rms	0,83 kg/s
Cms	0,19 mm/N
B*I	8,01 Tm
Sound pressure 2 V, 1 m	87 dB
Power recommendation	50 – 200 W

Conclusion

Once again, Eton manages to convince even demanding sound lovers with a speaker series. The Onyx system is a big hit, quite different from the top system Core 3, and perfect in its own way.

Elmar Michels

Eton Onyx 16/80/28

Price	1.600 Euro
Contact	ACR, Switzerland
Internet	www.etongmbh.com

Rating

▶ Sound	55 %	★★★★★
Bass foundation	11 %	★★★★★
Neutrality	11 %	★★★★★
Transparency	11 %	★★★★★
Spatiality	11 %	★★★★★
Dynamics	11 %	★★★★★
▶ Lab	30 %	★★★★★
Frequency response	10 %	★★★★★
Maximum level	10 %	★★★★★
Distortion	10 %	★★★★★
▶ Processing	15 %	★★★★★

Absolute Top Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

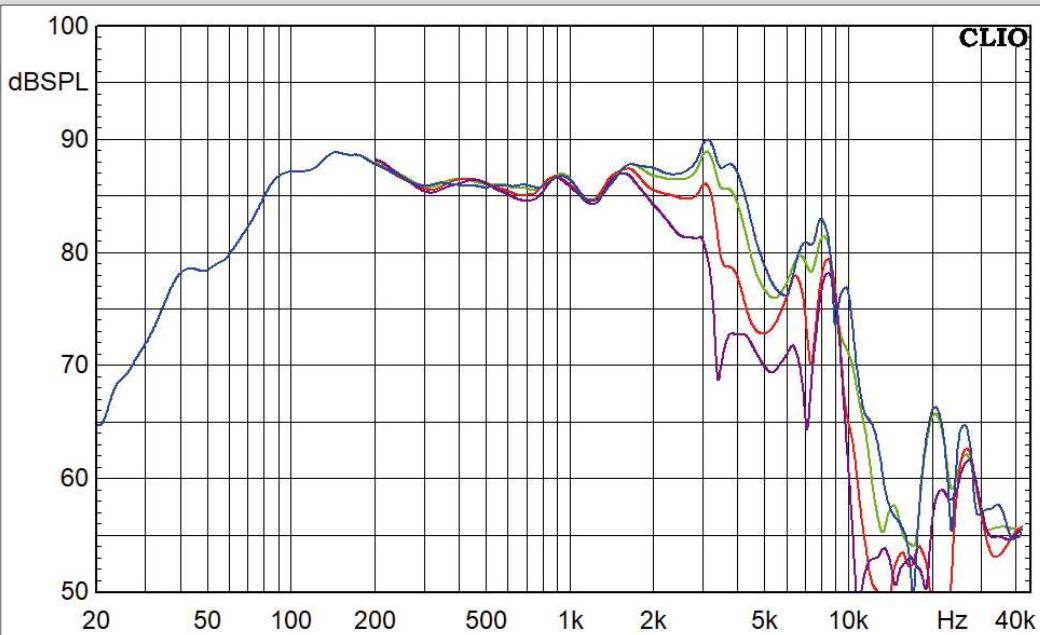
Price/performance: very good

„Harmonious and detailed sound for connoisseurs.“

Eton Onyx 16



CAR&HIFI Laboratory



The Onyx 16 delivers an excellent frequency response from bass to 3.5 kHz and can be used in both three-way and two-way configurations



The massive die-cast basket of the Onyx 16 is not stingy with installation depth; only the neodymium drive slims down

With the Onyx drivers, Eton launches a new line of high-end loudspeakers. There are three drivers: the Onyx 28 tweeter, the Onyx 80 midrange driver, and the Onyx 16 bass-midrange driver, which is the subject of this review.

The Onyx 16 is a bass-midrange driver that forms the backbone of the series, and its designers have given it the best prerequisites. Already its particularly deep diaphragm signals that the development was not subject to many compromises and that a shallow mounting depth did not play a role. Instead, the paper cone is allowed to spread out unhindered. To increase stability, the diaphragm shows two sets of radial embossing, and if you take the Onyx 16 in your hand, you can well feel the stiffness. The whole thing resides in an impressive matte black aluminum basket, which scores with rich stability and excellent ventilation. Everything about the motor is also of the finest.

