

CAR & HiFi

INTERNATIONAL

2/21 · 4,80 €

European Edition



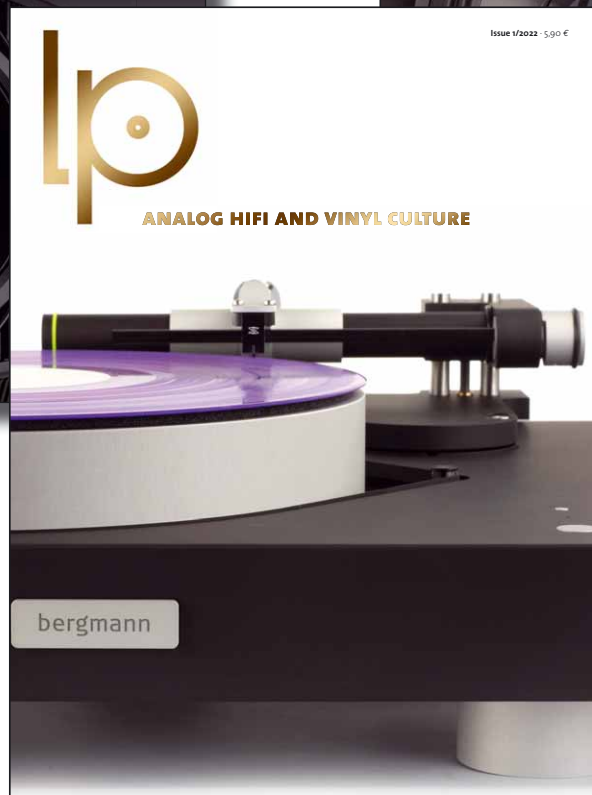
Featured brands

- Audio System Germany
- Axton • Brax • ESX • Eton
- Ground Zero • Helix • Match
- Musway • Pioneer

Best topics

- Premium camper naviceiver
- Sound upgrade with DSP
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- Bargain amplifier series
- 7 subwoofers tested

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TECHNIK FÜR KLANGBEGEISTERTE

Sound and entertainment

Welcome to the second issue of CAR&HIFI International! Number 2 is fully packed with reviews on the newest in-car technology, designed to make your everyday in-car experience perfect. Starting with camper van equipment we proudly present Pioneer's latest flagship headunit, offering everything you need in your Fiat Ducato (even the new Ducato 8) or Iveco Daily. In order to upgrade factory systems, a DSP amplifier is still the weapon of choice. So we have reviewed two of them in this issue. Eton's Mini 150.4 DSP is the perfect allrounder and shines with built-in WIFI streaming even in hires quality. Second is the brand new M 5.4DSP by Match, a tiny amplifier that is capable to power up a standard factory system while offering 9

DSP channels to drive a fully fledged system, e.g. in a BMW or Mercedes. Finally, there's of course loudspeakers and subwoofers in this issue, ranging from hi-end to budget and from fullsized to stealthy.

Enjoy your read!



Elmar Michels
Editor-in-chief



CAR SPECIFIC

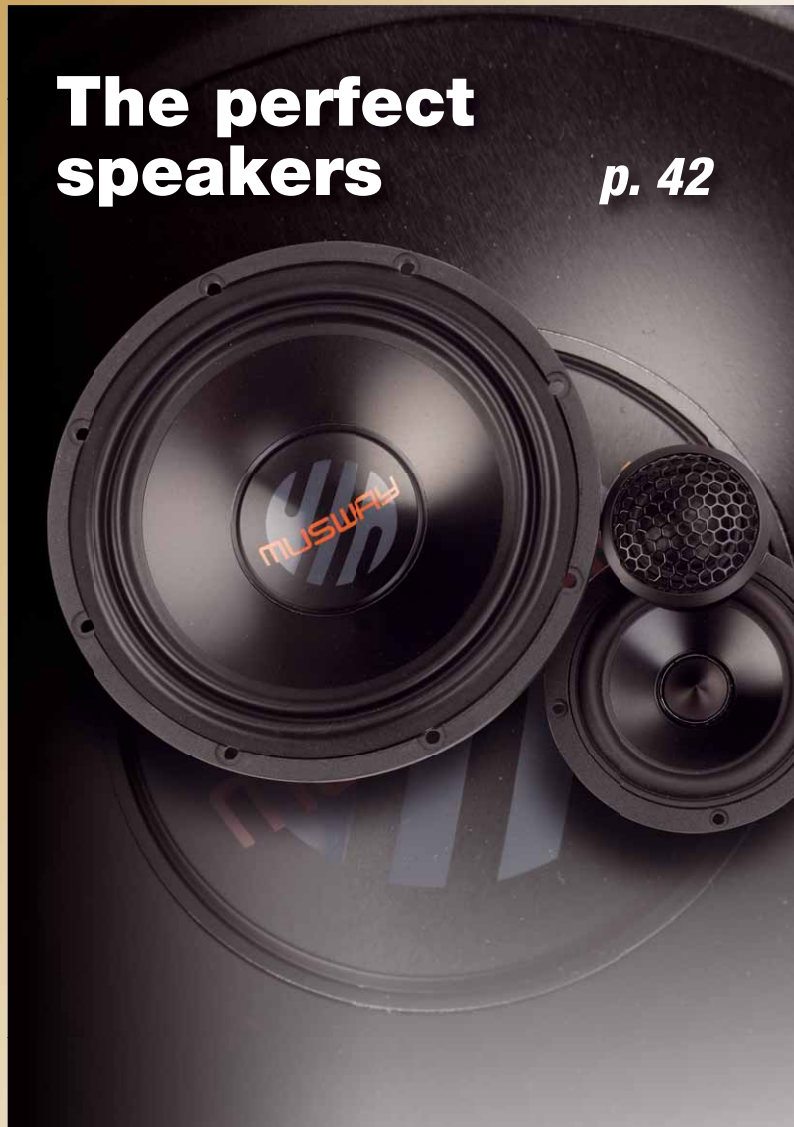
GZCS 200.2VW-T5/T6

- Fahrzeugspezifisches 2-Wege Komponenten-System geeignet für VW T5 und T6
- Klippel® optimierter Tieftöner
- Modellspezifischer 200 mm Kunststoffkorb
- 28 mm Seidenkalotten-Hochtöner
- 18 dB/Oktave Hochpassfilter mit Pegelanpassung
- Variabler 6 dB/Oktave Tiefpassfilter
- Plug & Play Verbindungsstecker
- Montageplatte für Hochtöner (für T5)
- Inkl. Befestigungsmaterial





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Camper navigation

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Pioneer AVIC-Z1000DAB 8

Bluetooth at its best

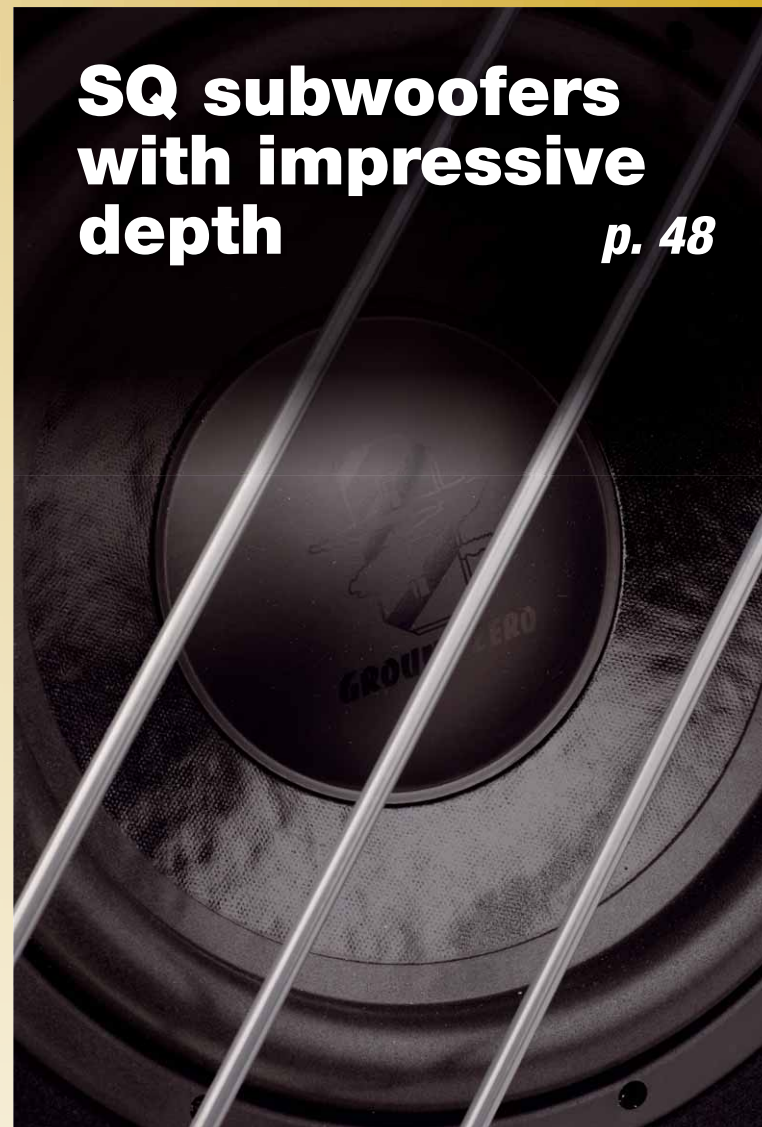
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Four-channel power amplifier with DSP and streaming *p. 18*



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► Musway M12

The new Musway 12-channel Class D amplifier with 16-channel DSP provides even the largest audio systems with power and sound configuration possibilities. The new amp has a Musway-like appearance - as befits a brand based on innovation and technology - compact on the outside and just as mature on the inside as it is ready to perform. Its full equipment, including 12 intelligent high-level inputs, an Error Protection System (EPS) and 295 MHz DSP technology that can be controlled via PC software or APP, arouse curiosity about the newcomer; Music streaming via optional Bluetooth USB dongle and the use of other Musway control tools distinguish it as a versatile center for modern sound concepts.

www.musway.de/english



► First glance at 2022

After missing two shows due to the pandemic, 2022 is very likely to bring us a new format for Europe's most important in-car entertainment show. Still in Salzburg/Austria, but now in the context of the tuning show 'Customized', we will attend the CarMediaWorld on April 27 - April 30, 2022 on the Salzburg fairground. CarMediaWorld will feature an exhibition of the car entertainment industry, while EMMA will arrange the European Finals of their Sound-offs. So if you are interested in the newest products of the industry or in Europe's best sounding cars, Salzburg will be the right place to get both.

www.emmanet.info

► New Radioactive amps

Ground Zero launches new amplifiers, namely two new amps in the Radioactive series. The two-channel GZRA 2HD and the four-channel GZRA 4HD offer plenty of power thanks to modern Class D technology. Variable crossovers, sturdy connection terminals and, last but not least, the automatic switch-on without a remote signal make them practical everyday companions. Of course there is also power at Ground Zero, namely up to 275 watts per channel into 2 ohms for the GZRA 4HD and up to 450 watts for the GZHA 2HD.

www.ground-zero-audio.com





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A CHOICE YOU MAKE

Denis Waitley

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QE1200.4



QE1000.1



QE900.4



QL600.2 24V



QS-TWO



QL600.4



QL500.2



QM400.2



QM400.4



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Suitable for Fiat Ducato 7/8, Iveco Daily

Fresh from the Caravan Show:
Pioneer AVIC-Z1000DAB

Camper navigation

- ▶ At the beginning of September, Pioneer presented its latest infotainment solution for Fiat Ducato and Iveco Daily at Germany's most important motorhome trade fair. CAR&HIFI International had the opportunity to test the exceptional device in detail before its market launch.





Traffic information is taken into account



Site guide from Promobil

Car media specialist Pioneer has custom-designed the AVIC-Z1000DAB for the new Ducato models 7 and 8. In addition, it also fits perfectly in the larger Iveco Daily from the Fiat Group. Mechanically, it fits perfectly into the camper's dashboard. The display snuggles into place and thus poses no danger to the occupants even in an accident.

Equally successful is the electronic integration into the onboard technology. The AVIC communicates with the Fiat's BUS system. It also controls the optional SDA-HU100 head-up display, which, in addition to speed and navigation instructions, displays warnings from the vehicle's assistance systems in the Fiat Ducato 8.

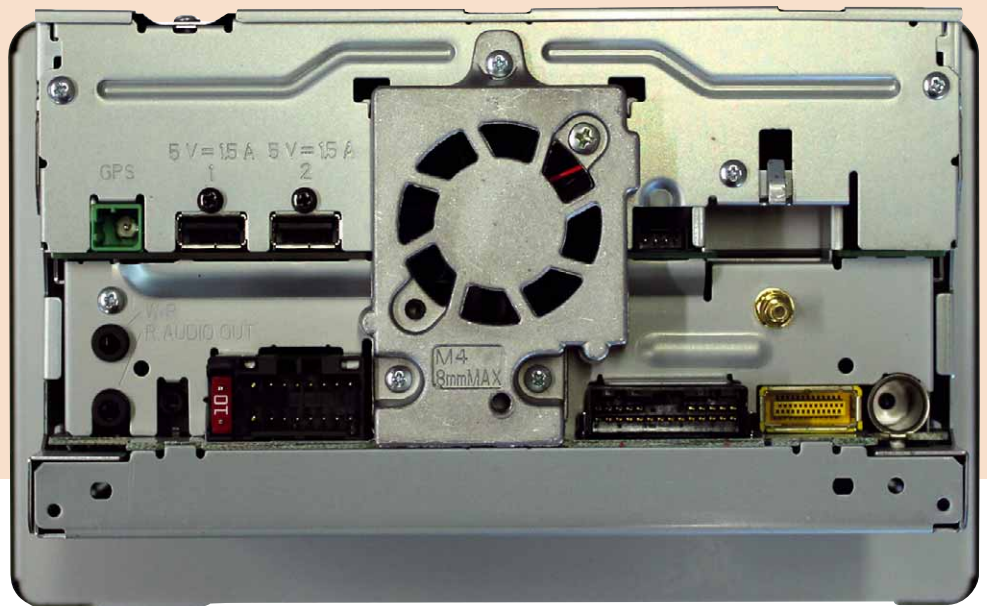
Navigation

The internal memory of the AVIC-Z1000DAB contains the map data of 44 European countries. The navigation software is the proven iGo from NNG. In this case, it comes in the lavishly equipped camper variant. All relevant vehicle parameters can be set. This guarantees that the selected route is also suitable and approved for the respective camper in terms of weight and vehicle dimensions. A feature that drivers of larger vehicles, in particular, will undoubtedly



Mechanically, the Pioneer fits exactly into the original slot

All connections are located at the rear



appreciate. Pioneer also provides the navigation system with data from the Promobil parking site atlas. The atlas knows the details, including supply and disposal options as well as overnight costs, of over 20,000 campsites. It thus allows precise trip planning without any nasty surprises at the destination.

Smartphone connectivity

The AVIC-Z1000DAB works perfectly with both iPhones and Android phones. They can be paired via USB and Bluetooth. The hands-free

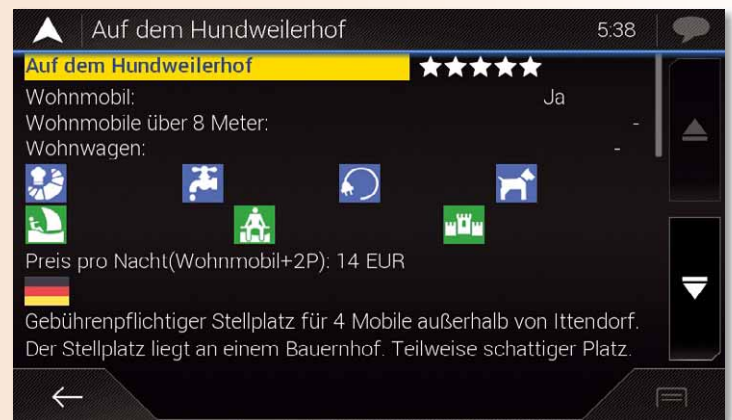
system offers good voice quality for both sides via the external microphone. The Pioneer also supports both Apple CarPlay and Android Auto. Thus, numerous cell phone apps, including navigation, can be used directly via the 9-inch touchscreen. Thanks to WiFi, CarPlay even works wirelessly. Compatible Android devices can also be mirrored to the Pioneer without a cable connection. When the head-up display is connected, turn-by-turn directions from Apple Maps or Google Maps are also displayed there.

Audio

In addition to the tuner for analog FM radio, the media center also has a receiver for DAB+ digital radio. The receiver showed a very stable reception even with a weak signal and the familiar crystal-clear, noise-free sound quality in the test. Switching from FM to DAB and vice versa is automatic when required. Thanks to Dual Zone, the living area can be supplied with its own media independently of the driver's cabin. For example, the driver and front passenger can listen to the radio while



The site can be selected directly at the touch of a finger



Detailed information about the site



Also Waze is supported

the rear passengers listen to a radio play from USB.

The sound optimization options are extensive. From graphic equalizers and internal crossovers to time alignment, everything you could wish for is on board. Besides the usual compressed audio formats, the Pioneer also plays uncompressed Flac files from USB.

Connectivity and operation

The back of the Pioneer offers a wide range of connectivity options.

There is no lack of AV interfaces or camera connections. External power amplifiers can be controlled via separate preamplifier outputs for the front, rear, and subwoofer, and two USB interfaces are available.

The AVIC-Z1000DAB can be operated entirely and intuitively via the capacitive touchscreen. In addition, Pioneer offers an external volume dial with buttons for camera direct switching, which is placed prominently and easily accessible on the display. When using CarPlay or An-

droid Auto, the respective voice control Siri or Google Assistant can also be used.

Test results

The AVIC-Z1000DAB's features can only be described as exhaustive. Everything you could want in terms of infotainment in the dashboard is on board here. Standout highlights are certainly CarPlay, Android Auto, DAB, especially the adaptation to the vehicle functions and the consideration of special camper needs.



The navigation system also knows remote parking spaces



Campsites can be searched for specifically



The device fits perfectly in Fiat Ducato and Iveco Daily

The NNG navigation software ranks among the best on the market, and the installed Promobil pitch guide is the pitch bible par excellence for most campers.

In our laboratory and practical tests, the Pioneer shows reliable performance in excellent quality in all of the extensive functions. The device responds quickly and smoothly during operation, and the on-screen menus are tidy and self-explanatory.

Conclusion

Pioneer's new AVIC-Z1000DAB is the ideal navigation and infotainment solution for the current Ducato models 7 and 8 as well as the Iveco Daily. Mechanical and electronic integration is exemplary; the needs of motorhome owners were taken into account during development and are fully met.

