CAR & HiFi

INTERNATIONAL

1/24 · 4,80 €

European Edition

Best topics

- 80s style car radio
- 10 channel DSP amplifier
- DSP PC-Tool 5 update
- 4 Sound quality subwoofers
- Double view solar cameras

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- Audio System Germany • Blaupunkt
- Brax/Helix/Match • Musway
- omniVID • Silent Angel

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2024 season

Do you own a mobile home? Then you should first read our story about high-end streaming, which - in addition to the reviews of a whole range of great in-car entertainment products – made it into this issue of CAR&HIFI INTERNATIONAL. I would also like to whet your appetite for a trade fair that is becoming more and more important every year, namely the most important show for in-car entertainment in Europe. Starting on April 18, 2024, the CarMediaWorld including the EMMA Eurofinals will take place in a small Austrian village called Salzburg, a show that attracts international exhibitors and visitors every year. You will find the report in the next issue.

Elmar Michels
Editor-in-chief

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Bass at its finest

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Tests

Categories

Upgrade amplifier

At Match there are two additions to the upgrade amplifiers. The UP 6DSP is a 6-channel model added to the DSP amplifiers UP 8DSP and UP 10DSP. Except for the even more compact housing, the UP 6DSP is a typical UP. All features such as the ACO platform are of course on board and the 6 Series is not behind the larger models when it comes to channel performance.

- **www.audiotec.fischer.com**

Custom-made protective grilles

ESX gives its Vision VXP84 and Vision VXP104 flat subwoofers all-round protection that is stable and also looks stylish. The set of grilles and the matching retaining rings is available from ESX specialist dealers.

- **www.esxaudio.de/english/**

New Mercedes speakers

With the MFIT100 Mercedes C-Class W205 Evo, Audio System brings a new two-way system for Mercedes. The name says it all, the set fits into the doors of the C-Class W205 and is an exact fit as an MFIT set and comes with all mounting materials.

- **www.en.audio-system.de**

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>
> *(Elmar Michels, Car & Hifi)*

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DESIGN TIP
Retro Radio
CAR&HiFi INTERNATIONAL 1/24

Universal for all vehicles with DIN radio

Blaupunkt Hamburg SQM 23 DAB: Modern technology with an 80s look

Back to the 80s

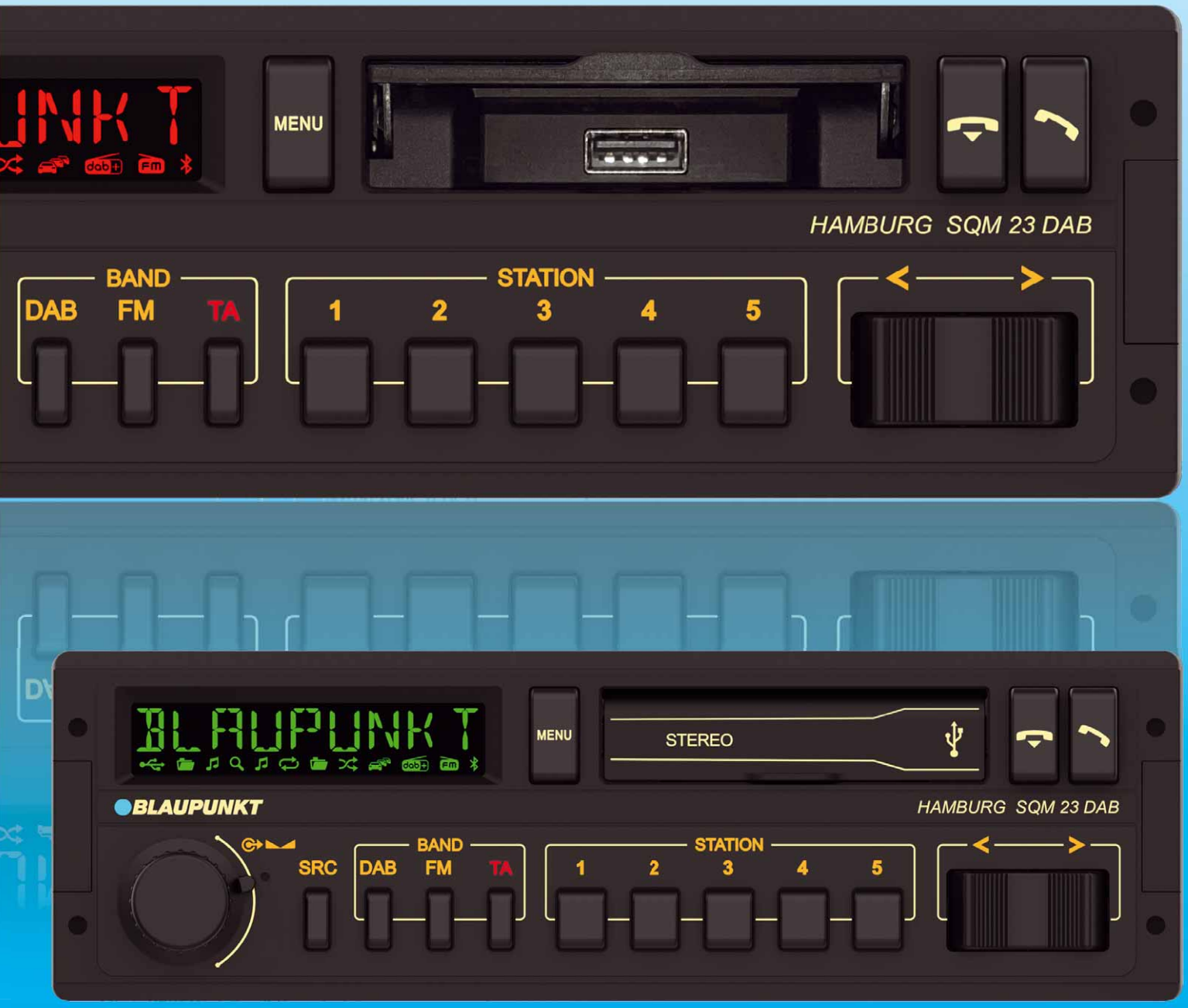
In 1983, Blaupunkt, then still part of Bosch, launched the Hamburg SQM 23 cassette radio. Evo-Sales is now launching the Hamburg SQM 23 DAB retro radio based on this classic.

In recent decades, many traditional German brands have been sold to investment companies, which then sell the brand rights in the individual product segments at a profit. Unfortunately, the new rights holder often launches container goods from the Far East under a well-known brand label. This usually has little or nothing in common with the original brand quality and philosophy.

A welcome counterexample is the Hameln-based company Evo-Sales, which today holds the Blaupunkt brand rights in Germany's car radio and accessories sector. The medium-sized Evo-Sales GmbH has over 35 years of experience in the car media industry. The car radios released under its direction uphold the old Blaupunkt quality standards and have proven themselves many times in our tests. Special highlights in the range are the retro radios. They conceal state-of-the-art digital technology behind a front in a historical design that looks remarkably similar to the legendary models of the last millennium.

Ideal for vintage cars

Volkswagen launched the Golf 2 in 1983. Mercedes had the W123, Ford the Sierra, and Opel the Kadett D. The legendary Citroen 2 CV „duck" was also available as a new car. Anyone who can call these or other historic vehicles from the 80s their own today is unlikely to install a modern



The assumed cassette slot conceals a USB port

car radio in the dashboard for visual reasons. Firstly, this would be a blatant breach of style, leading to problems with the H certificate. On the other hand, you would be reluctant to do without modern technology such as digital media, Bluetooth, and DAB+ digital radio. The Blaupunkt Hamburg SQM 23 DAB is the ideal solution in this case.