Noble neodymium ensures perfect symmetry in the air gap, and the copper coil is wound on an electrically non-conductive fiberglass carrier to avoid eddy currents. Finally, the finest soft parts such as spider and surround made in Germany and the symmetrical strands ensure optimum linearity.

Measurements

In front of the measurement microphone, the Onyx 16 impressively proves that the Onyx philosophy of diaphragm design is a success. Despite its stiff diaphragm, no resonance peaks interfere with the amplitude response. Of course, the Onyx cone resonates at some point, but this is strongly damped and occurs above 7 kHz. Thus, it is clear that the Onyx 16 is unrestrictedly two-way capable as a bass-midrange driver. If necessary, it plays up to 3.5 kHz. Thanks to its parameters tuned to the car door, it does not shy away from low tones and also plays with low distortion in the lower range.

Eton Onyx 16

Price/pair	600 Euro
Contact	ACR, Switzerland
Internet	www.etongmbh.com

Specifications

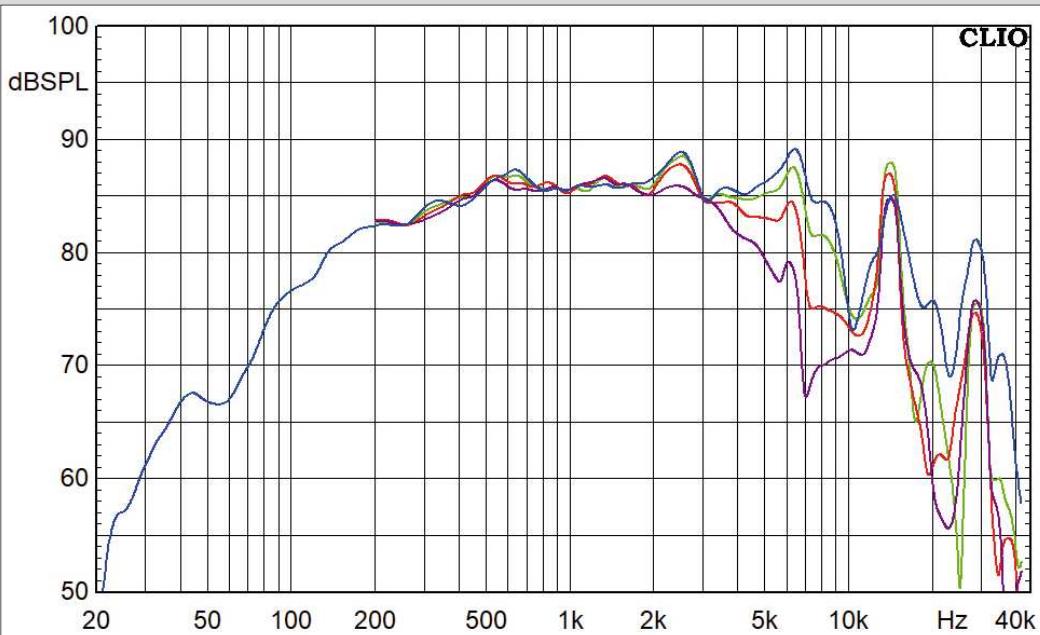
Outer diameter	165 mm
Installation diameter	147 mm
Installation depth	80 mm
Magnetdurchmesser	68 mm
Diaphragm material	paper
Voice coil	copper
Voice coil carrier	glass fiber
Magnet	Neodymium ring
Highest crossover frequency	3,5 kHz
Lowest crossover frequency	–
Weight	980 g
Other	–
Nominal impedance	4 Ohm
DC resistance Rdc	3,25 Ohm
Voice coil inductance Le	0,43 mH
Voice coil diameter	32 mm
Diaphragm area Sd	139 cm ²
Resonant frequency fs	72,0 Hz
Mechanical quality Qms	5,69
Electrical Q factor Qes	0,76
Total quality Qt	0,67
Equivalent volume Vas	9,30 l
Moving mass Mms	14,1 g
Rms	1,12 kg/s
Cms	0,35 mm/N
B*I	5,25 Tm
Sound pressure 2 V, 1 m	87 dB

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„Noble woofer for 2 or 3 ways.“

Eton Onyx 80



CAR&HIFI Laboratory



The Onyx 80 operates pretty wide-band and that at an astonishing output level of 87 dB at 1 W

With the Onyx drivers, Eton launches a new line of high-end loudspeakers. There are three drivers: the Onyx 16 bass-midrange driver, the Onyx 28 tweeter, and the Onyx 80 midrange driver, which is the topic of this review.