Dipl. Phys. Guido Randerath

| Specifications | |
|----------------------------|----------------------|
| Amplifier power | 15 |
| Output voltage/V | 3,5 |
| Output impedance/ohm | 490 |
| USB | |
| THD+N (%) | 0,044 |
| SNR (A) | 90 |
| Tuner | |
| THD+N (%) | 0,089 |
| SNR (A) | 63 |
| Crosstalk (dB) | 46 |
| Monitor size (cm) | 9 Zoll |
| Touchscreen | • |
| Parametric/graph. EQ bands | • |
| Crossovers | HP/TP |
| Pre-outs | 6 |
| AV-in | • |
| Digital output | • |
| Connection camera | • |
| MP3/WMA/AAC | •/•/• |
| USB / iPod | 2/• |
| Bluetooth HFP/A2DP | •/• |
| Maps | Europe |
| TMC/TMC Pro | •/- |
| Remote Control | - |
| Other | CarPlay/Android Auto |

Pioneer AVIC-Z1000DAB vehicle compatibility

In Fiat Ducato 7/8 and Iveco Daily.

Pioneer AVIC-Z1000DAB

| | |
|----------|------------------|
| Price | 1,400 Euro |
| Contact | Pioneer, Germany |
| Internet | pioneer-car.eu |

Rating

| | | |
|-----------------------|--------|-------|
| ▶ Sound | 15 % | ★★★★★ |
| Bass foundation | 3 % | ★★★★★ |
| Neutrality | 3 % | ★★★★★ |
| Transparency | 3 % | ★★★★★ |
| Spatiality | 3 % | ★★★★★ |
| Dynamics | 3 % | ★★★★★ |
| ▶ Image | 15 % | ★★★★★ |
| Sharpness | 2,5 % | ★★★★★ |
| Brightness | 2,5 % | ★★★★★ |
| Contrast | 2,5 % | ★★★★★ |
| Color reproduction | 2,5 % | ★★★★★ |
| Viewing angle | 2,5 % | ★★★★★ |
| Reflection | 2,5 % | ★★★★★ |
| ▶ Navigation | 15 % | ★★★★★ |
| Destination guidance | 5 % | ★★★★★ |
| Route calculation | 5 % | ★★★★★ |
| Features | 5 % | ★★★★★ |
| ▶ 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 | 40 % | ★★★★★ |
| Operation | 10 % | ★★★★★ |
| Reception test | 5 % | ★★★★★ |
| Build quality | 10 % | ★★★★★ |
| Features | 5 % | ★★★★★ |

Absolute Top Class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Ideal solution for Fiat Ducato 7/8 and Iveco Daily“

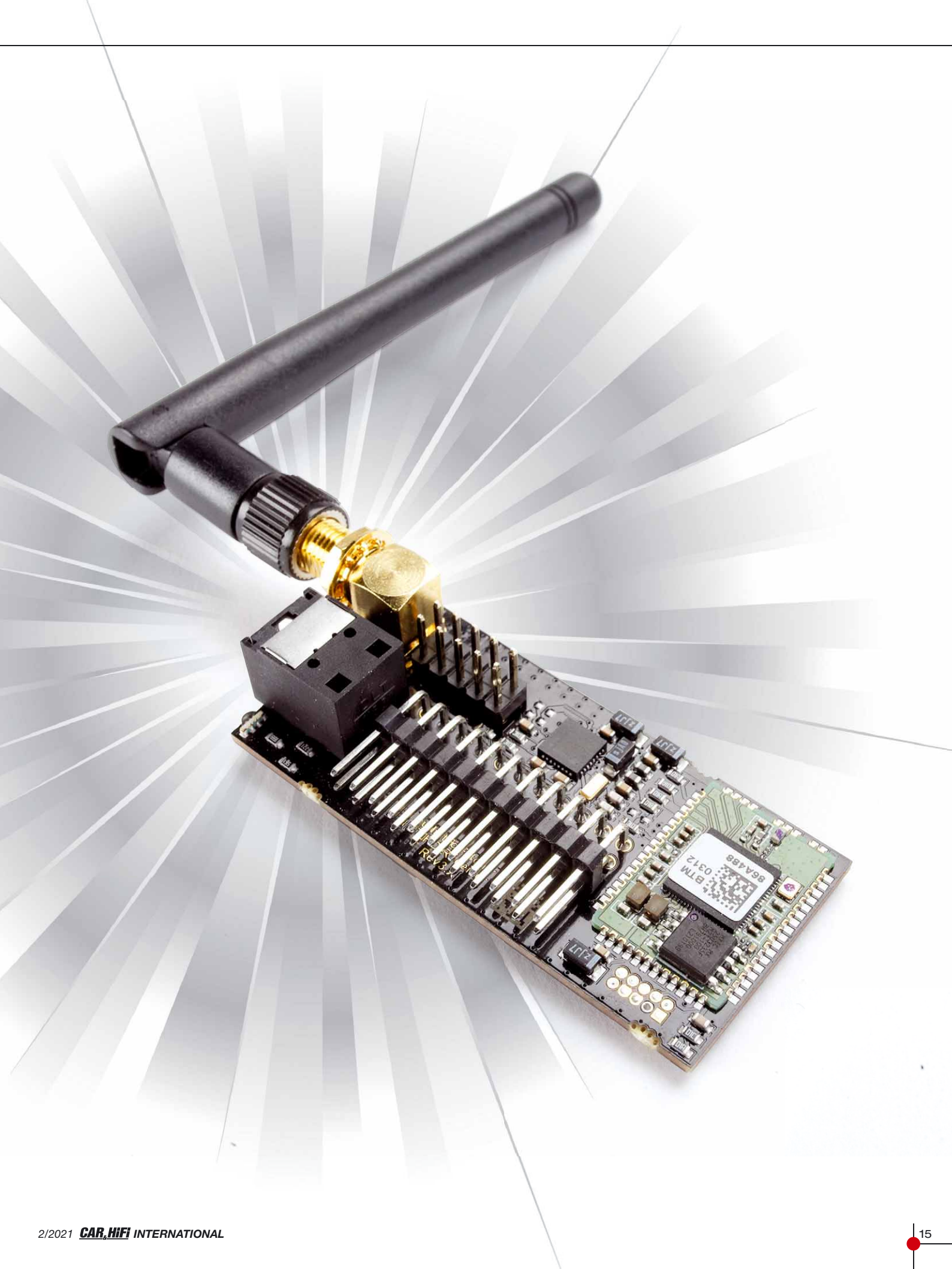
**Helix HEC BT HD – Bluetooth expansion card
for DSPs and DSP amplifiers**

Bluetooth at its best

► Music streaming from mobile devices is undoubtedly one of the most sought-after add-ons in recent years. Now Audiotec Fischer has come up with a new edition of their Bluetooth card.

Nowadays, the music consumed in the car comes from the smartphone and must reach the car hi-fi system from there, of course. Those who do not have a retrofitted head unit with Car-Play or Android Auto but continue using the origi-

nal radio often have only the good old jack connector at their disposal. But this can be done better and, above all, more conveniently. For all compatible DSP products from Audiotec Fischer, the new Extension Card BT HD does the job of playing

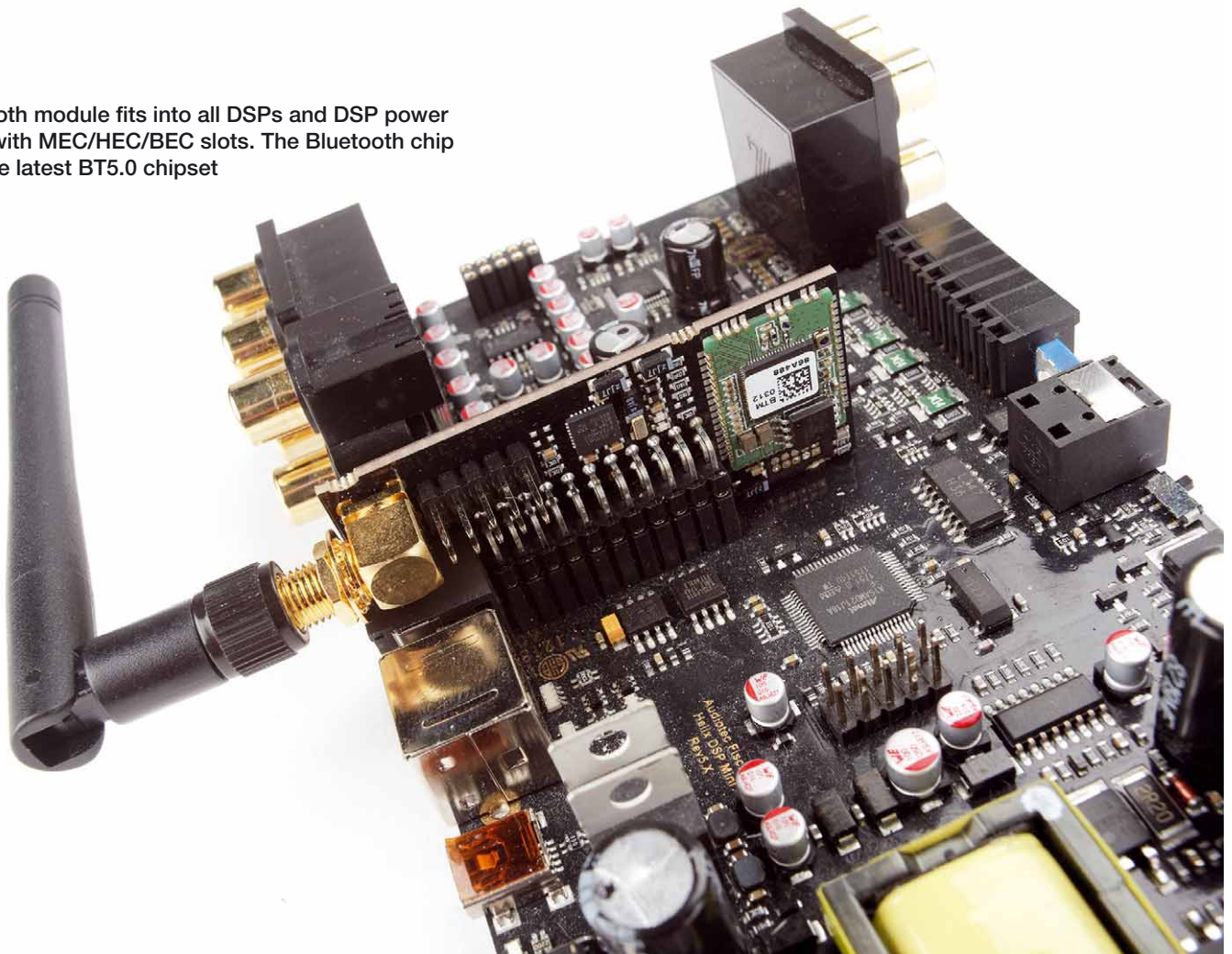


music wirelessly into the system via Bluetooth. It works with most DSPs and DSP power amplifiers of Match, Helix, and Brax (only the flat housings require their dedicated modules). However, if a slot for MEC/HEC/BEC modules is available, you're good to go. The novelty of the BT HD is the HD, which means High Definition. That's right; you can now stream music in Hi-Res quality via Bluetooth, thanks to the aptX HD transmission protocol, which is licensed for the BT HD alongside the normal aptX. With aptX HD, the music is transmitted



With the HEC BT HD, the PC software DSP PC-Tool can now also be used for wireless programming

The Bluetooth module fits into all DSPs and DSP power amplifiers with MEC/HEC/BEC slots. The Bluetooth chip contains the latest BT5.0 chipset



with 24 bits (16 bits = CD quality), and that's neat. The new chipset supports the latest Bluetooth standard BT5.0, which is generally faster than its predecessors and supports a higher data rate and sound quality. In general, sound quality has the highest priority. From the module slot, the music stream goes directly into the DSP chip without detours; because there is a direct connection for native I2S data, there are no receiver or converter components in the signal path. This is the best possible solution.

Best cooperation

Another new feature of the HEC BT HD is the possibility to program the DSP via Bluetooth. For this purpose, a notebook or PC with the DSP PC-Tool software and bluetooth capability must be available, of course. However, programming and music streaming do not work at the same time. The reason is that music streaming uses the maximum data rate; this is again in the spirit of the best possible sound quality, so we are happy to put up with it. Another cooperation exists between the Bluetooth module and the Director and Conductor remote controls. With these, Bluetooth playback can also be controlled with track jump forward/back and play/pause. The display remote control Director can do even more: Pairing and connection are also possible from the Director. With the newly implemented „Bluetooth Metadata“ function, music title and artist are presented in the display – very nice! In practice, detection, connection, and recognition via Bluetooth work quickly and smoothly. Whether the music

is played on the source device via a player or streamed from the Internet via Spotify, Tidal, etc., it all works flawlessly. The sound quality – assuming good recordings – is indeed top-notch. The sound comes with excellent three-dimensionality and is full of dynamics. We have never heard sound this good via Bluetooth before.

Conclusion

The Bluetooth module BT HD for Match, Helix, and Brax has become quite a sensation. It has the latest chipset and Bluetooth standard, and it even transmits high-resolution files with aptX HD. It is optimized in all aspects for the best sound and is reasonably priced at 130 EUR. Therefore, we would like to give it a big recommendation.

Elmar Michels



Bluetooth playback can also be controlled in conjunction with the display remote control. Title and artist are shown in the display

Helix HEC BT HD

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

Specifications

Bluetooth expansion module for Helix and Match DSP products

Inputs

- digital AUX source via Bluetooth

Outputs

- HEC/MEC/BEC slot

Features

- Bluetooth audio streaming
- Wireless DSP programming via PC
- id tag (artist and title) Display with Director
- BT playback control with Director and Conductor
- BT5.0 specification incl. aptX and aptX HD for Hi-res playback

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Germany 2/21

DSP programming and music streaming with the best possible quality."

Four-channel power amplifier with complete DSP amplifier with complete DSP and streaming

- ▶ After the extraordinary Stealth 7.1 DSP, the Mini 150.4 DSP is the second DSP amplifier of the new generation to be tested.





ETON

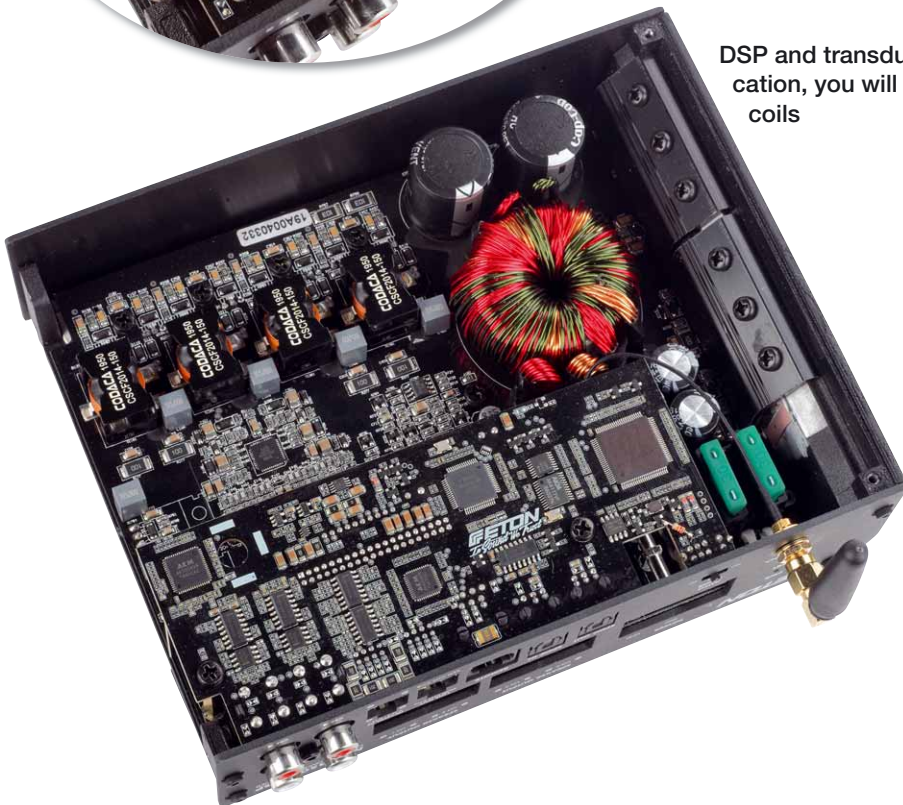
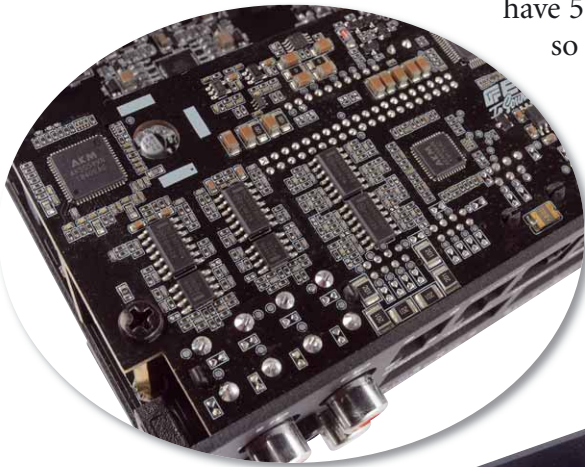
ETON

It's been a year since Eton took the industry by surprise with the Stealth, a state-of-the-art, compact, powerful amplifier that is one of the few of its kind to have streaming capability as a standard feature. What could be more obvious than to incorporate this digital technology into other amplifiers? And that's precisely what Eton has done. The Mini 150.4 is an excellent choice; like the Stealth, it is equipped with the latest Class D technology. As a four-channel amplifier, it also offers an excellent basis for building a car audio system.

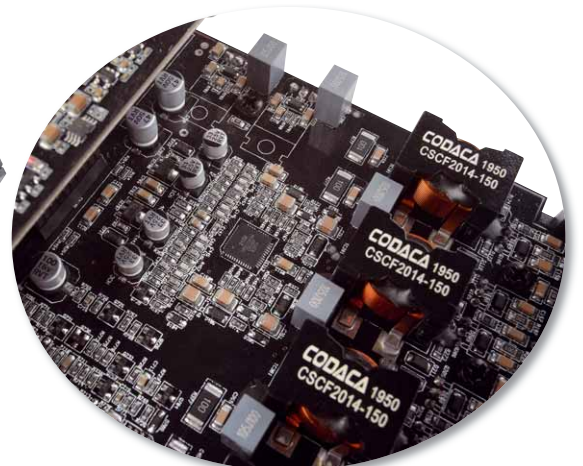
The analog signal processing of the Mini 150.4 disappears, a new digital board comes in instead; the Mini 150.4 DSP is ready? In principle, yes, but unfortunately, the digital board needed a new form factor, so it had to be redesigned. There are many indications that this is to become Eton's new universal weapon. It was decided from the start to spare no expense or effort. The DSP board of the Mini is of the finest and more than generously equipped. For example, we find an 8-channel AD converter, although the Mini only has four inputs. It gets even better: the DSP chip from AKM would even have 5 ADCs and 4 DACs on board so that one could have saved the external ADC.