Retro looks

Visually, the Hamburg SQM 23 DAB is a dead ringer for the 80s original. The buttons, rotary control, display, and cassette slot are modeled on the classic. But, of course, Blaupunkt will no longer produce a cassette radio in 2024. Instead, the supposed slot conceals a USB interface, which can be used to play digital music from a USB stick. The functions and, thus, the labeling of the buttons also deviate in part from the historical model, as they have been adapted to modern functionality. In addition, the illumination color of the LC display is now variable in seven colors, whereas in 1983, it was exclusively green.

Modern tech Of course, the Hamburg's entertainment offering is not stuck in the eighties. It receives radio programs in analog form via FM and AM and digitally via DAB+. It connects to smartphones via Bluetooth and USB. In addition to the USB interface in the „cassette slot," there is an extra one at the back. Both also work with iPhones. By dispensing with a mechanical drive, the device has a low mounting depth, making it easy to install even in tight spaces.

Bluetooth Music can be streamed wirelessly via Bluetooth when a smartphone is paired. You can even use the phone's voice assistant to select tracks and enjoy further functionality. Hands-free calling is also possible, of course. The necessary microphone is located in the front of the car radio. Alternatively, an external microphone can be connected, which is automatically recognized by Blaupunkt. If Auto Wake-Up is activated, the radio switches on automatically when a call is received, provided the ignition is switched on. Separate preamplifier outputs for front, rear, and subwoofer are available for use with external power amplifiers. The usual bass and treble controls are available for sound adjustment. MP2, MP3, WMA, FLAC, M4A (AAC), APE, and WAV can be played via USB.

Specifications

Power output	15
Output voltage/V	2,5
Output impedance/Ohm	730
USB	
THD+N (%)	0,04
SNR (A)	91
Tuner	
THD+N (%)	0,05
SNR (A)	62
Crosstalk (dB)	42
RDS	•
Channel memory	40
MP3/WMA/AAC	• / • / •
Mute/GAL	• / –
Loudness	•
Tone control	•
param./graph. EQ bands	– / 2
Pre-outs	6
Crossovers	–
Time alignment	–
Detachable front	–
Remote controol	optional
Aux-in front / rear	– / –
USB front / rear	• / •
iPod control	•
Bluetooth HFP/A2DP	• / •
Others	DAB+

Here fits the Blaupunkt Hamburg SQM 23 DAB

In all cars with a DIN slot. Installation and connection adapters are available as accessories for many other models.

Conclusion Functionally and technically, the Blaupunkt Hamburg SQM 23 DAB 2024 is up to date. Visually, it fits perfectly into vehicles from the 1980s. It is a top recommendation for historic vehicles from this period!

Dipl.-Phys. Guido Randerath

Blaupunkt Hamburg SQM 23 DAB

Distributor	Evo Sales GmbH, Hameln, Deutschland
Hotline	+49 5151 823820
Internet	www.bpautomotive.de

Rating

Sound	35 %	★★★★½
Bass foundation	7 %	★★★★☆
Neutrality	7 %	★★★★★
Transparency	7 %	★★★★★
Spatial imaging	7 %	★★★★☆
Dynamics	7 %	★★★★★
Lab	15 %	★★★½☆
• USB	10 %	★★★☆☆
Distortion	5 %	★★★★★
Signal to noise ratio	5 %	★★☆☆☆
• Tuner	10 %	★★★½☆
Frequency response	2,5 %	★★★★☆
Crosstalk	2,5 %	★★★★★
Distortion	2,5 %	★★★★★
Signal to noise ratio	2,5 %	★½☆☆☆
Practice	45 %	★★★★½
Operation	10 %	★★★★★
Features	20 %	★★★★☆
Reception test	10 %	★★★★★
Build quality	5 %	★★★★★

Top Class

★★★★★

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Price/performance: very good

„Perfect radio solution for historic vehicles"

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i7 | i3 | BASIC

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„With its Compose platform, Helix presents three speaker series - Basic, i3 and i7 - and a completely new approach to the in-car entertainment market. All models in this comprehensive range of tweeters, midrange drivers, woofers and coaxial units fit universally into standardised mounting positions. Vehicle-specific FlexMount adapters for the i3 and i7 series are offered for more than a dozen car brands from Audi to Volvo, with more to come. As a result, the Compose speakers are easy to install, including matching to vehicle wiring via FlexConnect, and take acoustic conditions into account. [...] **These speaker solutions are innovative, versatile and highly desirable.**“

- Expert Imaging and Sound Association

EISA AWARD Best Product 2023-2024
IN-CAR INTEGRATION
Helix Compose Platform

VERSATILITY AWARD
Rear-view camera system
CAR & HiFi INTERNATIONAL 1/24

omniVID Solar 5 Duo Rear-view camera system

Universal Solution

Whether you have a trailer, bike rack, or first or second car, this camera system offers a safe reversing solution for almost all applications. It is also easy to install without the need to lay cables.

Razor-sharp image without residual noise

Scope of delivery of the Solar 5 Duo

The solar duo package from omniVID includes a 5-inch monitor, a solar reversing camera, an additional solar camera, and two license plate holders. The additional camera can be a front or rear camera for a trailer, such as a caravan. It can also be attached to the bike rack if it covers the original license plate. This means it is unnecessary to remount the camera when changing use. The possibilities are endless thanks to the additional camera; it can also be used on a second car, in which case only the monitor needs to be moved - no problem, thanks to the suction cup holder and power supply via the cigarette lighter.

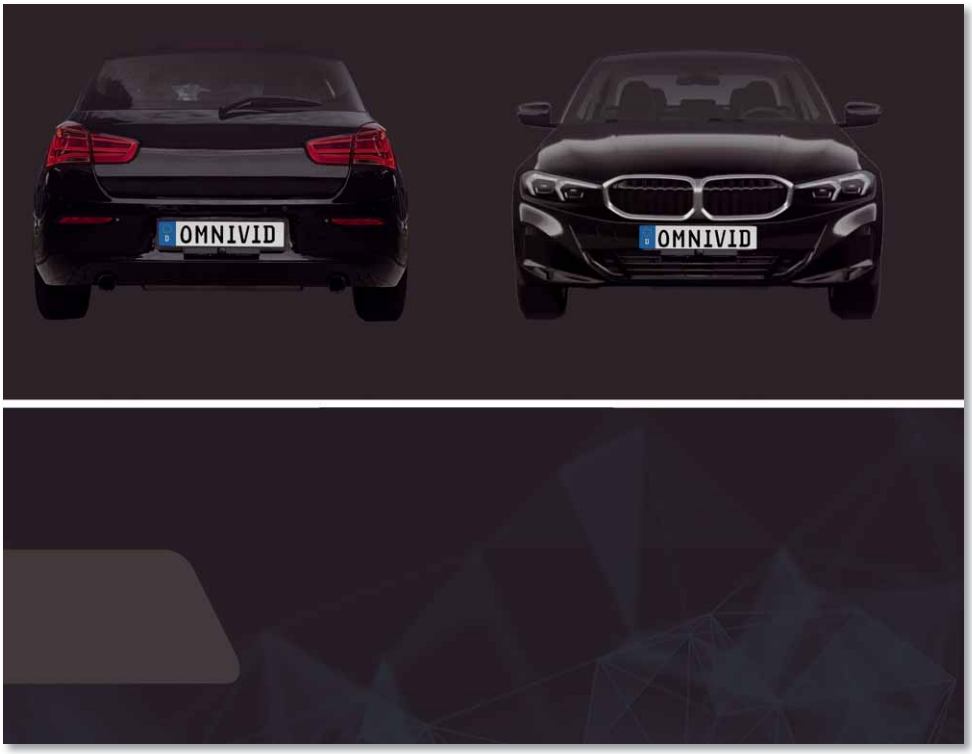
Monitor

The 5-inch monitor communicates wirelessly with the two cameras via a 2.4 GHz connection and offers a wireless range of up to 17 m. We had no reception problems in practical use on the trailer or during the „dry test“ with several room walls between the devices. Thanks to the digital transmission, the image is razor-sharp and noise-free.