The Onyx 80 is a jewel of a speaker that is a pleasure to hold and almost too good to hide away. The 80-millimeter midrange driver is beautifully crafted and radiates value with every component. There is a special die-cast basket with its filigree struts and ample rear ventilation. The high-quality surround and the elaborately pressed paper cone are just as pleasing. The latter features a ring of radially embossed ribs as an Onyx specialty, good for both stability and resonance behavior. The dust cap is made of aluminum and is glued directly to the coil carrier. Thus, it acts as a tweeter dome and influences the upper transmission end of the Onyx 80. The motor is perfectly manufactured; the precisely turned pole plates alone make speaker lovers' eyes glaze over. The magnet material is

expensive neodymium, in the form of a ring around the pole core (as with ferrite) and not as an economy version with an internal neodymium tablet. We again find perfect and complete ventilation with pole core drilling and a ring of holes under the voice coil in the drive. The latter has symmetrical lead outlets, as with all Onyx drivers.

Measurements

The Onyx 80 shows an almost ideal amplitude response between 200 Hz and about 8 kHz, which predestines it as a broadband midrange driver. However, it rejects true broadband fans, as a tweeter is still required. With 87 dB already at 2 V/1 m, it is very efficient for the small cone area. And what's almost even better: it doesn't only hold back with distortions at low levels but plays neatly above 300 Hz up to considerable volumes.

Conclusion

The Onyx 80 is a brilliantly crafted midrange driver with first-class performance.



The Onyx 80 is fully ventilated with pole core drilling and hole ring

Eton Onyx 80

Price/pair	400 Euro
Contact	ACR, Switzerland
Internet	www.etongmbh.com

Specifications

Outer diameter	94 mm
Installation diameter	76 mm
Installation depth	43 mm
Magnetdurchmesser	54 mm
Diaphragm material	paper
Voice coil	copper
Voice coil carrier	glass fiber
Magnet	Neodymium ring
Highest crossover frequency	7 kHz
Lowest crossover frequency	300 kHz
Weight	395 g
Other	-

Nominal impedance	4 Ohm
DC resistance Rdc	3,26 Ohm
Voice coil inductance Le	0,19 mH
Voice coil diameter	25 mm
Diaphragm area Sd	35 cm ²
Resonant frequency fs	125,0 Hz
Mechanical quality Qms	4,43
Electrical Q factor Qes	0,37
Total quality Qt	0,34
Equivalent volume Vas	0,87 l
Moving mass Mms	3,2 g
Rms	0,57 kg/s
Cms	0,50 mm/N
B*I	4,72 Tm
Sound pressure 2 V, 1 m	86 dB



Onyx 80 and Onyx 16 are supplied with high-quality grilles and rings

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„Jewel with exceptional performance.“

Eton Onyx 28

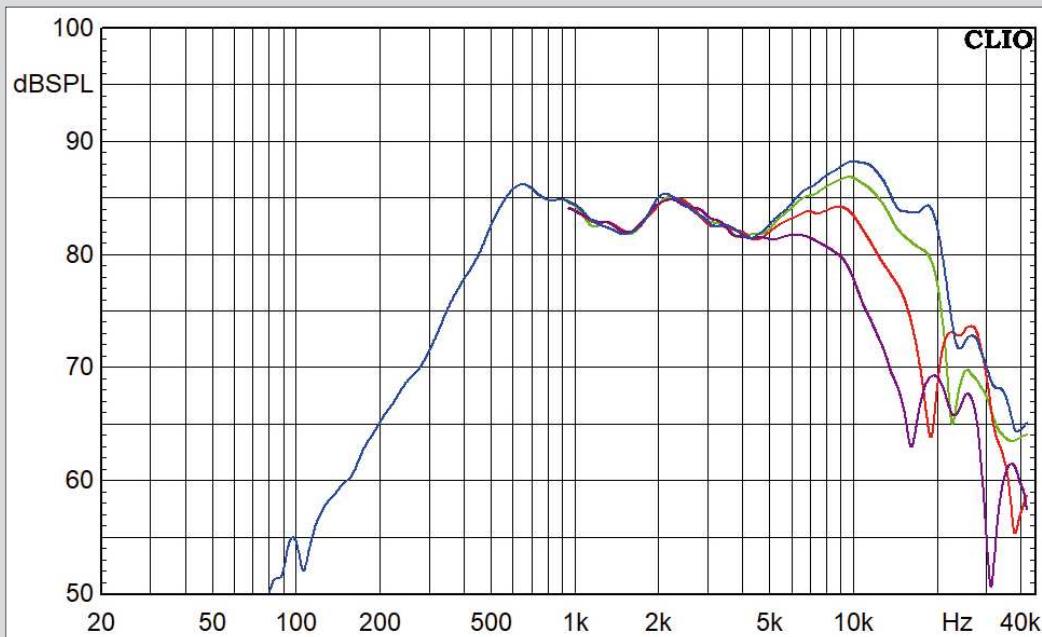
With the Onyx drivers, Eton launches a new line of high-end loudspeakers. There are three