Instead, Eton has given the Mini a converter of the very finest, namely the AKM AK5558 with 32 bits and AKM's Velvet Sound. The AK4458 DAC

also comes from this series, and its eight channels are even needed because the Mini has four amplifier channels and four processed outputs. The Mini DSP has also inherited the streaming capability and app control directly from the Stealth. Both work via WIFI, with the Mini DSP providing the hotspot. A small wired remote control is also included, so the Eton is well-equipped ex-works. The only accessory that requires an additional charge is the measurement microphone for frequency response measurement. As mentioned, the streaming input works via WIFI. Compared to Bluetooth, this has the advantage of a higher data rate so that Hi-Res music can be streamed. Streaming directly from the mobile device is no problem, but Apple users have an advantage when streaming from the Internet like Spotify or Tidal because this is only possible when the device is in Stealth WIFI and can receive external data at the



DSP and transducers are from AKM; in the amplification, you will find a Class-D driver and flat wire coils



same time. However, we think it is excellent that streaming and a wired remote control are already included. The motherboard of the Mini DSP is the same as the regular Mini 150.4 except for the signal processing, which means we have a beefy power supply and lots of SMD components. A four-channel Class-D driver chip helps to save space, just like the four-layer PCB, which is also good for „hiding“ critical lines in the sense of good EMC and undisturbed FM reception. The Class D coils turn out nicely generous again; excellent, highly efficient flat wire coils are at work here.

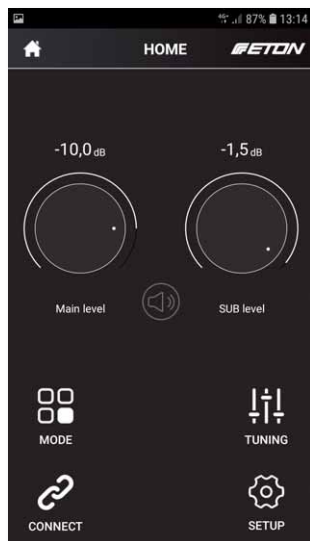
Software

Thanks to the integrated WIFI, programming the Mini DSP is entirely wireless. There are apps for Apple and Android that include almost all the functions of the desktop software and with which you can fully program the DSP. And that works flawlessly. Once you get used to the rotary controls, the settings are easy

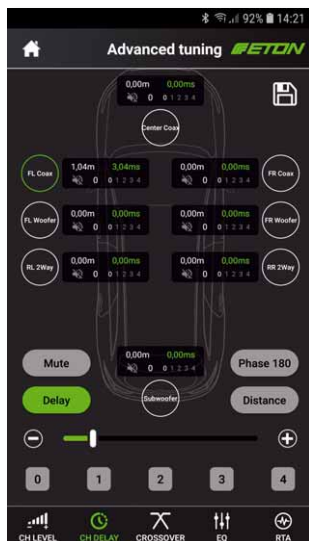


Full connection front: The contacts to power, loudspeakers, processed outputs as well as the speaker level inputs are realized via plug-in connections

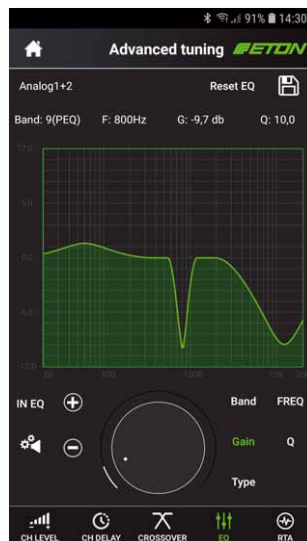
to make. As an alternative, +/- buttons are almost always available, which are very helpful. When setting frequencies, you hit your desired frequency in no time since you can make jumps of 100s, 100s, 4, or 1Hz. This is perfectly fine for an app and works great. The home screen offers a large volume control; then, you can move on to source selection, setup, or tuning. The setup menu contains the DSP setup management and basic settings like colors or the filter characteristics of the AKM converter.



The home screen offers level control for the stealth and the subwoofer output. Submenus for source selection and settings are accessible from here



In the runtime menu, there are also buttons to reverse polarity and mute individual speakers



The 21 + 10 EQs at the inputs and outputs can be used as fully parametric EQs or shelf

Specifications

Dimensions 183 x 146 x 50 mm

Inputs

- 4-channel high-level
- 4-channel RCA
- Gain control per channel pair
- 1 x digital S/PDIF (optical)
- Sensitivity 6 V (RCA), 18 V (high level)

Outputs

- 4-channel RCA (8 V)
- 1 x digital S/PDIF (optical)
- Remote-out

App

(Android V 1.3.4 used in the test)

Equalizer

- Inputs: 21 bands per channel
- Outputs: 10 bands per channel
- parametric, +12 -- -12 dB
- 20 – 20 k Hz, 1 Hz steps, Q 0.1 – 10
- Shelf 20 – 20 k Hz, Q 0.1-10

Crossovers

Outputs:

- 20 – 20k Hz, 1 Hz steps.
- Butterworth, 6 – 48 dB/Oct.

Time and SPL

- Sample rate 48 kHz, 7-mm steps (0.02 ms)

Outputs:

- 0 – 686 cm (20.00 ms), 1024 samples
- Phase 0, 180°
- SPL for input pairs and individual outputs, steps adjustable at 0.1 dB

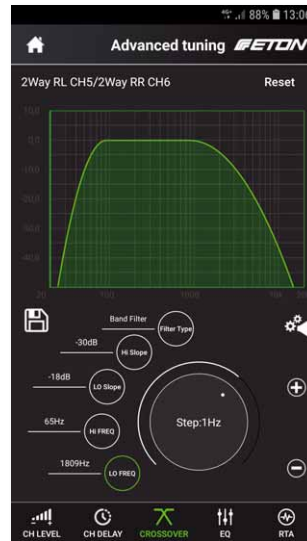
Features

- 2 setups, switchable via pushbutton or app
- Start-stop capability up to 6.1 V
- RTA real-time frequency response measurement (with optional microphone)
- WIFI access point for programming via app and music streaming

Optional accessories

- Measurement microphone for RTA frequency response measurement

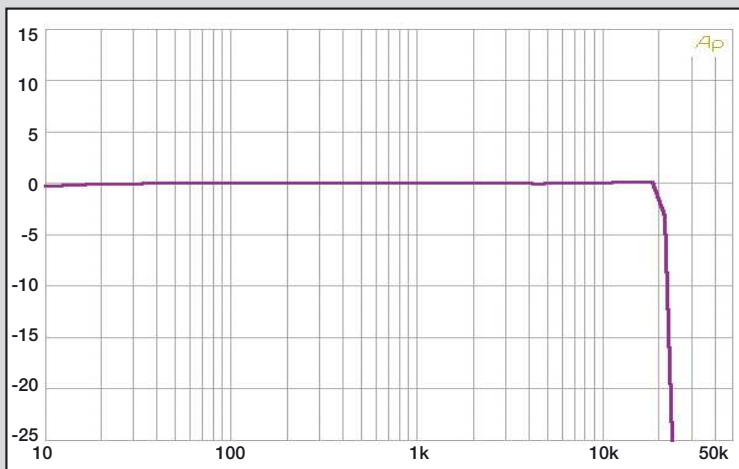
The sensitivity adjustment options under MAX level are nice, available in 0, +6, and +9 dB for inputs and outputs, respectively. Under Tuning, we find the classic DSP functions. The channels are not assigned with a free routing but distributed via drag & drop into an auto pictogram. The channels can be mixed in percent and classified by front/rear/center/sub. Systems with active front can be realized equally well as three-way systems or the partially active BMW/Mercedes combination with front woofers and mid-highs. Crossovers (up to 48 dB/oct) and delays (7 mm/0.02 ms) function as you would expect: clear and concise. The 31 EQ bands are divided into 21 input EQs and 10 output EQs. Eton emphasizes the inputs, aiming at integration into more complicated factory systems. As usual, channel pairs can be adjusted together or



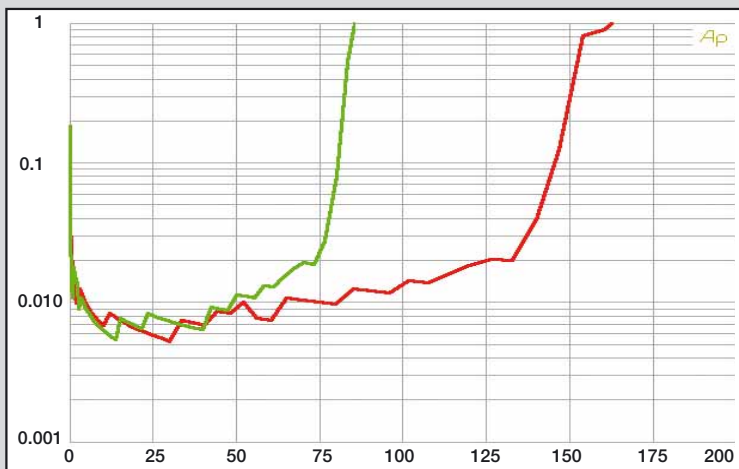
The app offers crossovers, EQs, and shelves as filters, here we show the setting of a bandpass crossover

The basic settings include color selection for remote control and amp, characteristics of the converter filters, and buttons for adjusting the sensitivities of the inputs and outputs

CAR&HIFI Laboratory



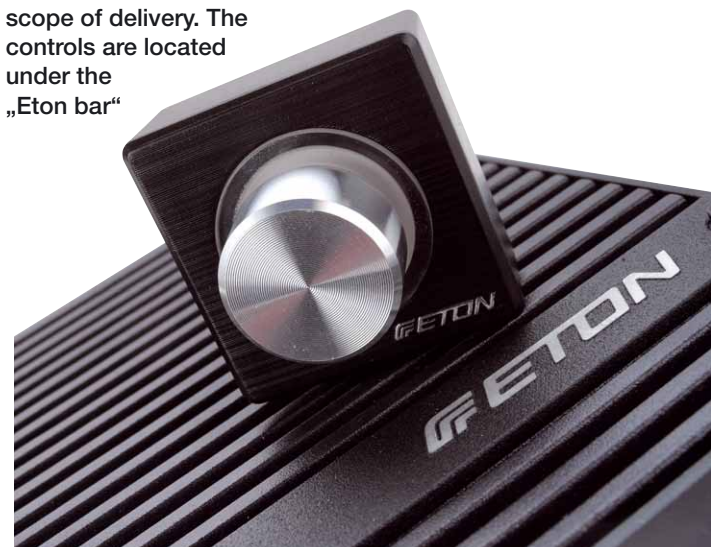
With a 48 kHz sampling rate the Mini has a playback range of up to 24 kHz; the crossovers can be adjusted from 6 to 48 dB/Oct.



The Mini produces almost no distortion, even with DSP. There is also more than enough power for a small four-channel unit.

individually. This applies to all EQs, including those of the digital inputs, which means that you have everything you need at your fingertips – except vehicle sound detection, which is not (yet) available but could be added via an update. Unfortunately, we are still waiting for this and the completion of the desktop software, which is available for download as a beta version.

The remote control is also included in the scope of delivery. The controls are located under the „Eton bar“



As an accessory, there is a measurement microphone for the integrated RTA (real-time frequency response measurement)



Measurements and sound

We were already wholly convinced by the Mini 150.4 without DSP, as it is one of the best small Class D amplifiers our lab has ever seen.

Of course, the DSP version follows on seamlessly and delivers the same power values with 84 and 151 watts into 4/2 ohms. Distortion is a record low, which pleases the technology freak and can't hurt the sound. The Mini 150.4 DSP also belongs to the best in its class in terms of sound. It plays very tidily and audibly, and it's a pleasure to discover small details in the music and pay attention to the subtleties. The bass pulls through sufficiently and belongs to the clean, dry variety. In general, nothing seems softened or imprecise over the entire frequency range. But you don't have to listen to the Mini 150.4; it also manages to play so smoothly and fluidly that you listen to music with the most extraordinary naturalness.

Conclusion

"Stealth meets Mini"? This experiment has been more than successful. The Mini 150.4 DSP is a terrific power amplifier with enough power and the finest technology. With an 8-channel DSP, WIFI streaming, and a remote-control handset, it leaves nothing to be desired. The fact that the whole thing is available for well under EUR 600 is insane!

Elmar Michels

Specifications

| | |
|---------------------------|-------|
| Channels | 4 |
| Power 4 Ohm | 84 |
| Power 2 Ohm | 151 |
| Power 1 Ohm | 0 |
| Bridged power 4 ohms | 302 |
| Bridged power 2 Ohm | 0 |
| Sensitivity max. mV | 410 |
| Sensitivity min. V | 6.7 |
| THD+N (<22 kHz) 5 W | 0.007 |
| THD+N (<22 kHz) half load | 0.006 |
| SNR dB(A) | 87 |
| Damping factor 20 Hz | 179 |
| Damping factor 80 Hz | 172 |
| Damping factor 400 Hz | 160 |
| Damping factor 1 kHz | 149 |
| Damping factor 8 kHz | 18 |
| Damping factor 16 kHz | 5 |

Features

| | |
|---------------------------------|--|
| Low pass | 10 – 20k Hz |
| High pass | 10 – 20k Hz |
| Bandpass | 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 switch-on (autosense) | •, DC or signal |
| RCA outputs | 4CH processed |
| Start-stop capability | • (6.1 V) |
| Dimensions (L x W x H in mm) | 183 x 146 x 50 |
| Other | remote control, WIFI, DSP, S/PDIF In/Out |

Eton Mini 150.4 DSP

| | |
|-------------|-------------------|
| Price | 570 Euro |
| Distributor | ACR, Switzerland |
| Hotline | info@etongmbh.com |
| Internet | www.etongmbh.com |

Rating

| | | |
|---------------------------|------|-------|
| ▶ Sound | 40 % | ★★★★★ |
| Bass foundation | 8 % | ★★★★★ |
| Neutrality | 8 % | ★★★★★ |
| Transparency | 8 % | ★★★★★ |
| Spatiality | 8 % | ★★★★★ |
| Dynamics | 8 % | ★★★★★ |
| ▶ Lab | 35 % | ★★★★★ |
| Performance | 20 % | ★★★★★ |
| Damping factor | 5 % | ★★★★★ |
| SNR | 5 % | ★★★★★ |
| Distortion factor | 5 % | ★★★★★ |
| ▶ Practice | 25 % | ★★★★★ |
| Features | 15 % | ★★★★★ |
| Build quality Electronics | 5 % | ★★★★★ |
| Build quality Mechanics | 5 % | ★★★★★ |

Absolute Top class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: excellent

„Super sound with DSP WIFI streaming.“

Match M 5.4DSP + M 2.1AMP: a 5-channel DSP amplifier and a bass amplifier

Sound upgrade goes micro

- ▶ With the tiny M 5 and M 2 amplifiers, Match has made it possible to supply a complete hi-fi system in the most compact way. We are going to shed some light on what is possible with the new Match M 5.4DSP and M 2.1AMP amplifiers.

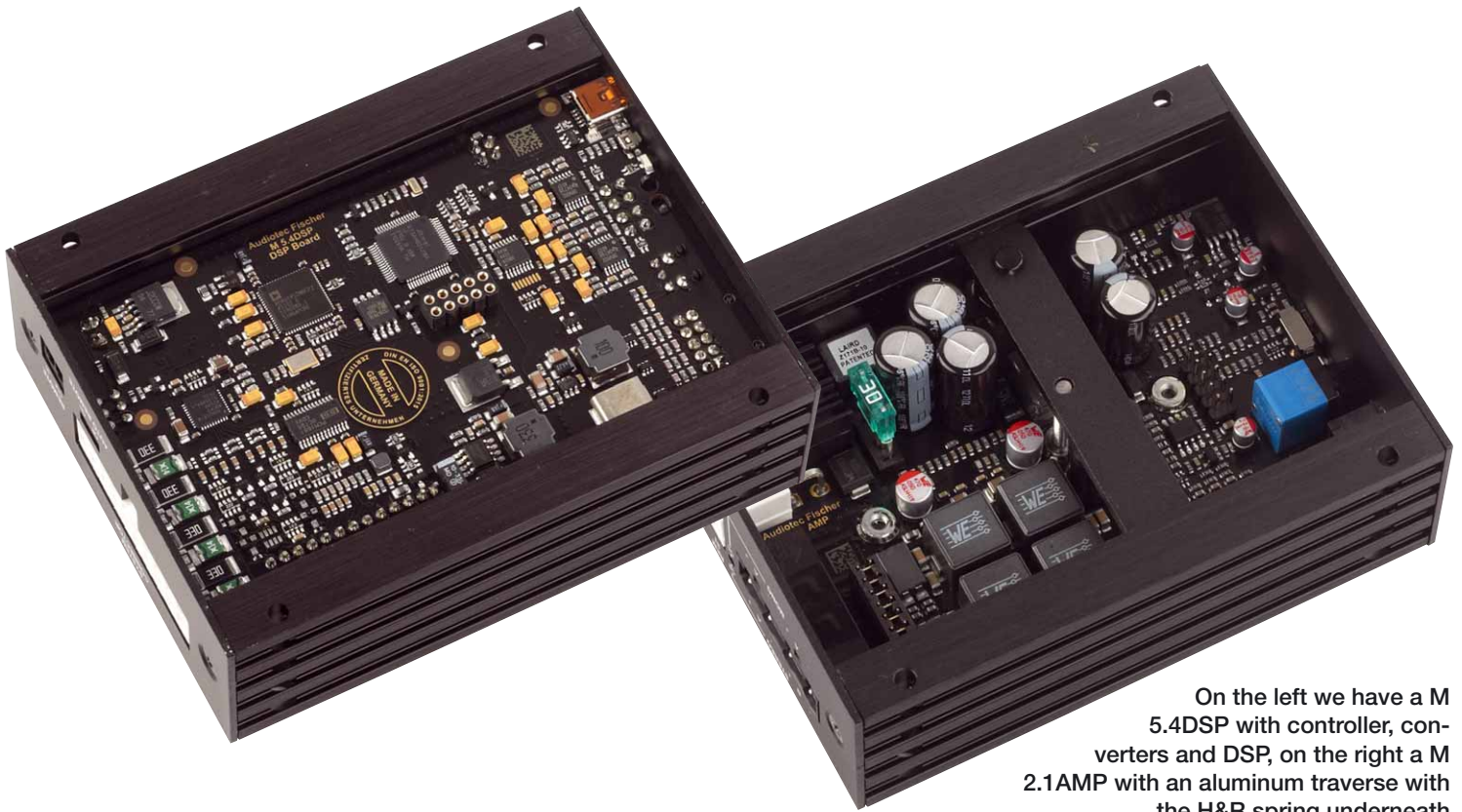




MATCH
BY AUDIOTEC FISCHER

AMP ▶▶

M5.4DSP ◀◀ **MATCH**
BY AUDIOTEC FISCHER



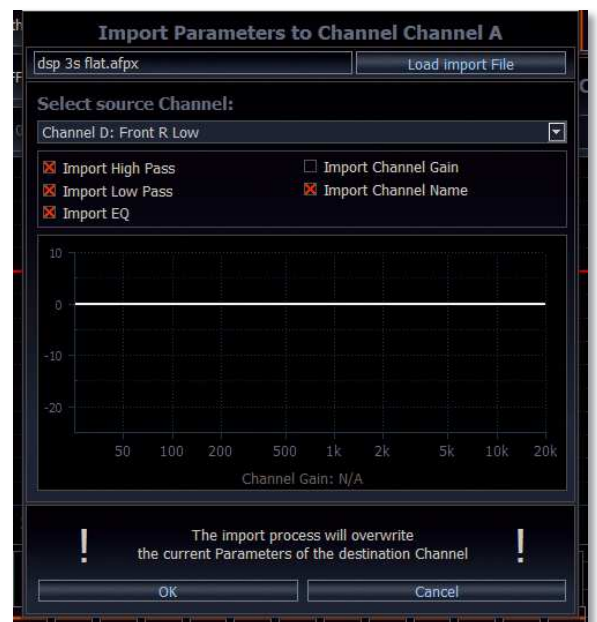
On the left we have a M 5.4DSP with controller, converters and DSP, on the right a M 2.1AMP with an aluminum traverse with the H&R spring underneath

Since its inception, the Match brand has been all about plug and play sound upgrades. Starting quite ahead of their time with the completely new type of PP amplifiers, Match shaped what we know today as the DSP amplifier category. In addition to the affordable PP amplifiers and the „large“ UP ... DSP amplifiers, two new models are now available in the M series. Leaving aside all the other awesome perks: the Match M amplifiers are very, very small. Despite the housing size of just 11 x 8.5 x 3.5 cm, they are still fully-fledged power amplifiers with lots of power. The new M 5.4DSP includes 4 satellite channels and a stronger subwoofer channel, which also runs full-range and is therefore also suitable for a center. For this kind of application, the M 5.4DSP is programmed in the standard mode at the factory. A special feature is

that „Augmented Bass Processing“ is already available for the subwoofer and can therefore be easily found even by inexperienced users. This is a game changer for the bass sound, considering the limited output pow-

er. These and all other functions are enabled after activating the VCP, so that the full 9 DSP channels are at your disposal. In addition to the 5 built-in amplifier channels, there are also 4 processed outputs to control

The import function now allows partially importing input and output settings. EQs, crossovers, gain and channel names can be selectively imported



additional amplifiers. This makes the M 5.4DSP a full-fledged control center even for full-blown audio systems – only that it is small enough to fit in the palm of your hand. The highlight of the M 5.4DSP is the option to choose between MidPower and HighPower mode. In MidPower mode, the amplifier is limited in power, but is still 100% plug and play capable via the original vehicle wiring harness. The HighPower mode offers more power, but requires a separate power supply from the battery. The M 5.4DSP still has the latest 32-bit controller, which enables all the conveniences such as the ACO platform including ISA and VCP. The M 5.4DSP is therefore not limited in its DSP options; it offers the full range of DSP functions of the top Match models. The only restrictions are the limitation to four inputs and the frequency range up to 22 kHz.