Large 5 inch monitor with anti-glare protection

The range of applications is broad

Guidelines can be activated as a parking and maneuvering aid in the monitor settings. These are height-adjustable in 5 stages. The display duration of the camera image can also be adjusted. You can choose between a total of 6 time windows ranging from 45 to 240 seconds. Of course, the system language, display brightness, contrast, and display color can also be adjusted in the menu. The system languages available are German, English, and French. The USB-C interface allows installing functionality and system updates to keep the system up to date.



Only one possible application: front and rear cam

The monitor can be attached to the windshield or dashboard

Cameras

The two solar cameras each feature a 5200 mAh battery. In addition to solar charging, the battery can be charged via a power bank if the vehicle has been parked in an underground garage for longer, for example. Thanks to the low energy consumption, a fully charged battery can last up to 100 days without further charging. When not in use, the cameras go into power-saving mode. They are switched back on fully when the acceleration sensor detects a movement. Thanks to the CMOS sensor, the cameras send images with 1280 x 720 pixels to the monitor, and the light sensitivity of 0.5 lux enables good images even at night.

Installation

The scope of delivery includes an EU license plate holder for each camera. To install the cameras, simply unscrew the current license plate

holder and screw on the new one together with the camera. The process only takes a few minutes and does not require much manual skill. The camera module can also be fitted with license plate holders in a different format. Thus, using the cameras with classic cars, US cars, or trailers is also no problem.

There are several options for mounting the monitor. The suction cup holder can be attached to the windshield or dashboard, and there is also a ventilation slot holder. In the monitor settings, the camera image can be mirrored horizontally and vertically, and the cameras can even be mounted upside down.

Conclusion

The omniVID solar duo package offers the right option for every vehicle thanks to its two cameras, simple installation, and various mounting options. Whether used as a front and rear camera or mounted on a vehicle combination, the system delivers razor-sharp images and makes it much easier for the driver to keep an overview. It is a great help when maneuvering.

Lilit Tuma,
Dipl. Phys. Guido Randerath

The cams are powered by solar cells and wireless transmission make installation child's play

The camera module is simply mounted with the license plate

omniVID Solar 5 Duo reversing camera system

Price	230 Euro
Contact	MMC Trade GmbH
Internet	www.omnivid.de

Features & Specifications Monitor

- Screen size 5 inch/ approx. 12.7 cm
- Display resolution 800 x 480 pixels
- Brightness 500 cd/m²
- Operating voltage via the cigarette lighter 9-32 V
- Operating voltage via USB 5 V
- Operating temperature -20 to +70 °C
- Weight (without holder) 170 g
- Dimensions (without holder) 13 x 10.8 x 4.2 cm
- Parking aid lines adjustable in 5 levels, can be deactivated
- Languages German, English, French
- Image settings Brightness, contrast, color, horizontal and vertical mirroring

Features & Specifications Cameras

- image sensor CMOS
- Resolution 1280 x 720 pixels
- Image angle 160° horizontal, 110° vertical
- Battery type and capacity Li-Ion, 5,200 mAh
- Charging power solar panels 1.5 W max.
- Operating temperature -20 °C to +70 °C
- Protection class IP67
- Camera angle 0° to 80° vertical
- Transmission frequency 2.4 GHz
- Max. Transmission power 100 mW
- Max. Transmission range 17 m
- Weight (without license plate holder) 673 g
- Dimensions 52.9 x 13 x 1.4 cm

Scope of delivery

- 2 x camera solar module
- 2 x license plate holder
- 5" monitor
- Car adapter for the cigarette lighter socket with integrated USB charging port
- Suction cup holder for windshield and dashboard
- Clamp mount for air vent
- 2 x USB charging adapters for the camera module battery
- License plate mounting material
- Operating instructions in German