drivers: the Onyx 16 bass-midrange driver, the Onyx 80 midrange driver, and the Onyx 28 tweeter, which is the subject of this review.

It is not small, but it feels good in the hand. Already when you unscrew the solid aluminum housing, the rich sound of the metal winding leaves a quality impression that you only get with few speakers. The rea-



CAR&HIFI Laboratory



Due to its large dome, the sound pressure of the Onyx 28 drops quite a bit under an angle, so it must be aimed at the listener

son for unscrewing may be that you prefer to use the Onyx 28 without a grille, or the second housing is used. In addition to the aluminum cup, the Onyx 28 also comes with a dashboard enclosure consisting of solid aluminum. The tweeter itself works with a relatively sizeable 28-millimeter fabric dome. The dome is so fine (and coated by hand with a special coating developed for the Onyx) that you can see right through it. The view is not of the pole plate or damping piece but of an Eton specialty called RCFS. This is an attenuation of the pole plate reflections consisting of concentric waves. The goal is to dampen and scatter the inevitable rearward sound from the dome so that no unwanted standing waves are created. Eton has also taken the utmost care with the ventilation. The rear chamber, which is a matter of course in this class, is designed asymmetrically, and surround ventilation was not forgotten. CCAW, or copper-coated aluminum wire, is used for the voice coil, helping to

save weight. Like all Onyx chassis, the Onyx 28 has a symmetrical lead layout with opposite outlets so that no imbalance occurs during oscillation.

Measurements

The Onyx 28 achieves an exemplary amplitude response from 500 Hz to 20 kHz, with the grille acoustically designed to be almost „transparent“. The amplitude hump around 10 kHz can be smoothed out easily, although the situation in a car is, of course, different than in our standard baffle. Downward, the operating range is limited at 2 kHz, since below that, the distortion also goes up at higher levels. Still, within its operating range, the Onyx 28 remains super clean, as it befits a high-end tweeter.

Conclusion

With the Onyx 28, you get one of the most sophisticated tweeters that delivers what it promises in all respects.

The Onyx 28 can be mounted either in an aluminum cup or in a surface-mount housing



Who is ACR?

Started in 1975 with a 28 m² shop for home loudspeaker kits in the heart of Zurich/Switzerland, ACR Braendli + Voegeli AG is today one of the largest distributors of car audio and car multimedia products in Europe. The ACR range comprises eight established brands, exclusively distributed by ACR: Axton, Emphaser, Eton, Focal, Radical, Spectron, Xzent, Zealum and Zenec. The company is certified according to DIN EN ISO 9001:2015 in the areas of engineering, import & export, logistics and sales & marketing since November 2009. There is large dealer network with a three-digit number of shops in the DACH / Benelux region and numerous distributors in various EU and non-EU countries.



Under the ultra-thin fabric membrane, a special diffuser prevents unwanted reflections from the pole plate

Eton Onyx 28

Price/pair	600 Euro
Contact	ACR, Switzerland
Internet	www.etongmbh.com

Specifications

Outer diameter	59 mm
Installation diameter	51 mm
Installation depth	31 mm
Magnetdurchmesser	–
Diaphragm material	paper
Voice coil	copper
Voice coil carrier	glass fiber
Magnet	Neodymium ring
Highest crossover frequency	–
Lowest crossover frequency	2 kHz
Weight	145 g
Other	–
Nominal impedance	8 Ohm
DC resistance Rdc	6,55 Ohm
Voice coil inductance Le	0,21 mH
Voice coil diameter	28 mm
Diaphragm area Sd	6 cm ²
Resonant frequency fs	580,0 Hz
Mechanical quality Qms	–
Electrical Q factor Qes	–
Total quality Qts	–
Equivalent volume Vas	–
Moving mass Mms	–
Rms	–
Cms	–
B*I	–
Sound pressure 2 V, 1 m	84 dB

CAR & HiFi
INTERNATIONAL Germany 1/21
„High-end textile dome at its best.“





Audio System X06 Evo BR
– Powerful bass
with a 6.5 inch driver

Down-sizing

► Small subwoofers don't have to be low SPL. This is probably what Audio System thought when they created the X06 Evo. Here is the test of the power dwarf.