The second new amplifier is called M 2.1AMP and it comes in the same format to match the M 5.4DSP. The highlight is that the M 2.1AMP can be used both as a stereo and as a mono amplifier. With its HiRes frequency range of up to 40 kHz and absolutely impeccable measurement results, it is a fully-fledged stereo power amplifier. When set to mono it drives a subwoofer with 350 W into 2 ohms. This is made possible by a newly developed technical platform with an extremely high-clocked step-up converter in combination with a proprietary Class HD concept and the use of new double-sided FETs, which can dissipate excessive heat in two directions, resulting in an impressive 96 % efficiency. To achieve



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

Specifications Match M 5.4DSP

Dimensions (L x W x H in mm) 110 x 85 x 35 mm

Inputs

- 4-channel high level
- 1 x digital S/PDIF (optical)
- Sensitivity 5 – 11 V

Outputs

- 4-channel RCA (3 V)
- Remote-out

DSP-Software (V 4.77a)

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 – 5,20 ms, 256 samples

Virtual channels:

- 0 – 354 cm (10,40 ms), 512 Samples

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

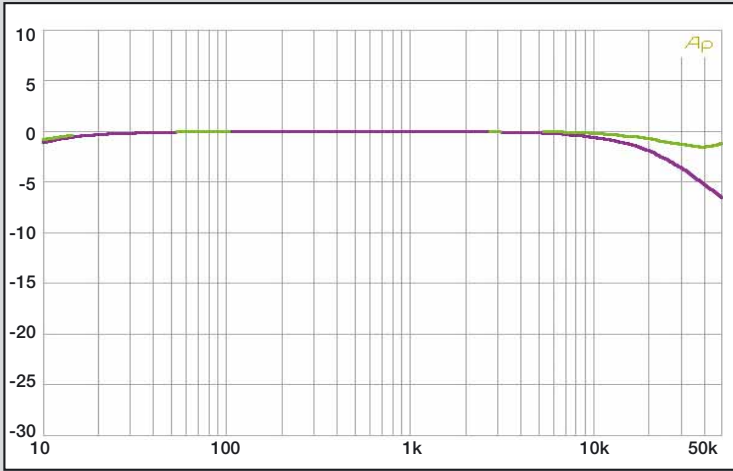
Features

- 10 Setups with fast switchover
- User-defined routing of in- and output ports
- SCP control connector for programmable remote controls and accessories
- Start-stop capability up to 6V
- Signal-dependent switching to digital input
- 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
- Device Monitor (temperature and voltage monitoring)
- ATM fully automatic time alignment
- Automatic input gain setting using proprietary signals
- Easy import of existing setups
- Standard programming or VCP, 8 virtual channels, user-defined routing, EQ, time alignment and FX-Processing

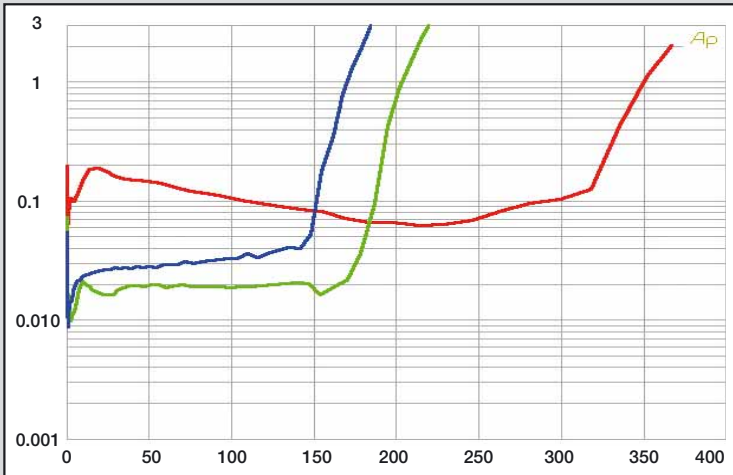
Optional accessories

- Wired remote control (programmable)
- Display remote control director with memory, USB, etc.
- Smart remote control Conductor
- WIFI Control for wireless programming
- Measurement microphone MTK1
- Plug&play harness kits

CAR & HIFI Laboratory



In stereo mode, the M 2.1AMP reaches 40 kHz at -6 dB, and the mono mode (green) runs even smoother.



The stereo mode (blue) delivers clean 2 x 170 W at 4 ohms. In the mono mode, the M 2.1AMP easily nails 200 W at 4 ohms and 350 W at 2 ohms.



The M 2.1AMP only has a ground lift switch and sensitivity controls to operate

a record-breaking power density, a two-channel amplifier IC is used and the critical components are fixed in a special way. As with some amplifier ICs, in the M 2.1AMP Match also works with contact pressure in order to ensure optimal heat dissipation, in this case with an aluminum cross-bar and a dynamic, spring-loaded coupling, for which a spring was specially developed by the H&R spring specialist. The same contact pressure is guaranteed through the entire temperature range from -40 ° C to 120 ° C and it does not decline over time.

The prime application for our combination of M 5.4DSP and M 2.1AMP is the sound upgrade of a ,regular‘ factory sound system. With its four high-level inputs, the M 5.4DSP takes the signal directly from the factory radio and distributes it to the channels via DSP. The M 5.4DSP takes over the front and rear doors and the center. Via the processed outputs, woofers such as a BMW or Mercedes front woofers can be fully supplied with power. A second M 2.1AMP can eventually take over an extra retrofit subwoofer.

Software

The DSP functions are of course controlled via the in-house “DSP PC-Tool”, which happens to be the most extensive and powerful tool present on the market today. In addition to 30 EQs per channel, time correction for both inputs and outputs and of course freely programmable crossovers, there is VCP (Virtual Channel Processing) with the option of processing channel groups as virtual channels between inputs and output channels. For example, a three-way front system with six output channels for the right and left sides can be managed by the virtual channels in front left and right. The runtimes of the individual loudspeakers and the crossing of tweeters, mid-range and woofers are carried out with the output channels, and this is also where the peculiarities of the installation background are brought to a balance. The crucial equalization can easily be managed with the virtual front channels, for the entire front system and across all crossover frequencies. With the virtual channel, the entire three-way side can also be „shifted“ using time correction or the level can be adjusted using the gain control. The FX sound effects now also act

on the virtual front, center and rear channels, with which two-way centers can also be perfectly controlled. Algorithms for optimizing the center, front and bass can be activated in the FX(effects) menu. First of all, the existence of the Real Center is a blessing, the center canal signal is calculated here by real audio processing. So the Real Center is not a makeshift solution like a mono sum or a wrongly polarized sum of left and right. There is a clarity expander for the center and front, which affects the mid-range playback, for example the reproduction of voices. The front can also be „pulled apart“ to expand the stage illusion. The bass processing includes the SubXpander, which adds low tones to the music by generating subharmonics for existing frequencies. There is also a dynamic bass boost that enhances the bass depending on the playback volume. This is very helpful, for example, with factory systems with woofers and subwoofers that only have limited capacities. For all FX functions there are adjustment knobs that can be used to specifically adjust intensity and function.

The latest measurement functions of the PC tool are also supported. The well-known RTA (real-time frequency response measurement with optional microphone) can automatically set the EQs if desired. Tolerance thresholds and the number of setting attempts are adjustable. This ensures that a decent result is always achieved even when using relatively inaccurate microphones. In addition to the acoustic measurement, there is also the ISA (Input Signal Analyzer), an electrical measurement function for the analog inputs. For example, if you have connected the loudspeaker lines of the vehicle to the DSP inputs, you can determi-



Specifications

| | |
|-----------------------------|---------|
| Channels | 1 / 2 |
| Power 4 Ohm | 2 x 170 |
| Power 2 Ohm | 0 |
| Power 1 Ohm | 0 |
| Bridged Power 4 Ohm | 206 |
| Bridged Power 2 Ohm | 350 |
| Sensitivity max. mV | 940 |
| Sensitivity min. V | 4,8 |
| THD+N (<22 kHz) 5 W | 0,018 |
| THD+N (<22 kHz) Halblast | 0,030 |
| Signal-to-noise ratio dB(A) | 93 |
| Damping factor 20 Hz | 67 |
| Damping factor 80 Hz | 67 |
| Damping factor 400 Hz | 66 |
| Damping factor 1 kHz | 63 |
| Damping factor 8 kHz | 17 |
| Damping factor 16 kHz | 5 |

Features

| | |
|-----------------------------------|--|
| Low pass | - |
| High pass | - |
| Band pass | - |
| Bass boost | - |
| Subsonic filter | - |
| Phase shift | - |
| High-level inputs | - |
| Separate gain control (Autosense) | - |
| RCA outputs | - |
| Start/stop capable | • (6 V) |
| Dimensions (L x W x H in mm) | 110 x 85 x 35 |
| Others | Mono/stereo mode, digital input, ground lift |

Match M 2.1AMP

| | |
|-------------|---------------------------|
| Price | 400 Euro |
| Distributor | 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 | - | - |
| Signal-to-noise ratio | 5 % | ★★★★★ |
| Distortion | 10 % | ★★★★★ |
| ▶ Practice | 25 % | ★★★★★ |
| Features | 15 % | ★★★★★ |
| Build quality electronics | 5 % | ★★★★★ |
| Build quality mechanics | 5 % | ★★★★★ |

Top class

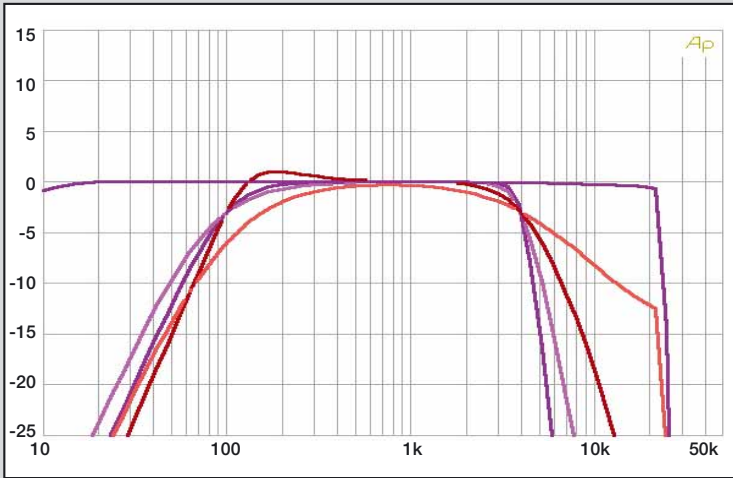


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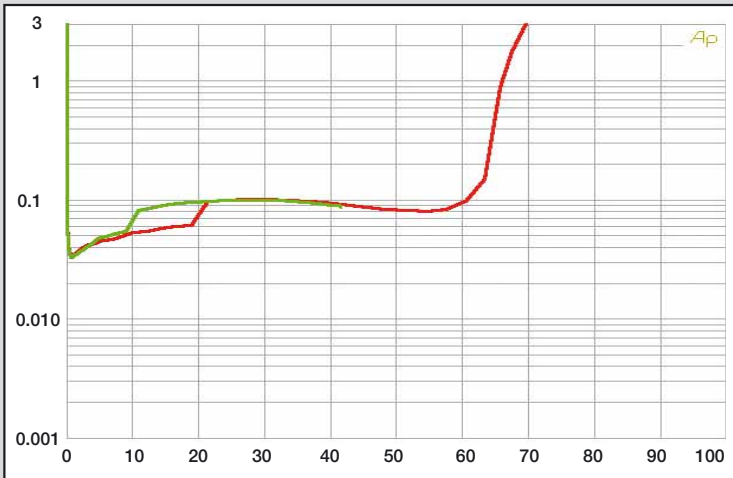
Price/performance: very good

„A sleek and flexible performance enhancer or simply a great power amplifier for your own needs.“

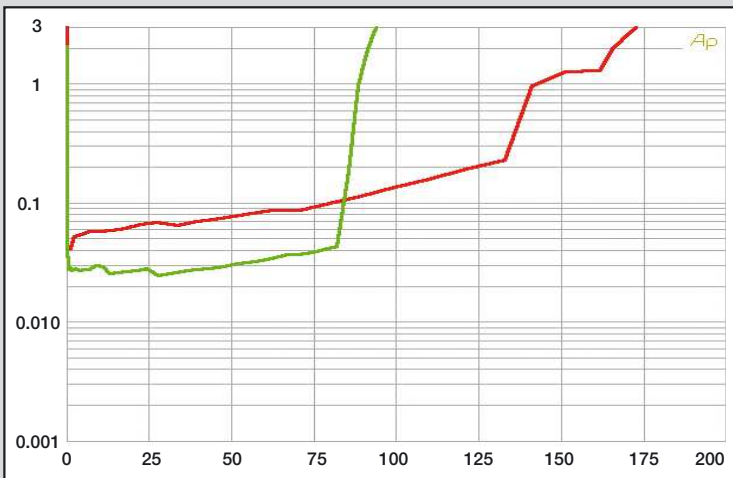
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A frequency range up to 22 kHz, crossovers with different characteristics (high pass) and different slopes.



The MidPower mode reaches up to 43 W, where the M 5.4DSP is slacking off. The high power mode delivers identical distortion, but runs all the way up to 66 W.



Channel 5 of the M 5.4DSP already supplies 90 W at 4 ohms, the 163 W at 2 ohms is also sufficient for small subwoofers.

ne how much signal is coming in. The PC Tool offers a frequency response measurement of all input channels so that you can see immediately whether a working full-range signal is present. In addition, sums of several inputs can be measured, so you can track down 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 DSP tuning, because the input EQs (and the input time alignment) can be set simultaneously with the measurement and with an immediate success control. There is also the ATM (Automatic Time Measurement), which enables fully automatic time alignment of the entire system. The advantage here is that the measurement signal is played as a sound file like a piece of music via the head unit; this feature is available for all vehicles. The measurement is then carried out with the company's own measurement signals programmed in-house and with lots of audio processing, whereby the running time of all loudspeakers in the system is compared with a reference loudspeaker and then calculated. The input sensitivity can be adjusted with the software. In the range from 2.8 to 11 volts, all inputs are set simultaneously, which is a quick and easy solution. Also included is the expanded import function for setups, which is now also available for the inputs. This makes life easier, especially for professionals, because customized setups can be transferred fully or partially to a new device. The existing subwoofer settings of a twelve-channel setup can, for example, be assigned to any two channels with a single click. The transmission of high-pass, low-pass, EQ, gain and name between any available channels are possible for inputs and outputs – very handy for power users. The numerous integration features such as po-



The M 5.4DSP is a full package with Molex sockets, digital input and control port

wer 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 are especially commendable. The in-house ADEP.3 system is able to bypass the loudspeaker diagnostics of some vehicles, thus bypassing error codes or even switching off channels.