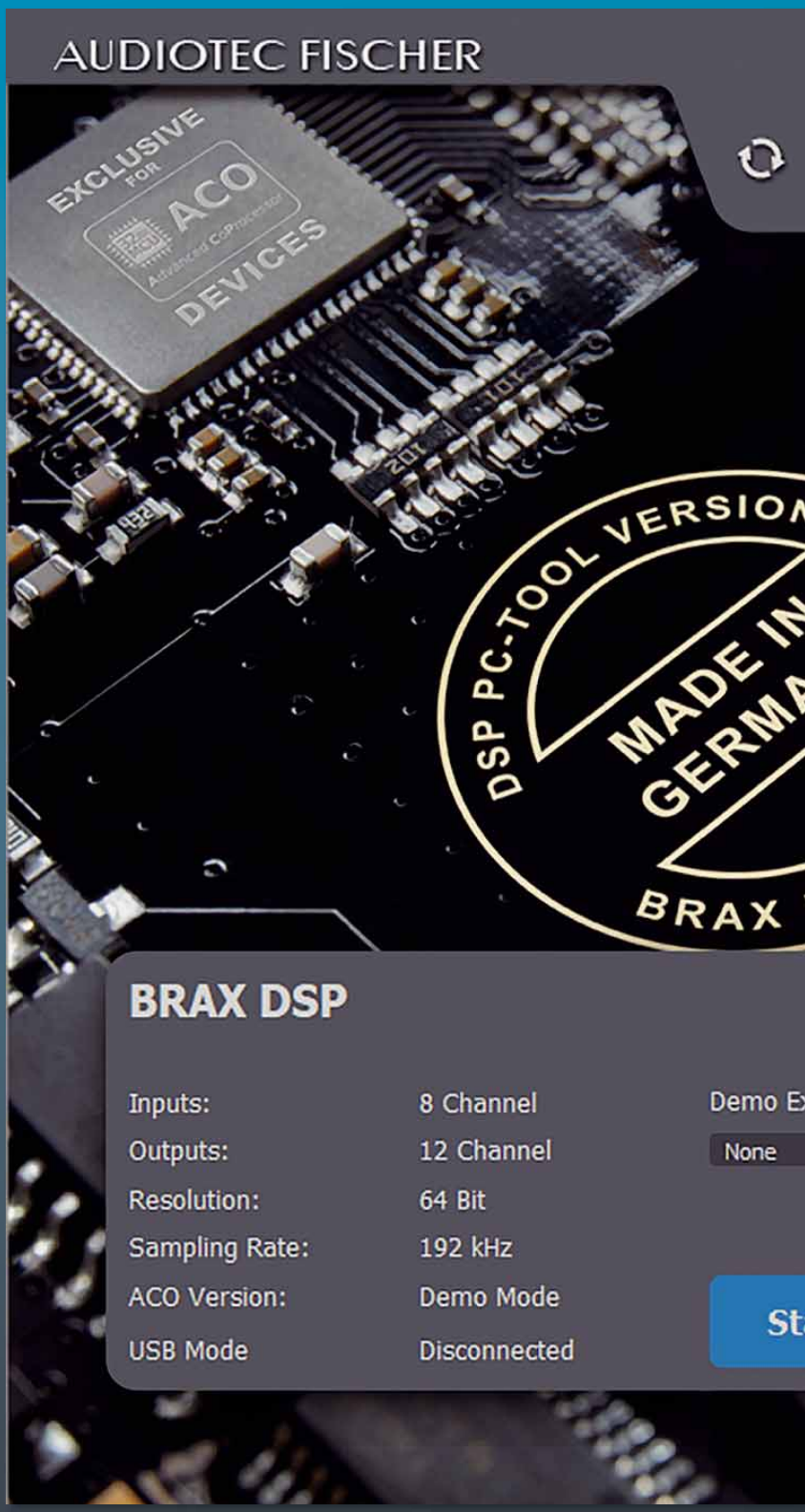
CAR&HiFi INTERNATIONAL Germany 1/24

„Universal reversing solution“

New functions of the DSP software from Brax/Helix/Match

DSP PC Tool – Upd

The DSP PC Tool is the DSP software from Audiotec Fischer. It works with DSP products from the Brax, Helix and Match brands. Since version 5 was released in 2022, new functions have been constantly added; it is now time to describe the most important new features in detail.



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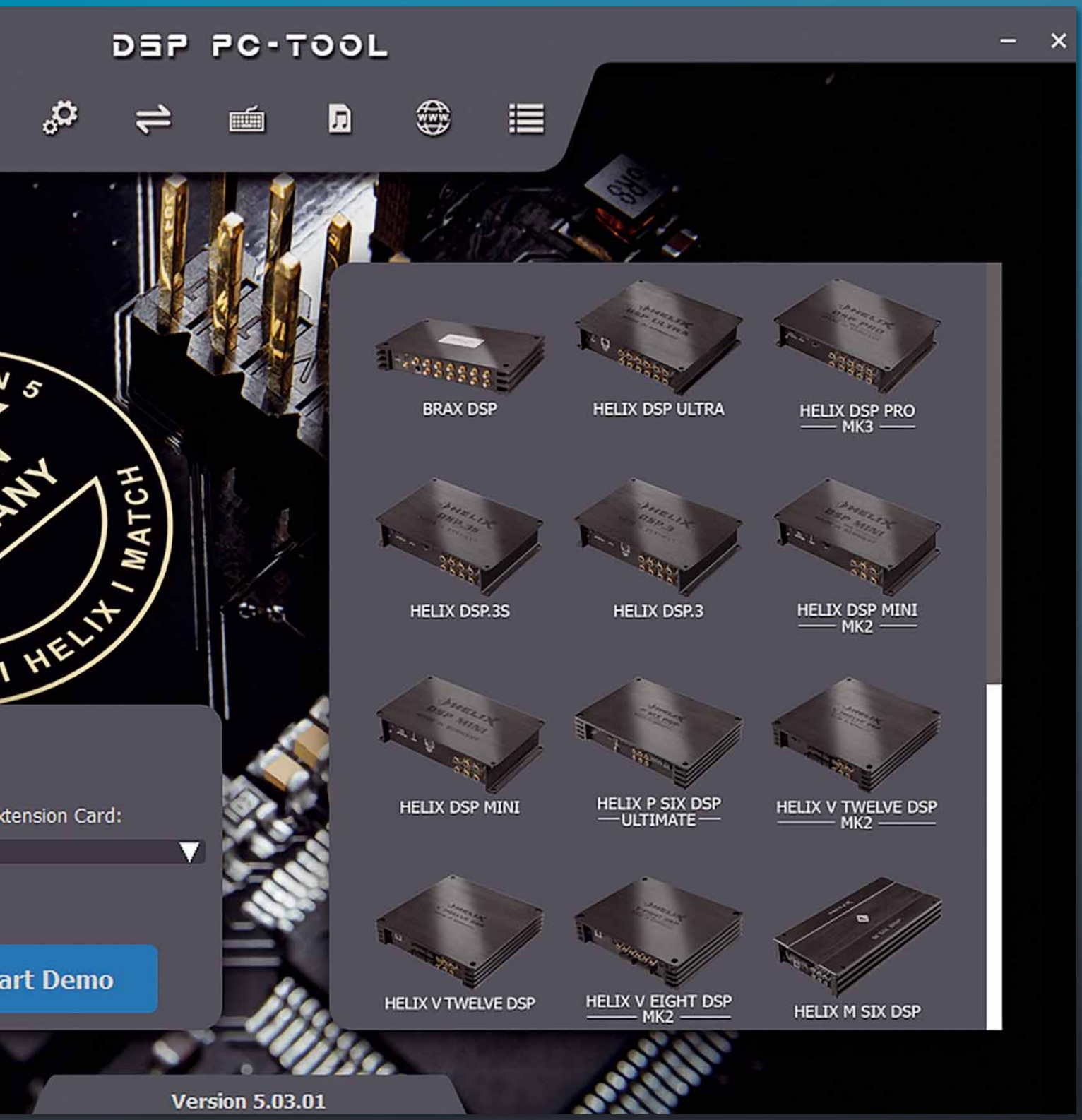
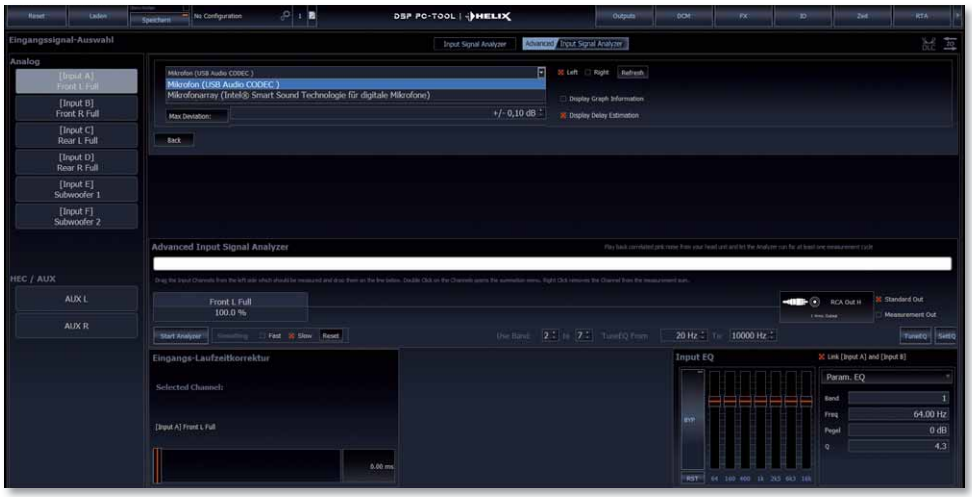

DSP PC-TOOL
BRAX DSP
HELIX DSP ULTRA
HELIX DSP PRO MK3
HELIX DSP.3S
HELIX DSP.3
HELIX DSP MINI MK2
HELIX DSP MINI
HELIX P SIX DSP ULTIMATE
HELIX V TWELVE DSP MK2
HELIX V TWELVE DSP
HELIX V EIGHT DSP MK2
HELIX M SIX DSP
xtension Card:
art Demo
Version 5.03.01

The DSP PC Tool PC software has been designed from the outset to control all Audiotec Fischer stand-alone DSPs and DSP amplifiers across all brands. This makes it very easy for the user and the installer to program a wide variety of devices, as they are automatically recognized and displayed in the software with their hardware characteristics, such as the number of channels. The software has also been continuously developed and equipped with new functions right from the start. New versions of the PC tool are constantly being made available, at the latest when a new DSP product is launched on the market. On the hardware side, the devices can be divided into two periods: The period before ACO and the period after ACO. With the introduction of the ACO platform (Advanced Coprocessor), the DSPs were given completely new possibilities such as advanced measurement functions and features programmed by Audiotec Fischer that go far beyond the instruction set of the DSP chip. For example, the coprocessor supports the ISA (Input Signal Analyzer), which can perform electrical measurements on the DSP's inputs. On the software side, the introduction of the fifth generation of the DSP PC Tool can be described as a quantum leap. Functions such as TuneEQ, which adjusts selected EQ bands to a target curve, including the selected filter slope such as low-pass 12 dB/oct., were and are groundbreaking. Since the release of DSP PC Tool 5, however, the developers have not been idle, and the latest functions are again a huge step forward, both for the integration of the retrofit system into the original system and for sound design.