Well done: The heavy driver is held
and supported in an MDF ring

Audio Systems X-woofers are available in 15-, 12-, 10-, 8- and 6-inch versions, with the 6-inch being the youngest member of the family. Nowadays, subwoofers can be small – but actually, everyone wants a decent bass sound. If a small subwoofer is to offer proper output, it must be built all the more massive.



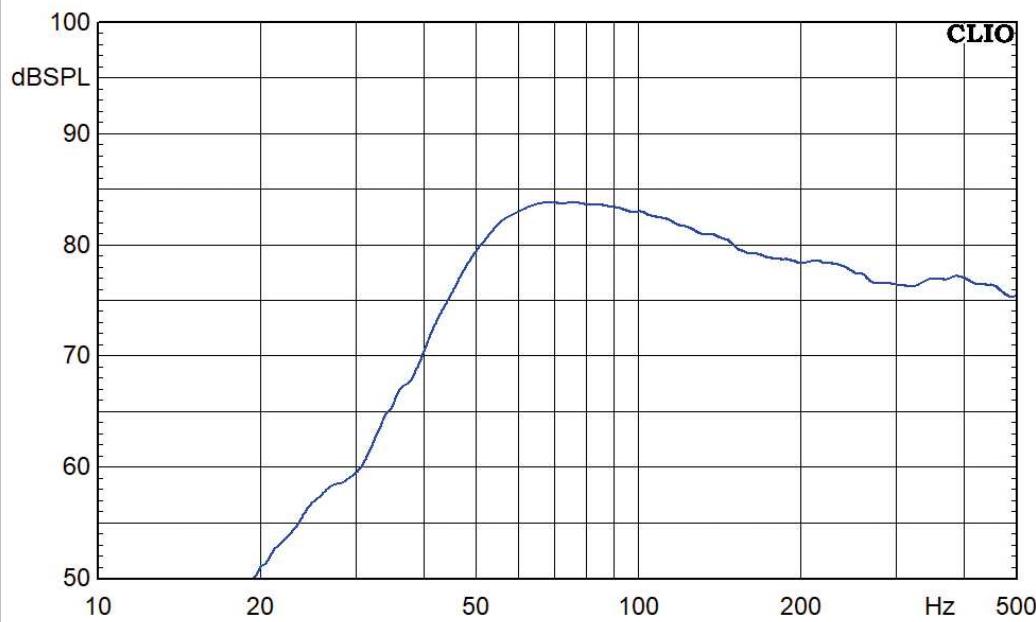
Since sound pressure results from the diaphragm area and the diaphragm excursion of the subwoofer, a subwoofer with a small diameter must have a long throw. And that's exactly what Audio System has done with the X06 Evo. Its 38-millimeter voice coil is wound exceptionally long on the carrier so that it does not move out of the drive air gap at high excursion. The diaphragm must also be stable so that it does



not deform or even tear. Therefore, the X06 has been given a thick paper diaphragm, further reinforced by a plastic coating and a fiberglass dust cap. A sturdy die-cast basket and a full-weight magnet system are also helpful. To pump the necessary power into the little one, its voice coil has two 2 ohm taps. We tested the X06 Evo BR as a cabinet subwoofer, and the cabinet is also new. It's made of sturdy 19 millimeters thick MDF, with the front almost doubled up to 35 millimeters so you can sink the

As for the bass driver, only the nominal size of 6 inches is modest. The X06 has become a massive subwoofer

CAR&HIFI Laboratory



Up to 50 Hz, there's full sound pressure, a respectable 84 dB at 1 W – a reasonable tuning

Who is Audio System Germany?