Measurements and sound

The M 5.4DSP starts with 4 x 43 W in MidPower mode and with 4 x 66 W in HighPower. There is also 90 W at 4 ohms on channel 5 and a full 163 W at 2 ohms. The distortions are kept within limits and always remain below 0.1%. The M 2.1AMP impresses in stereo and mono mode at 4 ohms with even lower distortion values below 0.03% and 0.02 %. And check out this performance! We measure a full 2 x 170 W at 4 ohms, which is more than enough for a underseat woofer or any component system. With 206 W at 4 ohms in mono, the M 2.1AMP already proves very diligent, but at 2 ohms (or 2 x 4 ohms) the tiny box pushes the promised 350 W without complaining - a superb performance! In terms of sound, the small M amplifiers don't have to be shy when compared to the larger amps. The M 5.4DSP drives a two-way system clearly and cleanly with a remarkable sound quality. Voices and instruments sound



Match M 5.4DSP

Price 600 Euro
 Distributor Audiotec Fischer, Germany
 Internet www.audiotec-fischer.com

Rating

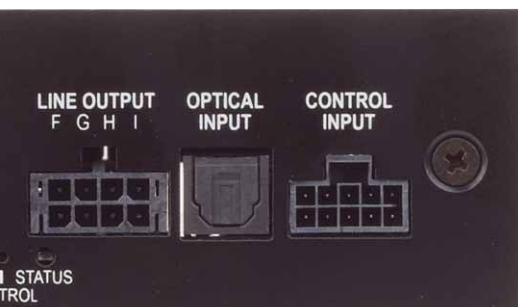
| | | |
|---------------------------|------|-------|
| ▶ Sound | 40 % | ★★★★★ |
| Bass | 8 % | ★★★★★ |
| Neutrality | 8 % | ★★★★★ |
| Transparency | 8 % | ★★★★★ |
| Spatial imaging | 8 % | ★★★★★ |
| Dynamics | 8 % | ★★★★★ |
| ▶ Lab | 35 % | ★★★★★ |
| Power | 20 % | ★★★★★ |
| Damping factor | — | — |
| Signal-to-noise ratio | 5 % | ★★★★★ |
| Distortion | 10 % | ★★★★★ |
| ▶ Practice | 25 % | ★★★★★ |
| Features | 15 % | ★★★★★ |
| Build quality electronics | 5 % | ★★★★★ |
| Build quality mechanics | 5 % | ★★★★★ |

Specifications

| | |
|--------------------------------------|-------------|
| Channels | 5 |
| Power 4 Ohm | 4 x 66 + 90 |
| Power 2 Ohm | 163 |
| Power 1 Ohm | — |
| Bridged Power 4 Ohm | — |
| Bridged Power 2 Ohm | — |
| Sensitivity max. mV | 3200 |
| Sensitivity min. V | 12,3 |
| THD+N (<22 kHz) 5 W | 0,047/0,03 |
| THD+N (<22 kHz) Halblast 0,101/0,045 | |
| Signal-to-noise ratio dB(A) | 91/86 |
| Damping factor 20 Hz | — |
| Damping factor 80 Hz | — |
| Damping factor 400 Hz | — |
| Damping factor 1 kHz | — |
| Damping factor 8 kHz | — |
| Damping factor 16 kHz | — |

Features

| | |
|-----------------------------------|---|
| Low pass | 10 – 20k Hz |
| High pass | 10 – 20k Hz |
| Band pass | 10 – 20k Hz |
| Bass boost | -15 – 6 dB/10 – 20k Hz |
| Subsonic filter | via DSP |
| Phase shift | 0, 180°/LZK via DSP |
| High-level inputs | • |
| Separate gain control (Autosense) | • DC |
| RCA outputs | • , 4CH, prozessiert |
| Start/stop capable | ü (6 V) |
| Dimensions (L x W x H in mm) | 110 x 85 x 35 |
| Others | digital input, 9-channel DSP, plug&play |



Top class



CAR & HiFi
 INTERNATIONAL Germany 2/21

Price/performance: excellent

„A sleek and flexible performance enhancer or simply a great power amplifier for your own needs.“



Main window containing crossovers, EQs, time alignment, phase and channel levels

natural and the tonal balance is done very neatly. In addition, there are astonishing reserves for dynamic jumps. With a three-way system, the M 2.1AMP is added to the woofers in stereo mode. Levels that meet the highest demands can now be achieved without any problems. It sets crisp and, if necessary, hard-hitting bass that is a pure delight. The M 2.1AMP is also fully convincing on the subwoofer, it has even heavier chunks under control and plays precisely and dynamically. On our part, there are no more wishes left unfulfilled.



Only with DSP PC-Tool: fully automatic time alignment using proprietary signals and algorithms



Conclusion

The new Match amplifiers M 5.4DSP and M 2.1AMP are perfectly suited for the smallest of spaces in a factory system to give the best possible performance. The M 5.4DSP already has enough boost to supply a small system on its own. Thanks to 9 DSP channels and the powerful software, it is also a perfect control center for complex audio systems. The M 2.1AMP offers a perfect performance supplement in the same micro format, which can also be operated in stereo or mono mode.

Elmar Michels



Michael E. Brieden
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Duisburg · Germany

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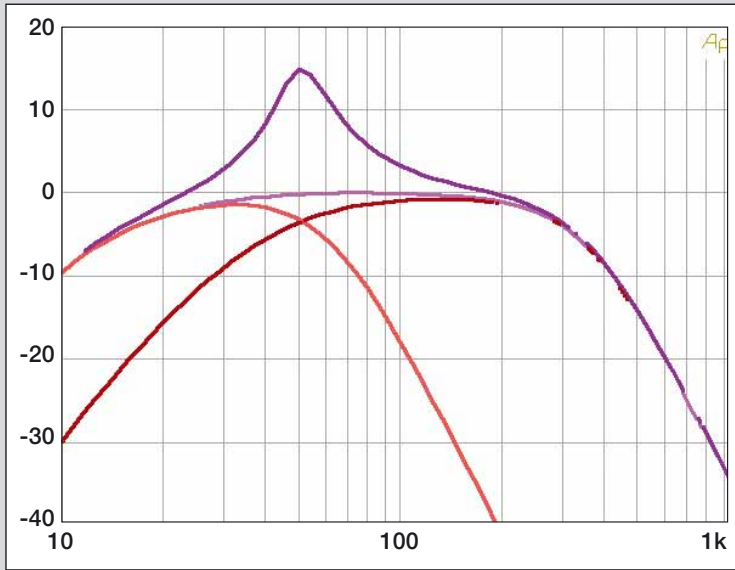
Axton A101 + A401 + A601 – new compact amplifiers under review

New Axton Digital Amplifiers

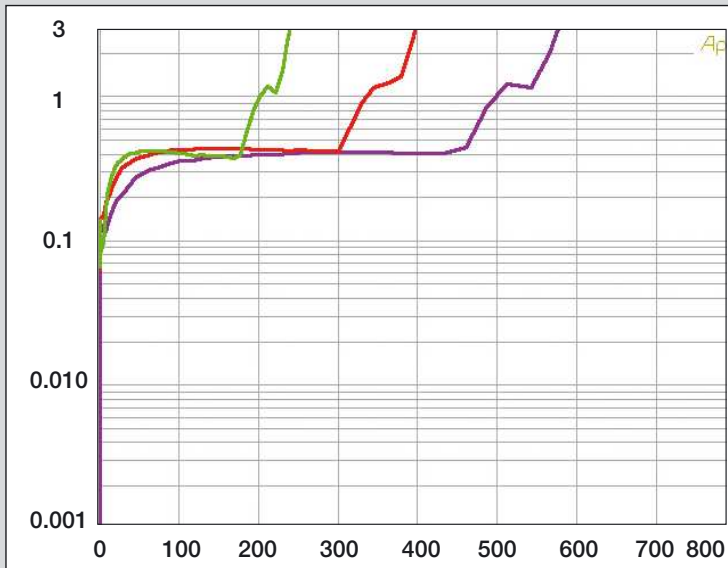
- ▶ They turned out to be authentic designer pieces, the amps from Axton's new A-series. We have the mono, the four-channel, and the six-channel in our test.



CAR&HIFI Laboratory



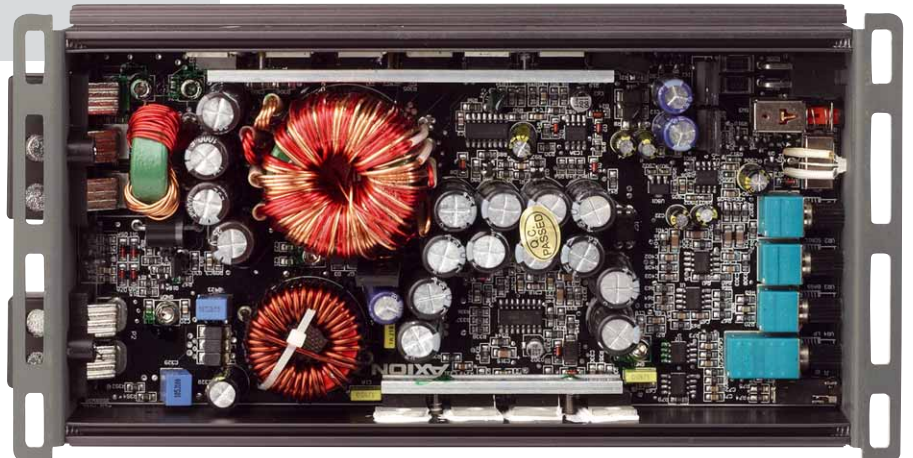
The A101 masters everything, including the subsonic filter and bass boost. There is nothing to complain about.



The A101 is one of the 1-ohm-stable mini power amps. Then it delivers 550 watts, but also at 2 and 4 ohms, there's a lot of power.

An excellent price-performance ratio is always in the foreground at Axton. Thus, the power amplifiers from Axton are also traditionally good and affordable. But this does not mean that you have to settle for outdated or second-rate technology. The new A-series instead shines with modern design and contemporary features. The series consists of the A101 monoblock, the A201 two-channel power amplifier, the A401 four-channel, and the A601 six-channel model, with prices ranging from EUR 180 to EUR 280. They all have a chic design in a matte look, which gives the amplifiers a high-quality appearance. The housings are entirely made of aluminum strand cast; only the connection fronts are sheet metal. And they have gone compact, as is common nowadays. Due to the limited space, we also find Molex connectors instead of RCA jacks and speaker terminals for contact, and only the Mono still has solid terminals for the subwoofer. The Mono is also the smallest at only 18.5 centimeters long, but even the A401 is only 23 centimeters, while the A601 is just over 28 centimeters long. The mono is even 1-ohm-stable, while all multi-channel speakers handle loads of 4 or 2 ohms.

All amplifiers operate according to Class-D with one driver IC per channel and MOSFETS





The A101 is fully equipped. Filters include subsonic, boost and low pass



The entire series is, of course, built according to the Class-D principle, the preferred means of getting high performance out of little space. The reason is the higher efficiency compared to Class-AB amplifiers, which means less waste heat so that smaller heatsinks are sufficient. The features of the A101 are excellent; there's not only a level remote control included, but the filter equipment is also quite generous with low-pass, subsonic filter, and boost. The multi-channel units are equipped a bit more sparingly, with only a choice of high-pass or low-pass up to 400 Hz per channel pair so that subwoofers and small speakers can be controlled. The contact options of the inputs are exemplary for all power amplifiers. High-level or regular RCA

Specifications

| | |
|-----------------------------|-------|
| Channels | 1 |
| Power 4 ohms | 228 |
| Power 2 ohms | 375 |
| Power 1 ohms | 553 |
| Sensitivity max. mV | 370 |
| Sensitivity min. V | 9,0 |
| THD+N (<22 kHz) 5 W | 0,075 |
| THD+N (<22 kHz) Half Power | 0,350 |
| Signal-to-noise ratio dB(A) | 64 |
| Damping factor 20 Hz | 106 |
| Damping factor 40 Hz | 124 |
| Damping factor 60 Hz | 124 |
| Damping factor 80 Hz | 131 |
| Damping factor 100 Hz | 131 |
| Damping factor 120 Hz | 131 |

Features

| | |
|---------------------------------|------------------|
| Low pass | 70 – 250 Hz |
| High pass | – |
| Band pass | 20 – 150k Hz |
| Bass boost | 0 – 15 dB/50 Hz |
| Subsonic filter | 20 – 50 Hz/12 dB |
| Phase shift | – |
| High-level inputs | • (Adapter) |
| Automatic switch-on (Autosense) | •, DC or Signal |
| RCA output | – |
| Start/stop capable | • (7,6 V) |
| Dimensions (L x W x H in mm) | 185 x 105 x 40 |
| Others | Remote control |

Axton A101

| | |
|-------------|------------------|
| Price | 180 Euro |
| Distributor | ACR, Switzerland |
| Internet | acr.eu |

Rating

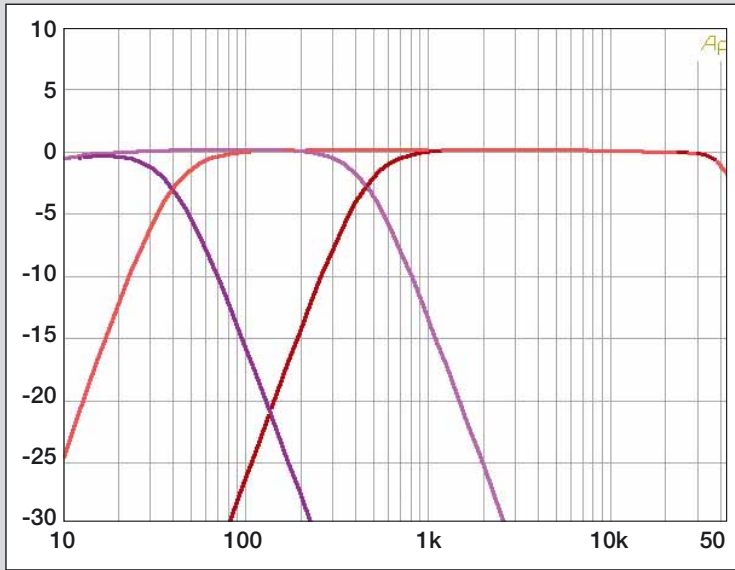
| | | |
|---------------------------|------|-------|
| ► Sound | 20 % | ★★★★★ |
| Bass foundation | 5 % | ★★★★★ |
| Bass pressure | 5 % | ★★★★★ |
| Accuracy | 5 % | ★★★★★ |
| Dynamics | 5 % | ★★★★★ |
| ► Lab | 55 % | ★★★★★ |
| Power | 40 % | ★★★★★ |
| Damping factor | 5 % | ★★★★★ |
| Signal-to-noise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

Upper class
 ★★★★★

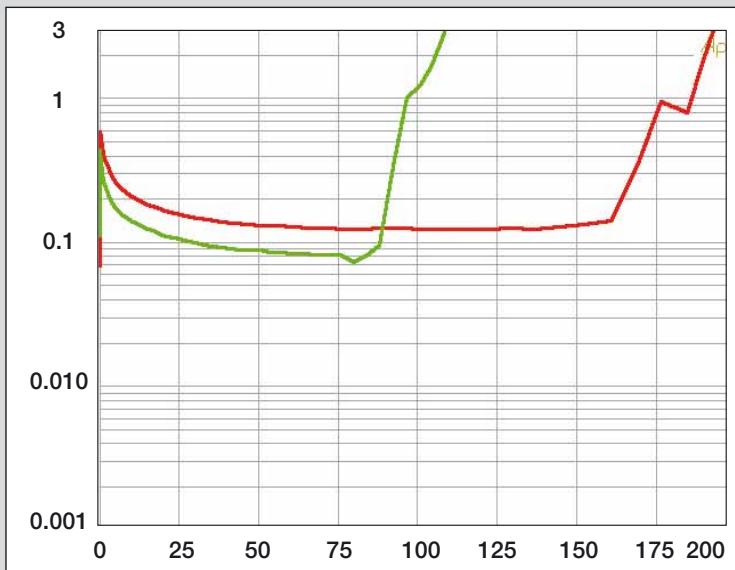
CAR & HiFi
 INTERNATIONAL Germany 2/21

Price/performance: excellent
 "Modern, strong, and affordable."

CAR&HIFI Laboratory



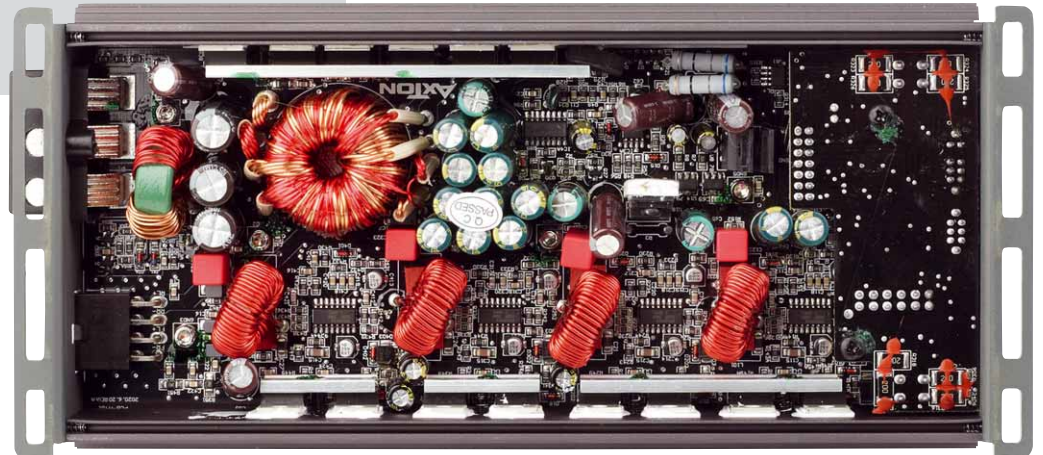
The A401's filters run from 40 to 400 Hz. This is sufficient for separating subwoofers and composite systems, but there is no bandpass.



With 0.1%, the A401 delivers little distortion, but this cannot be called exemplary.

signals can be selected via a switch. An automatic switch-on function also recognizes the DC offset of standard car radios and switches when a signal is detected. With the A401 and A601, there is also the practical option of supplying all channels with one pair of inputs. The internal design of the new A amplifiers is characterized by space utilization. Of course, tiny SMD components are used, and the boards are packed full. The mono is still the airiest. Here, only thick parts such as transformers and coils are spreading since a lot of power must pass through. The mono channel may therefore work with four transistors, while two are sufficient for the multichannel. The four-channel amplifier is clearly arranged. Here we find filtering, power supply, buffering, and power supply control on one side, while the second half of the board is occupied by the row of four amplifier channels. The output transistors are located on the side of the heatsink, and there is a driver chip for each channel and the Class D filtering, recognizable by the large coil. In the A601, we find, of course, six channels of the same construction, only these are not all on one side of the housing, but 5 + 1 distributed to save length. This makes the layout more intertwined, and therefore the end transistors are found on the opposite side of

The upper half of the mainboard is primarily occupied by the power supply, the lower half contains the four amplifier channels





The fronts of the A-series measure only 105 x 40 mm. The signal input is via Molex connectors, either higher low-level



the driver stages and filtering. The power supply control is offloaded to a daughterboard, so the A601 is only slightly longer overall than the A401.