The AISA can be found in the extended IO menu next to the ISA. Now select the sound card and activate "Display Graph Information" or "Delay Estimation" if required

LZK ex works: The summation shows a comb filter that moves to the left for larger time differences. Initially, 1.13 ms is suggested here

Advanced ISA

In addition to the familiar Input Signal Analyzer, the AISA is now a new tool that can be used to measure and compare the signal inputs. This is useful for detecting time differences or all-pass filters in factory systems and dealing with them if necessary. Thanks to the ACO platform, the previous ISA works with the support of the coprocessor, which is "misappropriated" as a measuring system. However, there are no unlimited resources available for this double load, so that the analysis of the input signals is carried out rather gently as a sweep over the set frequency range. The new feature of the AISA is that the DSP and the PC now work together with an external sound card, which relieves the coprocessor of the computing work. The sound card is always connected to the last RCA output of the DSP or the DSP power amplifier, from which the sound card receives the signal to be analyzed. Previously set features for the relevant channel are of course not affected and are only deactivated for measurement. The DSP PC-Tool then receives the information required for signal analysis from the sound card via USB. If a pink noise signal is now played back via the source, you can enjoy an immediate measurement curve. In contrast to

the ISA, the AISA does not sample the frequencies one after the other as a sweep; the AISA measures all frequencies simultaneously, so that the measurement takes place virtually in real time. This is, of course, of great convenience for the user, but that is not all; the AISA also includes other nice features that go far beyond the display of a frequency response curve. If required, a mathematical signal analysis can be carried out, which extrapolates existing filters or time differences and delivers them as numerical values. This is described using the examples of time, all-pass and equalizer.

LZK ex works: After the alignment with 1.13 ms, there is still a remainder of 0.06 ms at high frequencies

Times ex works

To determine a factory time alignment, two channels are added together in the AISA. If there is a time difference, the sum of the two (previously smooth) frequency responses appears as a comb filter effect. This means that the frequency response curve shows characteristic dips at certain intervals. When the "Delay Estimation" function is activated, the time difference in milliseconds is calculated from the position of these dips and displayed as a number. The suggested value for one of the two channels can now be entered as the delay for checking purposes. If it was the wrong one, the time difference will be twice as large and the comb filter will shift to lower frequencies; if it was the right one, the sum curve should be almost smooth. Minor inaccuracies can then be corrected manually, after which the time difference between the two channels is perfectly corrected.

LZK ex works: With the second alignment, the time differences are perfectly equalized, and the sum is smooth

All-pass filter ex works

All-pass filters rotate the phase in a certain frequency range without changing the amplitude of the sig-

All-pass: There are no differences in the individual measurements of the channels

All-pass: In the summation, 2nd order all-passes show up as dips; here there are two of them

All-pass: If you get the wrong channel during alignment, it gets worse: There are now 4 all-passes instead of 2

All-pass: Successful alignment on the correct channel with a smooth summing curve

nal. This means that you must compare two channels again to get to the bottom of them. As with a time difference, both channels measure smoothly and inconspicuously on their own. Only when they are added together does it become apparent that the two smooth curves do not add up to a smooth curve as expected, but that the sum again has characteristic dips at one or more frequencies. In our case, there are two all-passes at approx. 240 and 1400 Hz. As with the time, the all-pass filter(s) is/are now set in the input EQ for one of the channels, and again the effects on the wrong channel become worse, while the effects on the right channel disappear and a smooth sum is obtained. There is a trick for determining the numerical values: After reversing the polarity of a channel, the original minima show up as maxima and now the numerical values can be shown with the "Display Graph Information" function, you can see center frequency and Q as numerical values, which can then be set in the all-pass EQ.

EQ ex works

If the source device delivers a distorted signal, this can be identified immediately for each channel in the AISA. It is possible to correct the unevenness manually in the input EQ, but what is new with the AISA is that automatic alignment is also available. The TuneEQ, which previously only affected the output EQ, is now also available for the inputs. The number of bands to be used can be set, and after adjusting the measurement curve to the zero line, TuneEQ does the job and suggests the equalizer settings. The compensation curve then appears next to the measurement curve and the "Set EQ" button is used to transfer the

settings to the individual bands. The measurement curve should then be smooth during a final measurement. In most cases, several input channels are provided with the same EQ; it is practical to link the input EQs and transfer the settings.

Curve characteristics

If the factory speakers are actively driven, they receive a filtered signal from the factory system. This can be a high-pass filter for small door systems, for example. As a nice treat, the AISA provides a numerical frequency response analysis that displays the existing high and low pass filters with crossover frequency and slope, as well as the curve maximum and quality. This information is displayed by activating the "Display Graph Information" function.

Dynamic Loudness Control

Another new function is DLC, a signal level-dependent loudness function that can be used both to compensate for factory loudness and to program your own dynamic sound control. In principle, DLC is a two-band shelf EQ with a low shelf for the bass and a high shelf for the treble. As with the manual shelf, the frequency and amount of boost or cut can be entered. The difference lies in the level dependency of the DLC. A quiet threshold and a loud threshold can be specified, between which the DLC continuously changes the cut or boost of the shelf EQ. 0 dB is full level, -100 dB would be inaudible, -50 dB would be very quiet, and -3 dB would be a loud signal – selected at random here. If, for example, bass loudness is to be generated, a positive gain of a few dB below 100 Hz is set for the quiet signal, while the loud signal remains untouched at 0 dB. The music then receives the set dB in the bass for quiet tones (from the quiet threshold). Conversely, speakers can be protected from too much bass at high levels by assigning negative dB values to the loud

EQ ex works: The measurement of one channel shows a boost and a dip. The curve was zeroed manually

EQ ex works: The TuneEQ presents an alignment with 6 bands from 125 Hz to 6300 Hz, which is then applied with "Set EQ"

EQ ex works: The control measurement with corrected EQ (green) shows a smooth signal

threshold. For example, a composite system can be lowered below 50 Hz when it gets loud. The whole thing works in the same way with the high shelf for the treble. This is a very practical function, for example, to attenuate the tweeter slightly at high levels and thus avoid sounds that are too harsh. The readjustment by the DLC always takes place with a certain amount of inertia, thus avoiding ugly pumping during pauses in the music. The AISA again helps with the setting. First familiarize yourself with the characteristics of the source device and determine the corresponding dB values, which are displayed in the DLC window, by taking measurements with pink noise at different volume settings. You can set whether the DLC should only apply to the high-level inputs or also to AUX sources. With the selected DLC settings, you can now see the maximum control range and, depending on the input level, the current control curve. By measuring in the AISA, everything can be verified in the measurement window, where the real curve of the input including control is measured. By measuring at different volumes and saving the respective curves, you can obtain a complete picture of the dynamic loudness. If you want to compensate for dynamic loudness ex works, the ideal results are straight curves at all volume levels.