Audio System started with Axel Förde-
rer establishing his first Car hifi shop
in 1988. While importing Audio System
amplifiers, he took the chance to
develop his own loudspeakers and
crossovers. Now amplifiers and loud-
speakers are developed by two German
engineers, both dedicated car hifi spe-
cialists. Audio System products are
produced in the far east as well as in
Germany and EU, distribution covers
Germany with 350+ dealers, all Europe
and numerous countries worldwide.
Products are arranged in 9 different
lines from Carbon entry series to
Avalanche high end series, including spe-
cial compos and Perfect Fit speaker
sets and all necessary accessories.

woofer basket in. The reflex tunnel
has a generous cross-section and
opens out at the front. Trickily, it ex-
tends upwards inside along the front
wall. Despite the compactness of the
box, Audio System does not do with-
out stiffening boards. And we find
the support of the heavy magnet,
which is housed in a bracket, very
good. The inserted board with the
double connection terminal is also
very clever; an active module also
fits in its place.

Measurements and sound

The small X06 Evo is no lightweight,
even its massive cone assembly with
93 grams of moving mass wants to
be driven properly. The X06 Evo
achieves this with its perfectly bal-
anced parameters, which allow it
to run well in the compact 12-liter
housing. After all, 50 Hz lower cu-
t-off frequency is commendable, and
there's a comparatively good 84 dB
per watt. The small housing requires
that the X06 Evo BR connected to
4 ohms in series can act with small
amps; we recommend the parallel
connection, which provides mathe-
matically 1 ohm, but in practice is
instead 3 ohms, making it uncritical

even for small amplifiers. In action,
the X06 Evo BR amazes with a lot of
pressure. It refuses to deliver ultra-
deep dark bass orgies, but it bangs
all the better with normal music. It
heats up with crisp bass drums that
are an absolute joy and soars to as-
tonishing volume levels. In addition,
it plays razor-sharp and ultra-crisp
when needed, so you'll have a lot of
fun with it.



Specifications

Basket diameter	18,2 cm
Basket diameter	15,1 cm
Mounting depth	11,5 cm
Magnet diameter	12,0 cm
Housing width	42,0 cm
Housing height	26,5 cm
Case depth	15/23 cm
Weight	11,4 kg
Nominal impedance	2 x 2 Ohm
DC resistance Rdc	3,92 Ohm
Voice coil inductance Le	2,16 mH
Voice coil diameter	38 mm
Diaphragm area	137 cm ²
Resonant frequency fs	51 Hz
Mechanical quality Qms	5,20
Electrical quality Qes	0,50
Total quality Qts	0,45
Equivalent volume Vas	2,7 l
Moving mass Mms	93 g
Rms	5,80 kg/s
Cms	0,10 mm/N
B x l	15,41 Tm
Sound pressure 1 W, 1 m	84 dB
Power recommendation	150-300 W
Test enclosure	vented 12 l
Port dimensions (d x l)	56 cm ² x 20 cm

Conclusion

Crisp, powerful bass from a very
compact enclosure: the Audio Sys-
tem X06 Evo BR pulls it off with fly-
ing colors.

Elmar Michels

Audio System X06 Evo BR

Price	225 Euro
Contact	Audio System, Germany
Internet	audio-system.de

Rating

▶ Sound	50 %	★★★★★
Bass	12,5 %	★★★★★
Pressure	12,5 %	★★★★★
Purity	12,5 %	★★★★★
Dynamics	12,5 %	★★★★★
▶ Lab	30 %	★★★★★
Frequency response	10 %	★★★★★
Efficiency	10 %	★★★★★
Maximum level	10 %	★★★★★
▶ Processing	20 %	★★★★★

Top Class



CAR & HiFi
INTERNATIONAL

Germany 1/21

Price/performance: very good
„Extra-class power dwarf.“

Next issue November 5, 2021

Coming soon



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COMING SOON



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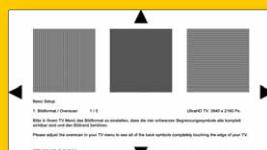
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mit professionellen Testbildern der HEIMKINO-Redaktion

Inklusive ...

... ausführlicher Dokumentation



Basiseinstellung Bildformat



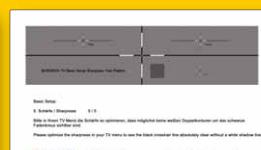
Basiseinstellung Helligkeit



Basiseinstellung Kontrast



Optimierung der Farbeinstellung



Schärfe-Einstellung



First-Check-Testbild



Universal-Testbild



Clipping-Test



Realbild für Helligkeitswerte



Realbild „Früchte“

und viele weitere Referenzbilder

JETZT erhältlich auf:
www.hifitest.de/shop
► bildoptimierung



Dipl.-Phys. Guido Randerath,
Chefredakteur Heimkino

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