Measurements and sound

The A401 puts out nearly 100 watts per channel into 4 ohms and surges up to 174 watts into 2 ohms. This makes it a very serious power amplifier, even for power-hungry combo systems or woofers, e.g., in BMW and Mercedes. The distortion values are at 0.1%, which is okay, but it's no mean feat for a four-channel power amplifier. The six-channel A601 does better, and its performance at 4 ohms is not inferior to that of the A401. Even at 2 ohms, it produces only a few watts less than its four-

| Specifications | |
|---------------------------------|-----------------|
| Channels | 4 |
| Power 4 Ohm | 96 |
| Power 2 Ohm | 174 |
| Power 1 Ohm | 0 |
| Bridged Power 4 Ohm | 348 |
| Bridged Power 2 Ohm | 0 |
| Sensitivity max. mV | 440 |
| Sensitivity min. V | 9,3 |
| THD+N (<22 kHz) 5 W | 0,17 |
| THD+N (<22 kHz) Halblast | 0,08 |
| Signal-to-noise ratio dB(A) | 93 |
| Damping factor 20 Hz | 46 |
| Damping factor 80 Hz | 45 |
| Damping factor 400 Hz | 45 |
| Damping factor 1 kHz | 43 |
| Damping factor 8 kHz | 12 |
| Damping factor 16 kHz | 3 |
| Features | |
| Low pass | 40 – 400 Hz |
| High pass | 40 – 400 Hz |
| Band pass | – |
| Bass boost | – |
| Subsonic filter | – |
| Phase shift | – |
| High-level inputs | • (Adapter) |
| Automatic switch-on (Autosense) | •, DC or Signal |
| RCA outputs | – |
| Start/stop capable | • (7,5 V) |
| Dimensions (L x W x H in mm) | 230 x 105 x 40 |
| Others | 2, 4 CH In |

| Axton A401 | |
|-------------|------------------|
| Price | 200 Euro |
| Distributor | ACR, Switzerland |
| Internet | acr.eu |

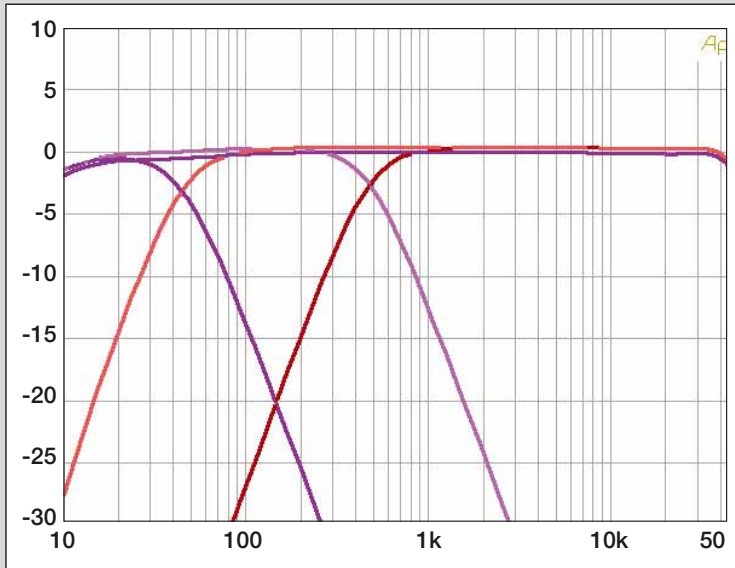
| Rating | |
|---------------------------|------------|
| ▶ Sound | 40 % ★★★★★ |
| Bass | 8 % ★★★★★ |
| Neutrality | 8 % ★★★★★ |
| Transparency | 8 % ★★★★★ |
| Spatial imaging | 8 % ★★★★★ |
| Dynamics | 8 % ★★★★★ |
| ▶ Lab | 35 % ★★★★★ |
| Power | 20 % ★★★★★ |
| Damping factor | 5 % ★★★★★ |
| Signal-to-noise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

Upper class
 ★★★★★

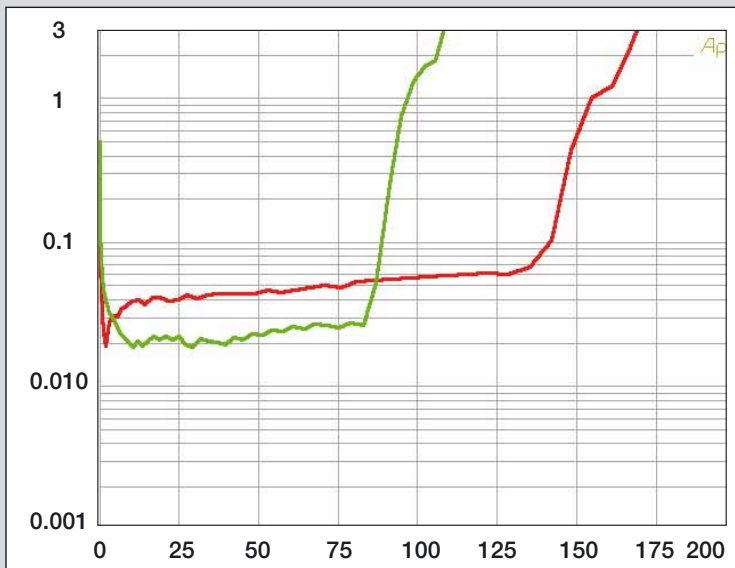
CAR & HiFi
 INTERNATIONAL Germany 2/21

Price/performance: very good
 "Modern, strong, and affordable."

CAR&HIFI Laboratory



On the A601, all channel pairs have the same filters as on the A401. There is no specialization for driving subwoofers, tweeters, etc.



The A601 delivers its power of about 100 and 150 W with minimal distortion. With values around 0.02% and 0.04%, it is doing very well.

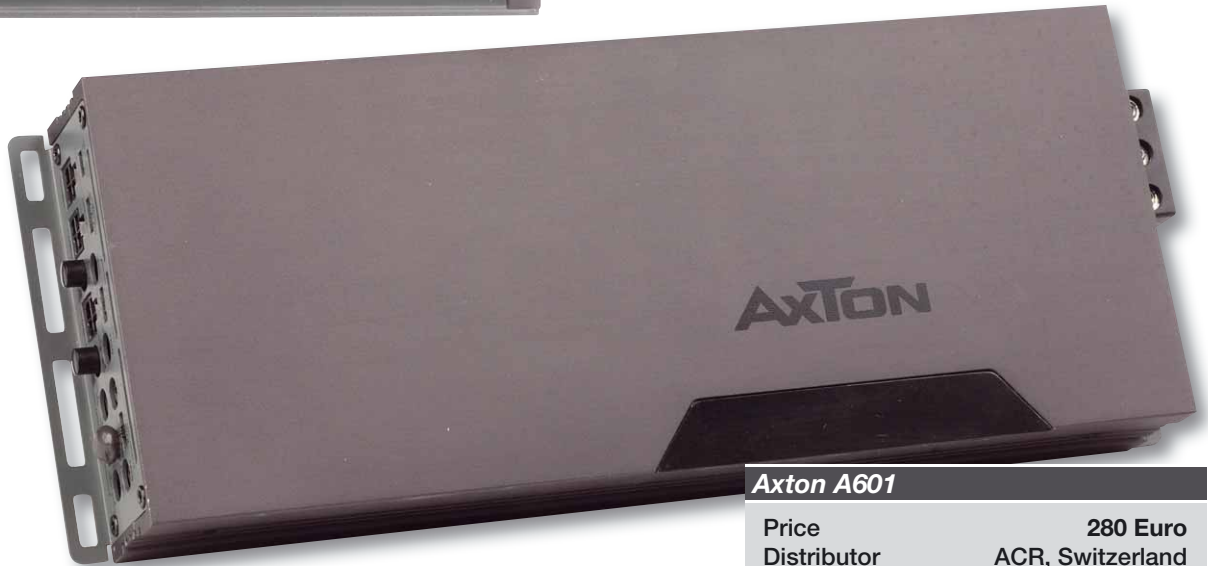
channel sister, which is commendable and a sign of a properly dimensioned power supply. In terms of distortion, it is even a lot better than the rest, and despite the many components, it does not produce more noise than the A401. Thus, the A-series comes out of the lab test successfully, the A601 particularly exemplary. Despite its small size, the A101 bass amplifier shows a very grown-up power output. Even at 4 ohms, the output of just under 230 watts is enough for a small to medium-sized subwoofer. At 2 ohms, 375 watts are available, which is more than enough for any typical sub. It is not at all self-evident that the A101 can also drive 1-ohm subwoofers, but it delivers a whopping 550 watts, which should satisfy ambitious level demands. All other measurement values are in the green zone; no top scores, but also nothing to criticize. The A401 also delivers plenty of power. Sonically, the A101 impresses with a lot of depth. It also demands a lot from the subwoofer with very bassy electro beats. R'n'B rattles through the car quite nicely, and the pressure buildup is generally proper. However, the A101 also feels comfortable beyond angry rumbling; it doesn't shy away from a rocking bass drum and effectively converts fast techno beats. The multi-channel power amplifiers also have enough zest

In the A601 only 5 channels fit in a row, number 6 is moved upwards next to the power supply





On the A601 all channels have the same filters equipped. High or low pass can be used to cross subwoofers or front/rear speakers



Axton A601

| | |
|-------------|------------------|
| Price | 280 Euro |
| Distributor | ACR, Switzerland |
| Internet | acr.eu |

to challenge the speakers even with low tones, especially when they're dynamic. They also don't run out of breath quickly during heavy bursts, so the sound remains clean even at higher volumes. They master the midrange and treble without fault; everything sounds as you'd expect, regardless of the music genre. Drum cymbals get a nice shine, and male and female voices sound realistic.

Conclusion

For little money, the new A-ampifiers bring a lot of music into the car. They have become compact and powerful and are technically up to date.

Elmar Michels

Specifications

| | |
|-----------------------------|---------|
| Channels | 6 |
| Power 4 Ohm | 6 x 96 |
| Power 2 Ohm | 6 x 154 |
| Power 1 Ohm | 0 |
| Bridged Power 4 Ohm | 3 x 308 |
| Bridged Power 2 Ohm | 0 |
| Sensitivity max. mV | 440 |
| Sensitivity min. V | 8,6 |
| THD+N (<22 kHz) 5 W | 0,025 |
| THD+N (<22 kHz) Halblast | 0,023 |
| Signal-to-noise ratio dB(A) | 87 |
| Damping factor 20 Hz | 81 |
| Damping factor 80 Hz | 84 |
| Damping factor 400 Hz | 86 |
| Damping factor 1 kHz | 81 |
| Damping factor 8 kHz | 19 |
| Damping factor 16 kHz | 5 |

Features

| | |
|---------------------------------|-----------------|
| Low pass | 40 – 400 Hz |
| High pass | 40 – 400 Hz |
| Band pass | – |
| Bass boost | – |
| Subsonic filter | – |
| Phase shift | – |
| High-level inputs | • (Adapter) |
| Automatic switch-on (Autosense) | •, DC or Signal |
| RCA outputs | – |
| Start/stop capable | • (8,6 V) |
| Dimensions (L x W x H in mm) | 282 x 105 x 40 |
| Others | 2, 6 CH In |

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 % | ★★★★★ |
| Noise | 5 % | ★★★★★ |
| ▶ Practice | 25 % | ★★★★★ |
| Features | 15 % | ★★★★★ |
| Build quality electronics | 5 % | ★★★★★ |
| Build quality mechanics | 5 % | ★★★★★ |

Upper class



CAR & HiFi

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Germany 2/21

Price/performance: excellent

"Modern, strong, and affordable."

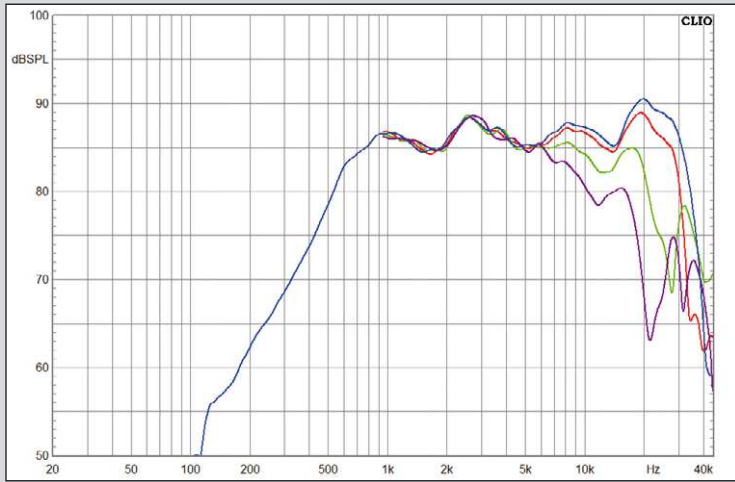
Musway MG6.3A – active three-way system for sound lovers

The perfect speakers

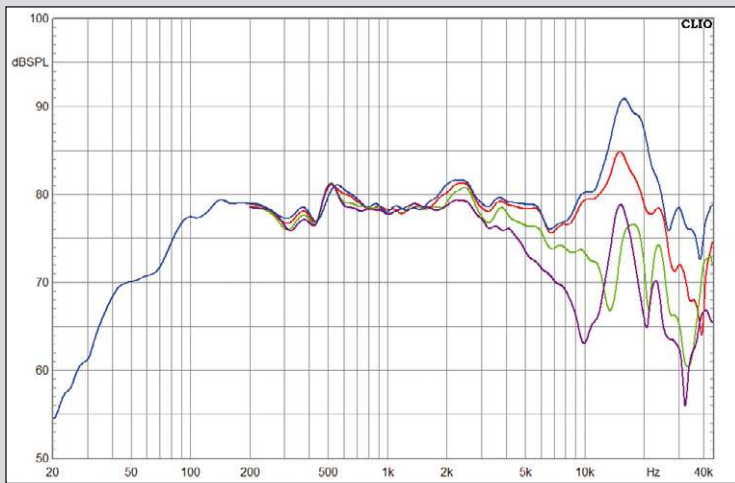
- ▶ With the MG series, Musway wants to enter the top league of car speakers. We test the MG6.3A active three-way system.



CAR&HIFI Laboratory



The tweeter can be coupled very low; from 2 kHz, it runs without problems. With an upper cut-off frequency of 30 kHz, it also has a vast bandwidth.



The midrange is fully present from 150 Hz and runs upwards out of our measuring range. Only around 15 kHz does a pronounced diaphragm resonance spread, which has to be filtered with DSP help.

Until now, most Musway speakers were either particularly practical or particularly cheap. The vehicle-specific series for BMW and Mercedes are elaborately made plug-and-play systems for premium sedans, but the standard component systems were below the EUR 200 threshold in the volume class. That is now changing: With the MG speakers, Musway announces higher ambitions. They are in a completely different league as far as the construction effort is concerned. There are three drivers: a 6.5" MG6.2W woofer, a small MG3M midrange driver, and an MG6.2T tweeter. You can already see from the designations that the woofer and tweeter can also be combined to form a two-way system. It can also be assumed that at least the two-way combination will be available passively with a crossover, too. Our three drivers already have one thing in common at first glance: They are beautiful and finely manufactured. The 6.5" is based on a die-cast basket that combines maximum stability with excellent ventilation. The cone, whose back is made of a layer of pressed paper, is only obstructed by filigree struts. The front and the dust cap, on the other hand, are made of aluminum - a very successful combination in terms of stiffness as well as internal damping. The motor is neatly made and so pretty that you might think there was a decorative cover on the backplate. But Musway has finely finished the



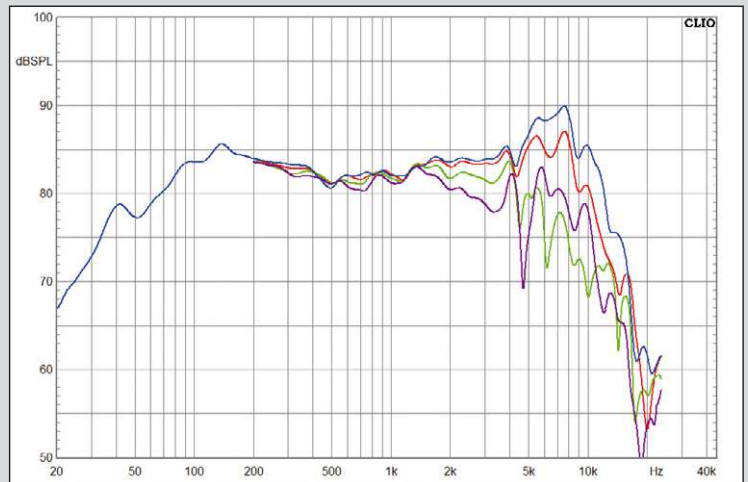
Only the finest: sturdy die-cast basket, wide spiders, and precision top plates

top plate itself to create its matte gray look. Lasered lettering, streamlined pole piece ventilation, and a perforated rim for voice coil ventilation are impressive. The midrange driver is also beautifully manufactured. With a nominal diameter of 3 inches, it belongs to the dainty cone midrange drivers and is therefore relatively easy to accommodate. This is also due to the neodymium motor, which is considerably less voluminous than a ferrite motor. The cone of the midrange driver is of pure aluminum; a sandwich construction is not needed. The aluminum dust cap is glued into the voice coil former and directly coupled to the voice coil. This results in an extra boost of sound pressure at the upper transmission end of the driver. That leaves the tweeter, which does not need to hide in terms of manufacturing quality. With a mounting depth of only 18 millimeters, a coupled chamber is nevertheless integrated into the housing, onto which the 25-millimeter fabric diaphragm is allowed to play. Thus, the tweeter is still very compact and can be coupled low.

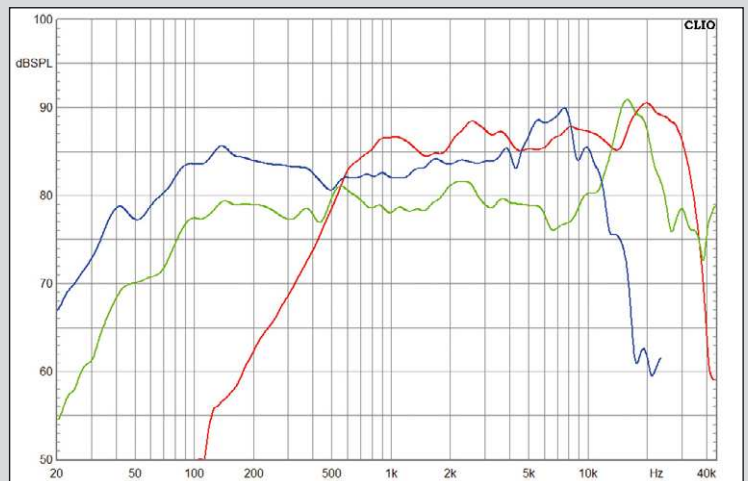
Measurements and sound

The low coupling is naturally not necessary in our three-way system. On the contrary, we try to let the midrange run through all essential frequencies. Our MG3M has the best prerequisites for this. Despite a modest cone area, it is already usable at

CAR & HIFI Laboratory



The woofer runs up to 4 kHz without interference and is thus suitable for two-way use without restrictions. With 84 dB, it is like many good speakers not too loud with 1 W, but the power amplifier fixes that.



Already the woofer and the tweeter show a wide common frequency range. The midrange driver can be decoupled from 150 Hz with any crossover frequency.



The MG family consists of the 6.5" woofer, the 3" midrange, and the 1" tweeter

150 Hz. Upwards there is no limit. After taming the resonance at 15 kHz via DSP, the little one passes as a full-range driver that covers the audio range even without a tweeter. As expected, the 6.5" is a real mid-bass driver and is also suitable for two-way applications without any problems. This also applies to the tweeter, which emits sound with its low resonant frequency of 750 Hz until well below 2 kHz. However, due to the dip in the frequency response, it makes sense to use it from 2 kHz. In distortion measurements, the Musway speakers managed to impress us. They are among the cleanest speakers in recent years. The 6.5" woofer operates almost distortion-free (for a speaker) up to the highest SPLs. The wicked K3 sticks to zero, and overall distortion remains record low above 100 Hz. The midrange does almost better, only it naturally manages less SPL.