“Display Graph Information” shows the frequency and slope of a set filter

DLC: A window opens in the AISA for Dynamic Loudness Control; our original signal shows a slight bass drop in the background

DLC: Finished dynamic loudness setting: Quiet curve (green with +12 dB in the bass, loud curve (red) with -2 dB in the treble, current measurement dotted white

Remote Tone Control

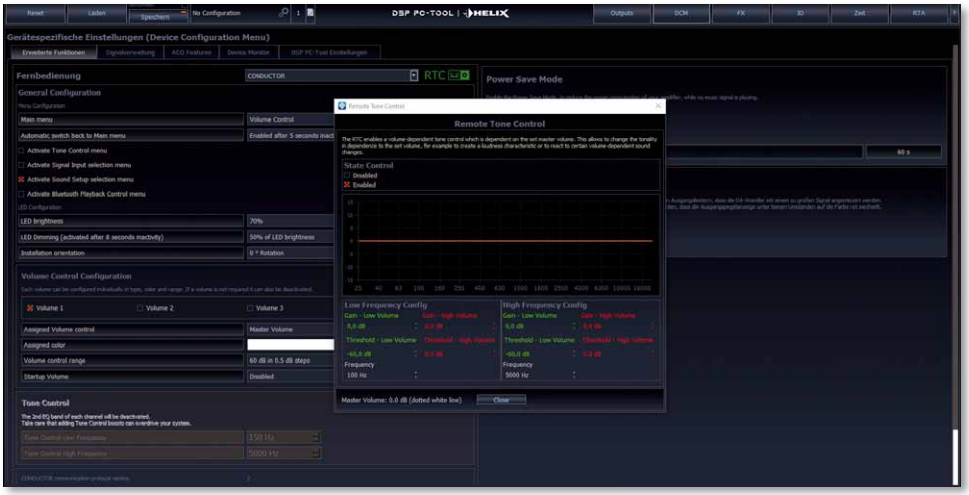
The RTC is nothing more than a DLC for remote controls from Audiotec Fischer. While the DLC refers to the high-level inputs, the RTC acts on the master volume control of a remote control. This is because if you access external sources such as Bluetooth or a streaming module, the volume control on the head unit is of no use. In such cases, an additional remote control is recommended, whose set volume then serves as a level control. This means that dynamic loudness can also be used for additional analog and digital sources.

DLC: Result check: Loud (green) with treble drop otherwise original, medium (blue) with smooth treble and approx. 6 dB more bass, quiet (red) with 12 dB more bass

Conclusion

The DSP PC-Tool is constantly adding new functions that make retrofitting DSP-controlled hi-fi systems ever more convenient. Although the new features such as the Advanced Input Signal Analyzer require an additional USB sound card, the DSP products from Audiotec Fischer are a big step towards a measurement system that is easy to use. And as always with the DSP PC-Tool, all owners of compatible DSP devices from the Brax, Helix and Match brands benefit from the updates completely free of charge.

Elmar Michels



RTC: The Remote Tone Control can be found in the DCM menu in the remote controls; when activated the symbol appears in green. The functionality is identical to DLC

Time vs all-pass

A time alignment and an all-pass filter have a similar effect when listening to music, both influence the spatial auditory impression. However, we are dealing with two completely different phenomena. What both have in common is that they only work when comparing (at least) two channels, so they always involve time or phase differences. Neither can be reversed if they are present in the source, i.e. the factory system. If you want to compensate for time differences or all-pass filters, the same time or all-pass filter must be set on the unaffected channels so that no more differences between the channels exist. However, the signal will not be as "original". An additional time delay is also not a problem, nobody should be bothered if the song starts a millisecond later – and the entire DSP generates a much greater latency anyway with its extensive computing work. And what is the difference between time and all-pass filter? Time alignment can be imagined as if the music is stopped with a stopwatch and played back after the set delay. The purpose is to make the tweeter wait for the midrange driver, for example, if the midrange driver is further away from the ear than the tweeter. The reason for this is that the sound is so slow that time differences can be perceived by the ear. It is important that the time delay is the same for all frequencies, i.e. bass and treble are delayed by the same amount of time. This is different with an all-pass filter. Like an EQ, an all-pass filter has a center frequency and a Q factor. An all-pass filter rotates the phase of the signal, whereby in the audio range the phase is 0° (no phase rotation) at very low frequencies and 180° at 1st order and 360° at 2nd order are achieved at very high frequencies. The phase angle is therefore dependent on the frequency, which is the main difference to time alignment. The effects are similar at high frequencies; for example, an all-pass filter (2nd order, 1 kHz) corresponds to a phase shift of 180° for a 1 kHz sine wave (period duration 360° = 1/1000 s) with a time delay of 1/2000 s, i.e. 0.5 milliseconds, and only 0.05 milliseconds at 10 kHz. This frequency dependency is the "problem" of the all-pass filter; it cannot replace a time alignment. Incidentally, reversing the polarity of a tweeter, which then plays with a 180° phase shift, has the same effect. The real reason for all-pass filters in factory systems is probably the lower cost. While time alignment is only possible digitally with a DSP and buffering, an all-pass filter can also be generated analog, if necessary, even passively with two coils and two capacitors for a 2nd order all-pass filter. The DSP PC Tool contains all-pass filters in the range of input and output EQs, also disguised as phase shifters in the time setting area.