Nevertheless, it plays impressively under 200 Hz; if you protect it from frequencies below 300 Hz, it delivers more than respectable SPLs without distortion. The tweeter has the easiest job. In the high-frequency range, it is the rule rather than the exception that the drivers work flawlessly. This is also the case with the MG6.2T, which produces no odd distortion and only makes a harmless little K2 outside the listening range. For this, there is the rarely awarded score 1+ in the discipline distortion - congratulations to the development department! The Musway then gives a gala performance at the amplifier. It spoils the ears with immense detail over the entire frequency range but without „splitting“ the music. The sound rolls out of the speakers just as casually as it can suddenly explode. Even giant dynamic leaps, such as during

drum solos, do not upset the system. The woofer delivers bone-deep bass beats, the snare blares vehemently from the midrange, and the tweeter adds a rich harmonic spectrum. It's a great sound, just as it should be for a three-way system. But that would be doing the Musway system an injustice because it reveals a lot of other qualities. It plays balanced even at low listening volumes. The dose of high-frequency information is always enough to be clear about the entire recording, but the highs do not push themselves out and act gently enough to be suitable for long distances. Natural instruments such as the double bass or saxophone shine in the most delicate colors and, if necessary, with a good splash of

smoothness. The spatial reproduction is tonally stable and precise. Once „pinned down,“ the musical actors don't move anymore, no matter what happens. Thus, the most diverse styles of music programs can be enjoyed at the highest level. From jazz trio to orchestral music, the sound is just as right as with solid rock music or techno.

Conclusion

With the MG6.3A triple combination, Musway has an absolute bombshell in its program. Everything is top-notch, with excellent measurement values and sound. This kind of thing sometimes costs several times more than what Musway charges.

Elmar Michels

Specifications

| | |
|--------------------------------|-----------------------|
| Basket diameter | 165 mm |
| Mounting diameter | 143 mm |
| Mounting depth | 67 mm |
| Magnet diameter | 90 mm |
| Basket midrange | 90 mm |
| Depth midrange | 41 mm |
| Dome diameter tweeter | 25 mm |
| Housing diameter tweeter | 44 mm |
| Max. XO freq wf/mr | 3,58/7k Hz |
| Min. XO freq mr/tw | 150/2k Hz |
| XO for test | 500/3k Hz |
| EQ for test | wf: (8,5kHz/-6 dB/Q4) |
| Grilles | •/•/• |
| Other | - |
| Nominal impedance | 4 Ohm |
| DC resistance Rdc | 3,66 Ohm |
| Voice coil inductance Le | 0,15 mH |
| Voice coil diameter | 32 mm |
| Cone area Sd | 129 cm ² |
| Free air resonance fs | 48,1 Hz |
| Mechanical Q Qms | 3,32 |
| Electrical Q Qes | 0,73 |
| Total Q Qts | 0,60 |
| Volume of suspension Vas | 15,20 l |
| Moving mass Mms | 16,6 g |
| Mechanical resistance Rms | 1,55 kg/s |
| Compliance Cms | 0,66 mm/N |
| B*1 | 5,00 Tm |
| SPL 2 V, 1 m | 84 dB |
| Amplifier power recommendation | 50 – 200 W |

Musway MG6.3A

| | |
|-------------|-----------------------|
| Price | 450 Euro |
| Distributor | Audio Design, Germany |
| Internet | audiodesign.de |

Rating

| | | |
|--------------------|------|-------|
| ▶ Sound | 55 % | ★★★★★ |
| Bass foundation | 11 % | ★★★★★ |
| Neutrality | 11 % | ★★★★★ |
| Transparency | 11 % | ★★★★★ |
| Soundstage | 11 % | ★★★★★ |
| Dynamics | 11 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| Distortion | 10 % | ★★★★★ |
| ▶ Build quality | 15 % | ★★★★★ |

Top Class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: excellent

"Noble speakers with perfect engineering."

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ANALOG HIFI AND VINYL CULTURE



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Ground Zero
GZUB 8BR + GZUB 10BR + GZUB 12BR
– the new Ground Zero Uranium subwoofers

SQ subwoofer with impressive depth

- ▶ Almost simultaneously with the Uranium speakers, Ground Zero is launching a new Uranium subwoofer line. We are taking a look at the three subwoofer boxes.





While GZUB 10BR and GZUB 12BR are about the same size, the GZUB 8BR is a really compact subwoofer



The Uranium series is far up within the Ground Zero product range. In contrast to the Nuclear series trimmed for SPL, the Uranium components appeal primarily to customers looking for the best possible sound quality. This is expressed in the names of the subwoofer single chassis GZUW 8SQ, 10SQ and 12SQ, but our test boxes are named GZUB 8BR, 10BR and 12BR according to the functional principle. The design of the boxes is kept clean and simple, with proportions that have been used for decades - black felt boxes that cling seamlessly to the back of the seat with their slanted rear walls. They are made of 19 millimeter thick MDF, except for the front surfaces. Which are 25 millimeters thick and hold the milled chassis and the three protective bars each, while plenty of material remains behind the cutting. The inside of the box is also very well made. There are edge strips and a perforated vertical support to stabilize the cabinets, and the bass reflex tubes are supported by MDF boards. The ports are all plastic pipes with a diameter of 7 centimeters. That sounds like (way too) little for a large 30 mm woofer, yet the generous trumpet openings inside and outside can effectively reduce whistling noises. The terminals are well crafted. Plugs for both 2-ohm coils are located next to each other at the same distance, so they can be easily connected to 4 or 1 ohms with the enclosed wire bridges. The built-in woofers show a high family resemblance, and all three pieces share excellent craftsmanship. It starts right with the frames made of sturdy die-cast aluminum. As usual, the cones are made of air-dried paper; they are of the thicker, more stable type. The surrounds are made of relatively light foam, so that

Very nicely made woofers:
a cast basket, a double magnet
and faced pole plates



they do not steal as much efficiency as thick rubber surrounds. Their profile is rather high than wide, as it should be in order to maximize the cone area. Details such as the leads are also very well made, the robust screw terminals sit immovably on cast lugs, they take thick cables and lead them downwards and not to the side, as seen in many other systems. This enables a secure hold and makes the installation easier. The tinsel leads to the coils are shaped like Nessie, they plunge through the centering and are thus held in place by it. The motors of all woofers work with two-inch coils, which is certainly sufficient for SQ woofers. Nevertheless, it is not a unitary motor, at least with the 8" woofer, the iron parts and the magnets are individually dimensioned. The small GZUW 8SQ has a linear stroke of approx. 6 millimeters; in the GZUW 10SQ and 12SQ we have approx. 10 millimeters. Mechanically, all baskets offer some freedom of movement.

Measurements and sound

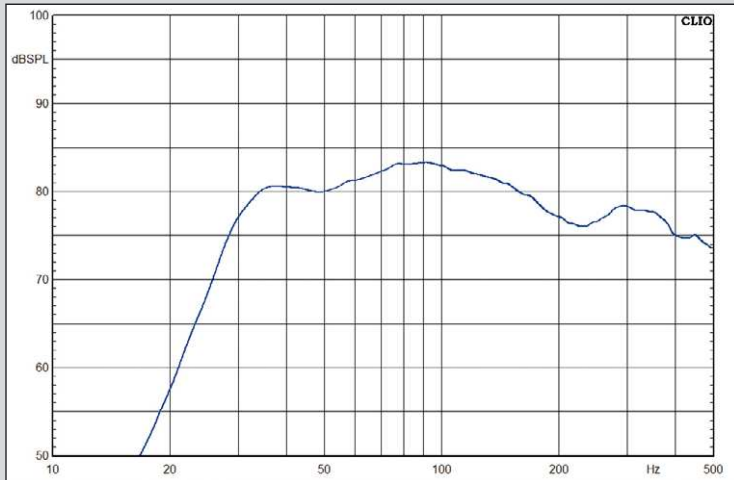
Ground Zero sticks firmly to the principle „The deeper, the better“ in development of the housing design. Even the small GZUB 8BR is tuned to almost 38 Hz, and the GZUB 10BR is at 32 Hz. The GZUB 12BR is tuned extremely low at 28 Hz, while only a few 12" woofers go below 30 Hz. The frequency responses look accordingly. Even the 8BR doesn't want to stop the descent into the bass cellar, it only gets somewhat quieter at 33 Hz. The 10BR easily dives below the 30 Hz mark and the sound pressure of the 12SQ fizzles out just above 20 Hz. And also in the

listening test the Ground Zeros never disappoint in the deep bass ranges. The 8BR already plays really low for the vast majority of applications, while the 12BR neatly reproduces everything down to infrasound. Admittedly a little quieter than the upper bass, but it sounds very pleasant nevertheless. The 10BR is somewhere in between, but also qualifies as a deep bass specialist. The 8BR delivers the most balanced and versatile sound, as it likes to play techno bass and plays nice and crisp in the upper bass. The GZUB 10BR is kind of everybody's darling, it plays punchy bass drums and doesn't shy away

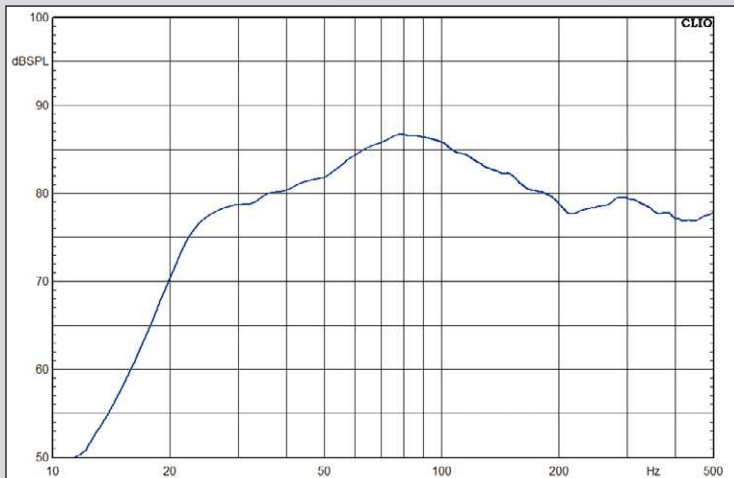
The GZUB family comes in sizes 8", 10" and 12" or 20, 25 and 30 cm



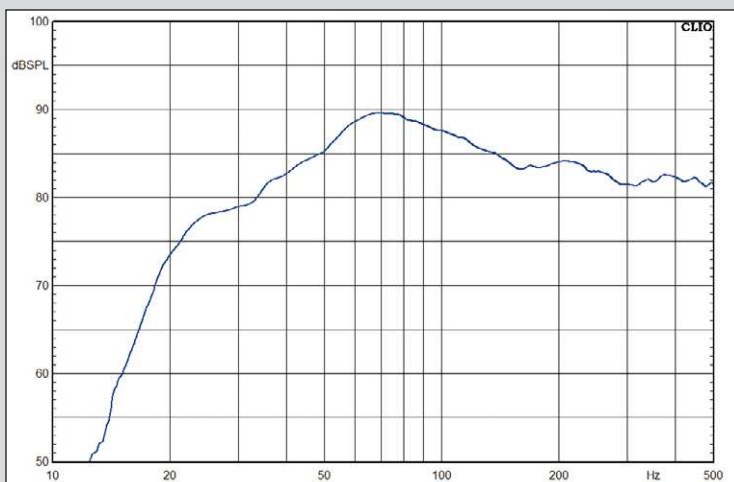
CAR&HIFI Laboratory



The GZUB 8BR gives the most balanced performance. Even it manages frequencies well below 40 Hz



The GZUB 10BR easily plays below the 30Hz mark. At the top it reaches up to 86 dB / 1 W



The GZUB 12BR only drops in sound pressure slightly above 20 Hz. In the most important bass range above 40 Hz it delivers a solid performance of 89 dB



The design is very practical: With the wire bridges, the double voice coils can be used either in parallel or in series

from deep R'n'B. It also delivers a lot of pressure and satisfies the level requirements. The GZUB 12BR has no problem doing this, it puts almost too much pressure and deep bass hum for an SQ woofer. So every woofer has its advantages, which the users can consider depending on their preference for sound and available space.

Conclusion

The GZUB woofers clearly prioritize the sound quality and can easily satisfy the most demanding listeners, being true Ground Zero creations that are not squeamish even in the deep bass. Yes, they can rock it.

Elmar Michels

Ground Zero GZUB 8BR

| | |
|-------------|-----------------------|
| Price | 250 Euro |
| Distributor | Ground Zero, Germany |
| Internet | ground-zero-audio.com |

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------|------------|
| Basket diameter | 21,5 cm |
| Mounting diameter | 18,1 cm |
| Mounting depth | 10,8 cm |
| Magnet diameter | 13,0 cm |
| Box width | 44,5 cm |
| Box height | 25,0 cm |
| Box depth | 28/32,5 cm |
| Weight | 12,4 kg |

| | |
|-------------------------|---------------------|
| Nominal impedance | 2 x 2 Ohm |
| DC resistance Rdc | 4,10 Ohm |
| Coil inductivity Le | 2,39 mH |
| Coil diameter | 50 mm |
| Membrane surface | 201 cm ² |
| Resonance frequency fs | 58 Hz |
| Mechanical Q-Factor Qms | 8,54 |
| Electrical Q-factor Qe | 0,71 |
| Overall Q-factor Qts | 0,65 |
| Equivalent volume Vas | 5,1 l |
| Moved mass Mms | 82 g |
| Rms | 3,52 kg/s |
| Cms | 0,09 mm/N |
| B x l | 13,19 Tm |
| SPL 1 W, 1 m | 83 dB |

| | |
|-----------------------|-------------|
| Recommended power | 200 – 500 W |
| Test cabinet | BR 21,5 l |
| Reflex tunnel (d x l) | 7 x 32 cm |

Upper class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Sound-oriented subwoofers
for deep bass fans“

Ground Zero GZUB 10BR

| | |
|-------------|-----------------------|
| Price | 300 Euro |
| Distributor | Ground Zero, Germany |
| Internet | ground-zero-audio.com |

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------|------------|
| Basket diameter | 26,2 cm |
| Mounting diameter | 23,6 cm |
| Mounting depth | 14,8 cm |
| Magnet diameter | 14,0 cm |
| Box width | 46,0 cm |
| Box height | 32,5 cm |
| Box depth | 25/32,5 cm |
| Weight | 15,6 kg |

| | |
|-------------------------|---------------------|
| Nominal impedance | 2 x 2 Ohm |
| DC resistance Rdc | 4,03 Ohm |
| Coil inductivity Le | 3,03 mH |
| Coil diameter | 50 mm |
| Membrane surface | 330 cm ² |
| Resonance frequency fs | 47 Hz |
| Mechanical Q-Factor Qms | 10,17 |
| Electrical Q-factor Qe | 0,65 |
| Overall Q-factor Qts | 0,61 |
| Equivalent volume Vas | 14,5 l |
| Moved mass Mms | 120 g |
| Rms | 3,49 kg/s |
| Cms | 0,10 mm/N |
| B x l | 14,86 Tm |
| SPL 1 W, 1 m | 86 dB |

| | |
|-----------------------|-------------|
| Recommended power | 200 – 500 W |
| Test cabinet | BR 28,5 l |
| Reflex tunnel (d x l) | 7 x 32 cm |

Top class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Sound-oriented subwoofers
for deep bass fans“

Ground Zero GZUB 12BR

| | |
|-------------|-----------------------|
| Price | 350 Euro |
| Distributor | Ground Zero, Germany |
| Internet | ground-zero-audio.com |

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------|------------|
| Basket diameter | 31,5 cm |
| Mounting diameter | 28,4 cm |
| Mounting depth | 15,7 cm |
| Magnet diameter | 14,0 cm |
| Box width | 52,0 cm |
| Box height | 38,0 cm |
| Box depth | 26/35,5 cm |
| Weight | 18,9 kg |

| | |
|-------------------------|---------------------|
| Nominal impedance | 2 x 2 Ohm |
| DC resistance Rdc | 4,04 Ohm |
| Coil inductivity Le | 3,03 mH |
| Coil diameter | 50 mm |
| Membrane surface | 498 cm ² |
| Resonance frequency fs | 38 Hz |
| Mechanical Q-Factor Qms | 8,84 |
| Electrical Q-factor Qe | 0,63 |
| Overall Q-factor Qts | 0,59 |
| Equivalent volume Vas | 39,7 l |
| Moved mass Mms | 154 g |
| Rms | 4,15 kg/s |
| Cms | 0,11 mm/N |
| B x l | 15,33 Tm |
| SPL 1 W, 1 m | 89 dB |

| | |
|-----------------------|-------------|
| Recommended power | 200 – 500 W |
| Test cabinet | BR 42 l |
| Reflex tunnel (d x l) | 7 x 20 cm |

Top class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Sound-oriented subwoofers
for deep bass fans“

ESX Q168P – compact subwoofer
in a flat under-seat enclosure

Mini subwoofer for underseat mounting

- ▶ The Q168P from ESX is remarkably flat and can fit in any recess. With a smart connection, it can also be used in a double pack. We put the compact flat-pack to the test.

The market is full of under-seat subwoofers. The mostly cuboid-shaped woofers are usually equipped with a small power amplifier and are so flat that they fit under the front seats in average cars. The goal is, as always, an invisible bass solution that doesn't have to be perfect but should conjure up that crucial extra portion of low-frequency sound for everyday use in the car.





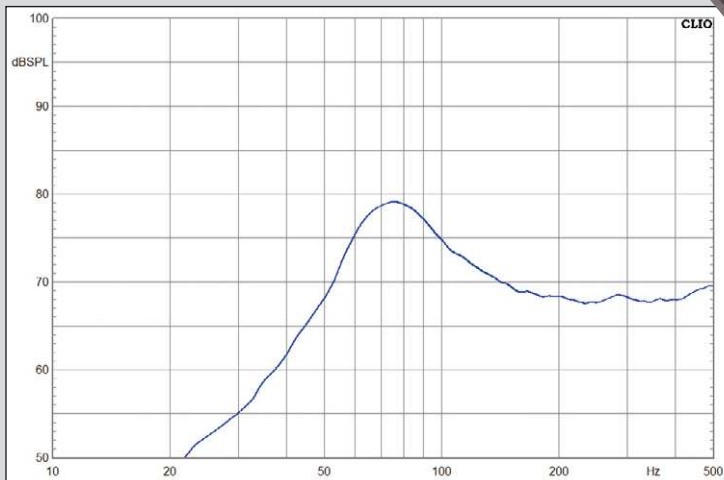


With a footprint of only 26 x 19.5 centimeters, the ESX168 is one of the smallest, and at 7.5 centimeters, it is also very flat. This means that it cannot only be installed under the seat but the woofer can also be placed in a storage compartment or the double trunk floor. The new thing about our Q168P is that it is passive, so ESX does without the amplifier module. Instead, the Q168P has a terminal

plate for Molex connectors, which is cleverly used. Since you have two front seats in the car, it makes sense also to install two under-seat speakers. However, this makes little sense with two active speakers. But

it does with the passive version. As a passive speaker, the Q168P can not only be supplied with an extra portion of amplifier power – with the enclosed connection cable of suitable length, the two under-seat cabinets are also wired in a flash. The amplifier only has to be connected to one of the two, and thanks to the two-channel cable, the amplified signal for the second one comes with it. The latter is then wired from the first Q168P. Each woofer has a 2-ohm coil, so using the pair on two amplifier channels is no problem. Of course, you can also operate only one Q168P. For this, one channel

CAR & HIFI Laboratory



Between 50 and 100 Hz, the Q168P plays quite lively. Because of the small enclosure and the heavy cone, it's only enough for 79dB/1W.