Musway M10 – 10-channel amplifier with 14-channel DSP

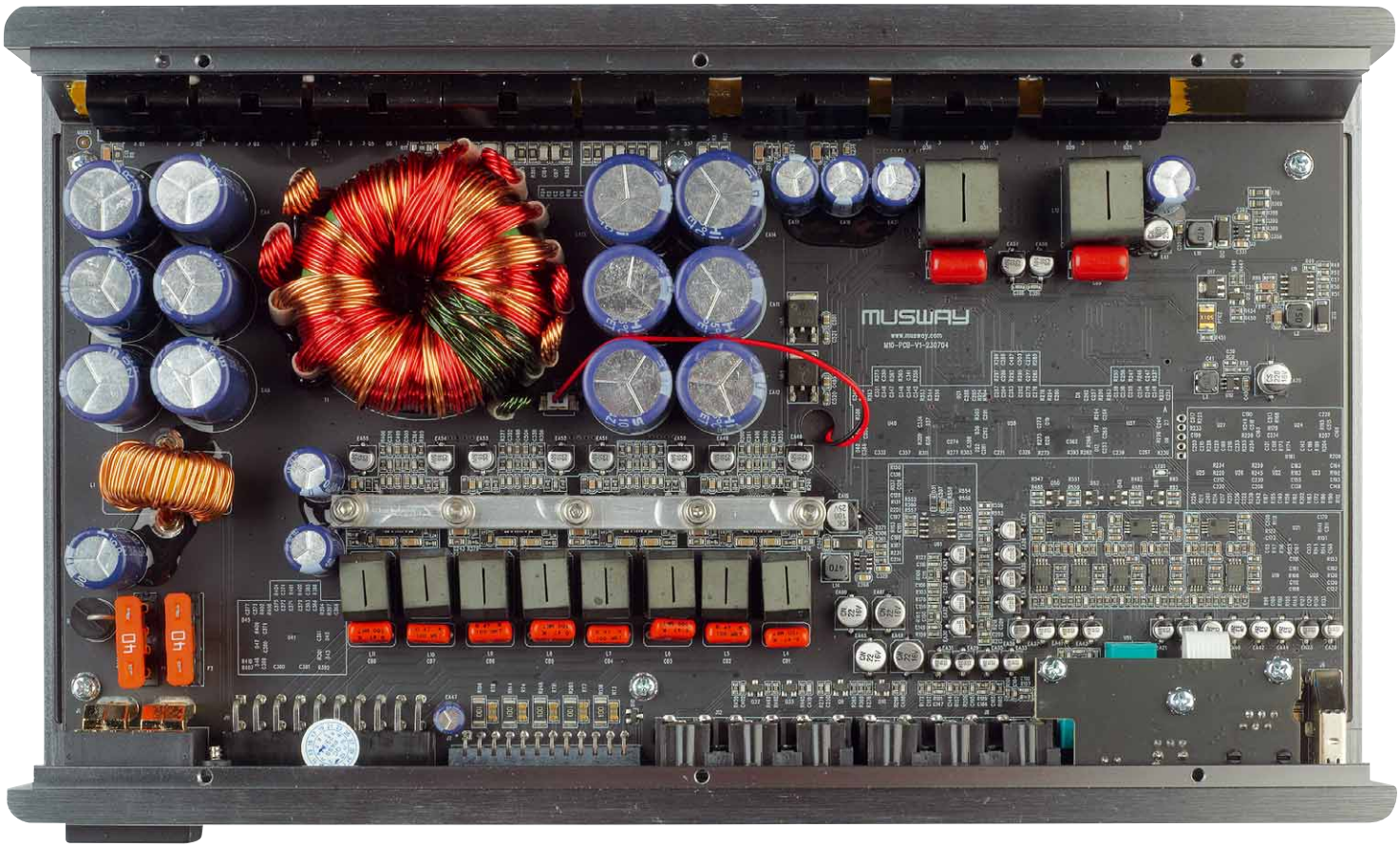
Powerful sound tool

After the M12, which caused a sensation in 2022, Musway is now launching the M10, a slightly different concept designed to supply even more extensive car audio systems with a single amplifier.


MUSWAY
HIGH QUALITY SOUND SYSTEM

RCA sockets for six inputs and four outputs, high level, and speakers run via Molex

Musway has always excelled with advanced DSP concepts since the introduction of the brand in Europe. The amplifiers are compact and work with many factory systems, so they are also popular as sound upgrades in modern vehicles. In addition to the stand-alone signal processors DSP68 and Tune12, there are various DSP amplifiers, including the small M6, which is now available in its third generation, and the previous flagship, the M12, with 12 amplifier channels and 16-channel DSP. The M10 is a new model with ten amplifier channels, which competes with the M12, especially as they are offered at the same price. Both have similar features and DSP functionality, except the M10 „only“ has 14 DSP channels, i.e., four processed outputs for expanding the system. This is perfectly acceptable, as the main difference between the M12 and M10 is the division of the amplifier channels. While the M12 contains twelve equal amplifier paths, the M10 comes with eight small channels and two „high-power“ channels with a whopping amount of extra power. The M10 is, therefore, predestined to drive the entire audio system, including the



The eight small channels reside under the powerful power supply with XXL transformer. The larger coils at the top right belong to the large channels

The PC software shows all essential functionality in the main window

subwoofers. If, for example, a system with an active three-way front system, center, rear system, and woofers is required – there is no problem with the M10. Ten speaker-level inputs are available for connection to the factory radio, which can handle up to 24 volts of input voltage and are, therefore, also suitable for factory packages with amplifiers. Musway even goes one step further for the bass channels with a maximum input voltage of 32 volts. The bass channels also have their own gain control, and there are two more for the small channels and the AUX inputs.

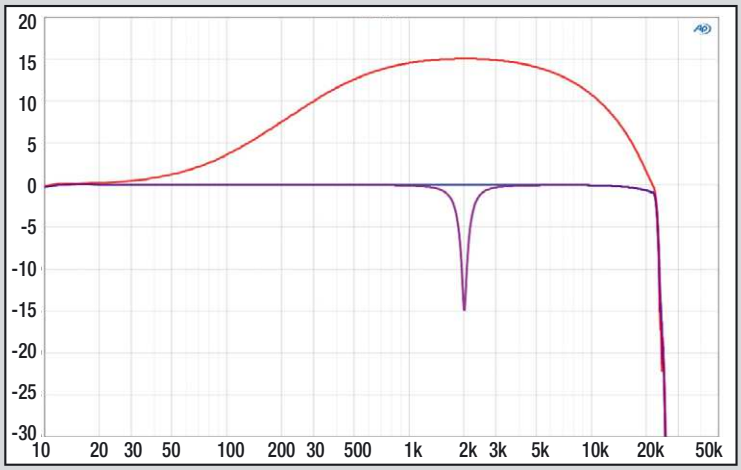
There is also an optical digital input and an interface for accessories. Various boxes, such as the DRC display remote control, can be docked here, but Bluetooth retrofitting is also likely to be very popular. There are two Bluetooth modules for this, the BTA2 and the BT-HD. The BTA2 is recommended for users who want to program the DSP wirelessly and have audio streaming on board. The BT-HD, however, does without the programming function but includes HiRes audio streaming, including aptX HD and up to 48 kHz/24 bit with Bluetooth 5.0 specification. In theory, this means better quality than with a CD. The BT-HD is, therefore, ideal for users of streaming services such as Tidal or Qobuz, which offer high-resolution music.

The housing of the M10 is made entirely of aluminum; it is very nice that two windows on the front of the housing are sufficient for reliable cooling, and there is no fan. Many power-carrying components are cooled via the housing cover, and this also gets a little warm during operation, so some space should be provided here when installing. However, the transistors of the power supply are located at the rear of the housing and are fastened classically with clips; the same applies to the end transistors of the high-power channels. The eight small channels, on the other hand, rely on two-channel amplifier ICs, as is standard in multi-channel amplifiers. A fivefold screwed heatsink provides the necessary contact

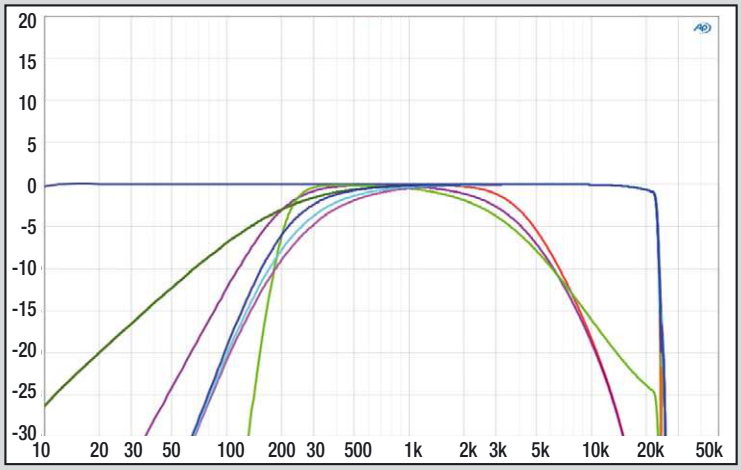
Software

All Musway DSPs can be programmed using PC desktop software or an Android app, the latter in conjunction with the optional BTA2 accessory. Except for routing and minor details, all relevant settings can be found in one window. When routing, it is essential to note that it is not enough to meter the inputs in the routing matrix; the correct checkmark(s) must also be set in the main window. There are bandpass crossovers for all channels up to 48 dB/octave in three characteristics. Programming the crossovers is a bit of a hassle, e.g., with odd orders for Linkwitz or varying attenuation at the set crossover frequency. However, the crossovers work in principle. The EQ bands can be set fully parametrically, and there is also time alignment of the outputs in 0.02 ms or 7 mm steps. Conveniently, the time or path is displayed precisely and in plain text, without any frills such as coarse and fine adjustment. The frequency window clearly shows what is happening, and the EQs are also easy to operate (also via the keyboard). The grouping of channels is well solved; a bridge circuit can also be displayed, and up to four channels can be combined into a subwoofer group, which is then recognized by the optional remote control. The extras are few, but they are important. We have a power-saving cut-off for Can vehicles, a setting for switching through vehicle sounds, and an auto-mute function to prevent crackling. Furthermore, the M12 offers an input pin for the reverse gear, which feeds in the vehicle sounds. This means that the Musway software is not the most complete on the market, but in most cases, it enables problem-free operation. A big plus point is the Musway „Tunest“ app, which, in conjunction with the BTS2, allows complete DSP programming and enables remote control functions such as master and sublevel, source selection, and source selection.