A woofer with an aluminum cone works in the small aluminum housing



Connection panel with two Molex sockets for amplifier and second woofer



The Q168P comes with a snakeskin cable that can connect either the amplifier or a second Q168P

with 2 Ohm power handling is sufficient. Our Q168P comes in a sturdy aluminum die-cast housing, so the best volume utilization is given, which is impossible with a wooden box. The bass driver works with a very sturdy sheet metal frame with profiled basket struts. The rectangular aluminum diaphragm is flat on the outside but tapers inward to contact the voice coil former. A rectangular dust cap is glued to the front. The rectangle has a good 200 square centimeters and thus corresponds precisely to a 20-cm round woofer. The motor is conventional; it works with a 38-millimeter voice coil and a ferrite ring.

Measurements and sound

A typical under-seat woofer is usually 5 liters, but the Q168P manages with 3 liters - a space advantage not to be scoffed at in some applications. However, the tiny sealed box also limits the output at low bass frequencies. The Q168P solves this dilemma quite remarkably. Despite the small volume, the built-in resonance of the woofer is a (relatively speaking) low 70 Hz. This is only possible because the woofer has a thick and heavy cone; its moving mass is three

times that of a standard 8-inch. What unfortunately comes along with this is poor efficiency, 79 dB at 1 W is not great. Despite its dimensions, the Q168P requires a bit of power from the amplifier. Then it runs quite remarkably from about 50 to 100 Hz and is thus not worse than a larger subwoofer. Sound-wise, it plays with high precision and responds to bass impulses without any delay. It masters fast bass runs in its sleep and can follow even complex music very well. Of course, there is no excessive bass, but the pressure is entirely sufficient. With a Q168P, mind you. If you add a second one, this solution is in no way inferior to a typical boxed subwoofer. What the Q168P lacks in low bass, it makes up for double and triple with clean bass.

Conclusion

The passive Q168P is a trendsetter. Thanks to Molex cables, it connects easily to the hip little multi-channel power amps and is just as elegant mounted individually or as a two-pack under the front seats. The reward is a tight bass that makes you happy.

Elmar Michels

ESX Q168P

| | |
|----------------------|--------------------------------------|
| Price | 125 Euro |
| Distributor Internet | Audio Design, Germany esxaudio.de |

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------------------------|---------------------|
| Basket diameter | 21,5 x 14,5 cm |
| Mounting diameter | 20 x 13 cm |
| Mounting depth | 5,0 cm |
| Magnet diameter | 9,8 cm |
| Box width | 19,5 cm |
| Box height | 7,5 cm |
| Box depth | 26,0 cm |
| Weight | 3,2 kg |
| Nominal impedance | 2 Ohm |
| DC resistance R _{dc} | 1,88 Ohm |
| Coil inductivity L _e | 0,65 mH |
| Coil diameter | 38 mm |
| Membrane surface | 202 cm ² |
| Resonance frequency f _s | 36 Hz |
| Mechanical Q-Factor Q _{ms} | 5,94 |
| Electrical Q-factor Q _e | 2,68 |
| Overall Q-factor Q _{ts} | 1,85 |
| Equivalent volume V _{as} | 6,5 l |
| Moved mass M _{ms} | 174 g |
| R _{ms} | 6,56 kg/s |
| C _{ms} | 0,11 mm/N |
| B x l | 5,23 Tm |
| SPL 1 W, 1 m | 79 dB |
| Recommended power | 100 – 200 W |
| Test cabinet | g 3 l |
| Reflex tunnel (d x l) | - |

Middle class



CAR & HiFi

INTERNATIONAL

Germany 2/21

Price/performance: very good

"Recommendable bass solution with the smallest of volumes."

Audio System
CO06 Evo + CO06 Evo DC + CO06 Evo QC
– 6-inch subwoofer with different voice coils

Small subwoofers for any amplifier

- ▶ Audio System offers a vast selection of small subwoofers. Now three new 6-inch drivers from the affordable CO series are coming to dealers. We take a closer look at the triplets.





Until the release of the Carbon series, CO components were Audio System's most affordable entrance. CO subwoofers are only available as small models with 8 or 6-inch nominal diameters, either as a chassis or mounted in special compact boxes. Now the CO 06 Evo is getting an addition in the form of the DC and QC variants. The abbreviations DC and QC refer to the voice coil configuration, meaning dual coil and quad coil. While dual voice coils are pretty standard, we find only a few woofers on the market that have four coils. But you don't actually need them because two coils are more than enough. If

you dig a little deeper, the coil puzzle becomes clear. The reason is that car hi-fi systems have changed in recent years. In earlier years, it was taken for granted that a serious hi-fi system consisted of several amplifiers with various speakers and subwoofers. You had an amplifier for typical component systems, one for kick basses, and above all, specialized amplifiers for subwoofers because they have the greatest hunger for power. As subwoofer amplifiers, there are classic monoblocks or a powerful two-channel power amplifier. These amplifiers can drive loads of 4, 2, or 1 ohm, hence the dual voice coils that allow for relative flexibility

in connecting subwoofers and amplifiers together. A 2 x 2-ohm dual coil can be paralleled to 1 ohm; in series, the coils give 4 ohms. This fits for large monoblocks and powerful two-channel amplifiers. A parallel connection with a 2 x 4-ohm dual voice coil results in 2 ohms, which works well with a smaller monoblock or for safe operation at an existing power amplifier with two free channels. While in the past large amplifiers with few channels were used, the trend of the last years goes to small amplifiers with many channels - often with several integrated amplifier chips on board. And instead of a thick subwoofer, many

The CO06 Evos differ only in the number of voice coils.
All have a truly fat motor with a comparatively substantial ferrite ring





The CO 06 Evo triplets: top left single voice coil, top right double coil, bottom quad coil

sound enthusiasts today prefer to install several small ones that can be installed more inconspicuously.

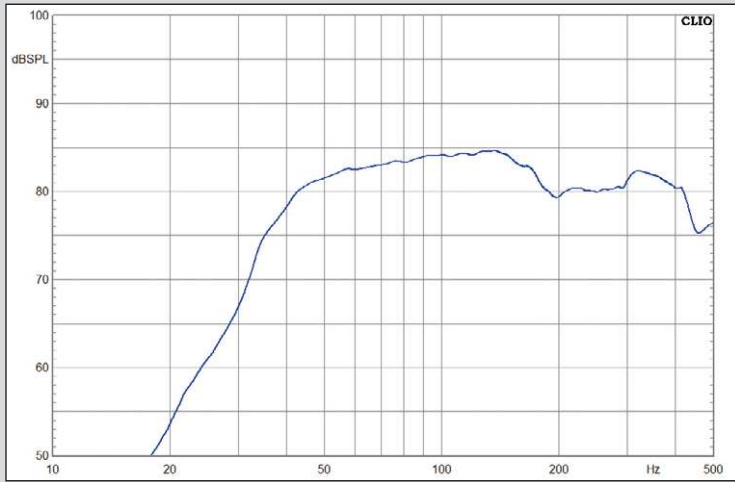
Audio System now takes this into account with the CO 06 Evo DC and QC. There is the CO06 Evo with a classic 4-ohm dual coil, then the CO06 Evo DC with 2 x 4-ohm dual coil for 2-ohm applications. The new CO06 Evo QC with 4 x 2-ohm quad coil is predestined for multi-channel power amplifiers. So you have enough channels, except that the-

se microamps often only deliver 40 watts per channel, so you need multiple channels to drive a subwoofer. And not all of these multi-channel power amps are bridgeable, so there are definitely applications for quad coils. So the CO06 Evo QC draws maximum power from four small channels, which adds up to enough watts for subwoofer operation.

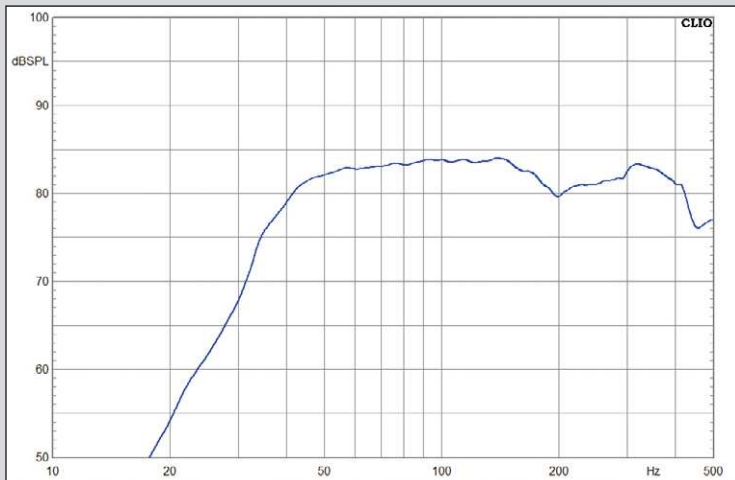
Technically, the three are pretty similar. The voice coil configuration is more or less the only difference.

They have in common the solid sheet metal frame and the wide spider for the woofer size. The cones are paper with a thick plastic coating from the front, resulting in sturdy constructions. The dust cap is made of impregnated fabric on the three. The motors have turned out quite splendidly, for which the substantial ferrite rings are responsible. The coil diameter is 38 millimeters, which allows the small woofers to handle a lot of power.

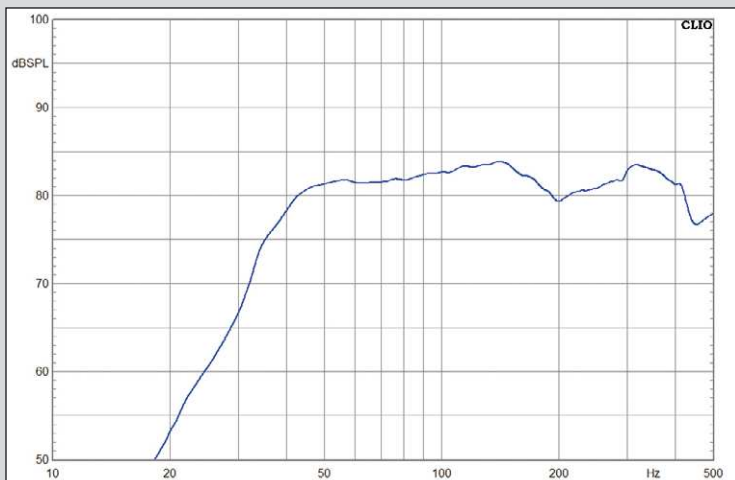
CAR&HIFI Laboratory



The CO06 Evo with 4 Ohm single coil runs fine linear down to a remarkable 45 Hz



Like the CO06 Evo, the CO06 Evo DC reaches 84 dB/1W



With the CO06 Evo QC, the quadruple coil in our configuration brings small losses, so that we measure it with 83 dB/1W

Measurements and sound

We connected the DC to 2 ohms in parallel and the QC in series-parallel to 2 ohms for our parameter measurements. As expected, the Thiele-Small parameters determined then were so similar that all three woofers run in the same enclosure. Because of the strong motor, the total Qs are low – sealed boxes are not recommended. Vented boxes can be small; the fun can begin at just under 10 liters. One or two liters more are not to be scoffed at, so we ended up with a good 12 liters of inside volume. Both in the simulation and in front of the measuring microphone, the three COs are practically indistinguishable. Our recommendations and scores, therefore, apply to all three. The CO06 Evo plays deep into the frequency cellar in the test box, not just for a six-incher. A very grown-up bass comes out of the small box. The CO also plays clean at low frequencies. Of course, it has no problems with bass runs in the upper bass, which has always been the domain of small and light woofers. The woofer also plays nicely punchy and can make the sound as fat as a big woofer. Of course, the maximum level is reduced because a subwoofer simply needs cone area. The CO does quite well, but it is happy about the support of one (or more) companions – which does not break the budget, considering the low prices.

Conclusion

With the three-pack CO06 Evo, Audio System always has the right subwoofer for any type of amplifier. Whether medium or small power amplifier, whether many or few channels, whether discrete transistors or power amplifier chips, now everyone should find the right woofer.

Elmar Michels

Audio System CO06 Evo

Price **60 Euro**
Distributor Audio System Germany
Internet audio-system.de

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------|---------|
| Basket diameter | 170, cm |
| Mounting diameter | 14,2 cm |
| Mounting depth | 8,2 cm |
| Magnet diameter | 12,0 cm |
| Box width | 0,0 cm |
| Box height | 0,0 cm |
| Box depth | 0,0 cm |
| Weight | 2,5 kg |

| | |
|-------------------------|---------------------|
| Nominal impedance | 4 Ohm |
| DC resistance Rdc | 3,13 Ohm |
| Coil inductivity Le | 1,39 mH |
| Coil diameter | 38 mm |
| Membrane surface | 129 cm ² |
| Resonance frequency fs | 49 Hz |
| Mechanical Q-Factor Qms | 4,47 |
| Electrical Q-factor Qe | 0,38 |
| Overall Q-factor Qts | 0,35 |
| Equivalent volume Vas | 6,5 l |
| Moved mass Mms | 38 g |
| Rms | 2,60 kg/s |
| Cms | 0,28 mm/N |
| B x l | 9,82 Tm |
| SPL 1 W, 1 m | 84 dB |

| | |
|-----------------------|-------------|
| Recommended power | 100 – 300 W |
| Test cabinet | BR 13,5 l |
| Reflex tunnel (d x l) | 7 x 30 cm |

Middle class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Miniwoofer with variable voice coil concept.“

Audio System CO06 Evo DC

Price **65 Euro**
Distributor Audio System Germany
Internet audio-system.de

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------|---------|
| Basket diameter | 170, cm |
| Mounting diameter | 14,2 cm |
| Mounting depth | 8,2 cm |
| Magnet diameter | 12,0 cm |
| Box width | 0,0 cm |
| Box height | 0,0 cm |
| Box depth | 0,0 cm |
| Weight | 2,5 kg |

| | |
|-------------------------|---------------------|
| Nominal impedance | 2 x 4 Ohm |
| DC resistance Rdc | 1,58 Ohm |
| Coil inductivity Le | 0,52 mH |
| Coil diameter | 38 mm |
| Membrane surface | 129 cm ² |
| Resonance frequency fs | 50 Hz |
| Mechanical Q-Factor Qms | 3,92 |
| Electrical Q-factor Qe | 0,37 |
| Overall Q-factor Qts | 0,34 |
| Equivalent volume Vas | 6,9 l |
| Moved mass Mms | 34 g |
| Rms | 2,75 kg/s |
| Cms | 0,30 mm/N |
| B x l | 6,80 Tm |
| SPL 1 W, 1 m | 84 dB |

| | |
|-----------------------|-------------|
| Recommended power | 100 – 300 W |
| Test cabinet | BR 13,5 l |
| Reflex tunnel (d x l) | 7 x 30 cm |

Middle class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Miniwoofer with variable voice coil concept.“

Audio System CO06 Evo QC

Price **70 Euro**
Distributor Audio System Germany
Internet audio-system.de

Rating

| | | |
|-------------------------|--------|-------|
| ▶ Sound | 50 % | ★★★★★ |
| Low frequency extension | 12,5 % | ★★★★★ |
| Sound pressure | 12,5 % | ★★★★★ |
| Sound purity | 12,5 % | ★★★★★ |
| Dynamics | 12,5 % | ★★★★★ |
| ▶ Lab | 30 % | ★★★★★ |
| Frequency response | 10 % | ★★★★★ |
| Efficiency | 10 % | ★★★★★ |
| Max. SPL | 10 % | ★★★★★ |
| ▶ Build quality | 20 % | ★★★★★ |

Specifications

| | |
|-------------------|---------|
| Basket diameter | 170, cm |
| Mounting diameter | 14,2 cm |
| Mounting depth | 8,2 cm |
| Magnet diameter | 12,0 cm |
| Box width | 0,0 cm |
| Box height | 0,0 cm |
| Box depth | 0,0 cm |
| Weight | 2,5 kg |

| | |
|-------------------------|---------------------|
| Nominal impedance | 4 x 2 Ohm |
| DC resistance Rdc | 2,31 Ohm |
| Coil inductivity Le | 0,68 mH |
| Coil diameter | 38 mm |
| Membrane surface | 129 cm ² |
| Resonance frequency fs | 51 Hz |
| Mechanical Q-Factor Qms | 3,34 |
| Electrical Q-factor Qe | 0,40 |
| Overall Q-factor Qts | 0,36 |
| Equivalent volume Vas | 6,6 l |
| Moved mass Mms | 33 g |
| Rms | 3,21 kg/s |
| Cms | 0,29 mm/N |
| B x l | 7,88 Tm |
| SPL 1 W, 1 m | 83 dB |

| | |
|-----------------------|-------------|
| Recommended power | 100 – 300 W |
| Test cabinet | BR 13,5 l |
| Reflex tunnel (d x l) | 7 x 30 cm |

Middle class



CAR & HiFi
INTERNATIONAL Germany 2/21

Price/performance: very good

„Miniwoofer with variable voice coil concept.“

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 build and sound quality
- **Top Class** – Products for higher demands with excellent performance, 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, prices and features may differ in the individual countries.

The star rating provides comprehensive and concise orientation when searching for devices for your in-car entertainment. However, depending on your situation and application, the device with the best star rating is not automatically the best fit for you. For example, an amplifier may score very well overall but may be difficult to connect to your car radio. So additional effort has to be considered for integration or a different model might be the better choice. 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

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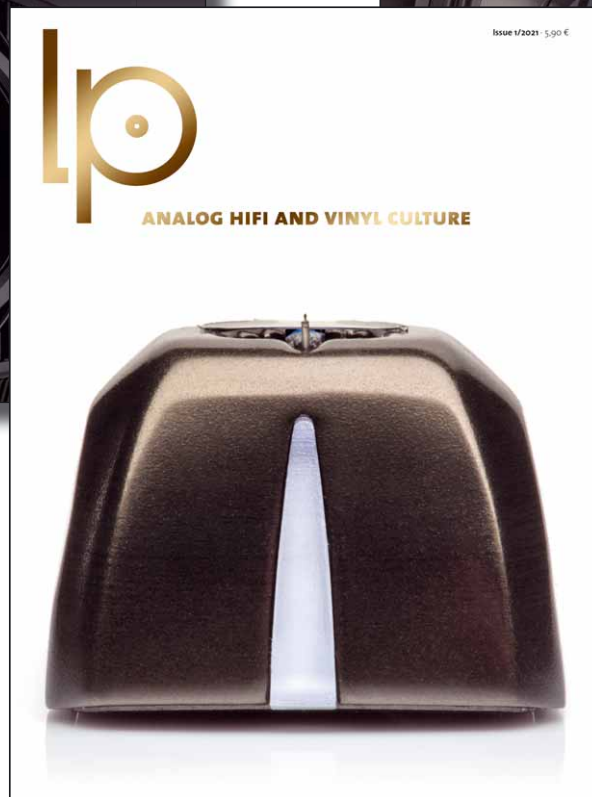


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