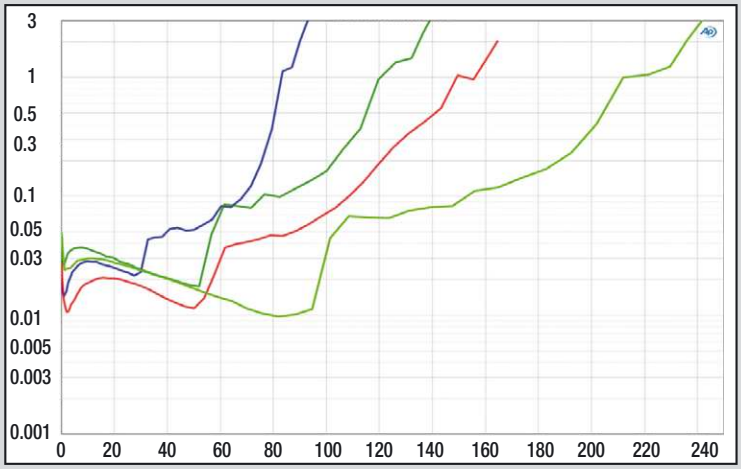
CAR&HIFI Laboratory



The 31 EQs per channel can be adjusted over a wide quality range with a gain of -15 to +15 dB



Due to the sample rate, the cut-off point is 22 kHz. The crossovers are programmed somewhat carelessly. Shown here: High-pass at 200 Hz (But, Bes, Lin) and low-pass at 3 kHz



Small channels at 4/2 ohms: blue, red. Large channels at 4/2 ohms: dark green, light green

The remote control regulates the master and sub volume, subwoofer groups, and the mute function

pressure for reliable cooling. The M10 relies on a classic transformer solution for the power supply, which may cost some efficiency, but performance is not a problem. Musway has hidden the digital section on the underside of the board on the heat sink side. Four mounting holes of the typical size can be seen, and based on our experience with the M12, a 32-bit ARM processor, an ADAU1452 DSP or a related Sigma processor from Analog Devices, and two PCM3168 audio codecs with AD and DA converters are likely to be hidden underneath.

Master and sub levels in the Android app

EQ settings in the Android app

Measurements and sound

We first notice that the M10 works with a sampling rate of 48 kHz. This can be seen from the fact that the frequency response is low-pass filtered at 22 kHz. Nothing else was to be expected given the 14 DSP channels, which already overload the DSP quite a bit, so a double sampling rate (which requires double the computing power) is not an option here. We liked the time alignment, which works in 7-millimeter steps (and displays them accurately). Only the crossovers are a bit of a mess: They do deliver steeper filter slopes with increasing steepness, but these are only remotely related to the set frequency. This is ok in practice, where you do not have to calibrate according to a numerical value anyway, as you can already find a good shape for the curve. The EQs, on the other hand, work perfectly according to the instructions. Let's move on to the M10's favorite discipline; fortunately, this is its performance! Even on the small channels 1 - 8, the M10 increases its output compared to the M12, namely 83 watts into 4 ohms and a whopping 157 watts into two ohms. Channels 9 and 10, with their thick MOSFETs, conjure up 122 watts into 4 ohms and 222 watts into 2 ohms.

All channels can also be bridged so that a subwoofer with 444 watts can be driven on the high-power channels. And as if that wasn't impressive enough, the M10 comes into its own when all channels are loaded. With 10 x 2-ohm load resistors, the power output adds up to an impressive

One of three Bluetooth sources: The BT-HD can stream audio in HiRes quality

Specifications

Inputs
- 10-channel high-level with autosense
- 6-channel RCA, 2 x gain control
- Sensitivity 6 V (RCA), 24 V (high level), 32 V (high level CH9+10)
- 1 x RCA stereo, gain control
- 1 x digital S/PDIF optical
- 1 x digital bluetooth

Outputs
- 4-channel RCA
- Remote-out

DSP-channels
- 14

DSP software (PC V3.4 in test)

Equalizer

Outputs
- parametric, 31 band per channel, +15 – -15 dB
- 20 – 20k Hz, 1 Hz steps, Q 0.1 – 10

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

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

Outputs
- 0 – 602 cm (17.7 ms), 1024 samples
- Level steps 0.1 dB
- Phase 0, 180°, mute

Features
- 6 presets
- Inputs and outputs arbitrarily routable
- Start-stop capability up to 7.1 V
- EPS (Error Protection System) for diagnostic function
- Signal dependent switching to Bluetooth or S/PDIF
- Signal dependent switching to high-level for vehicle tones
- Either high or low-level inputs

Optional accessories
- Bluetooth dongle BTS (streaming)
- Bluetooth dongle BTS-HD (hi-res streaming)
- Bluetooth dongle BTA2 (streaming + app control)
- Remote controller DRC1 (volume, bass level, sources, setups)

1166 watts. Sound-wise, the M10 leaves no doubt about its performance. It sounds exceptionally stately and powerful, and there is never any doubt whether the amplifier has a grip on the speakers. The „small“ channels are more than sufficient to drive even more demanding loudspeakers or composite systems. There are always lovely dynamic notes, and the M10 doesn‘t miss a beat in the bass, either. The tonality is pleasing and relatively neutral so we can actually only find good things to say about the entire M10 sound.

Conclusion

With the M10, Musway has created a powerful and universally applicable sound tool. Anyone who can cope with the 8+2 channel configuration should shortlist the M10.

Elmar Michels

Specifications

Channels	10
Power 4 ohms W	8 x 83 + 2 x 122
Power 2 ohms W	8 x 157 + 2 x 222
Power 1 ohms W	–
Bridged power W	4 x 314 + 1 x 444
System power W	1166
Sensitivity max. mV	390
Sensitivity min. V	3,0
THD+N (<22 kHz) 5W	0,02/0,033
THD+N (<22 kHz) half power	0,051/0,071
Signal-to-noise ratio dB(A)	89/84
Damping factor 20 Hz	128
Damping factor 80 Hz	128
Damping factor 400 Hz	124
Damping factor 1 kHz	109
Damping factor 8 kHz	12
Damping factor 16 kHz	3

Features

Low pass	20 – 20k Hz
High pass	20 – 20k Hz
Band pass	20 – 20k Hz
Bass boost	-12 – 12 dB/20 – 20k Hz
Subsonic filter	via HP
Phase shift	via DSP
High-level inputs	•
Auto turn-on	•, DC
Cinchausgänge	•, 4CH, processed
Start/stop capable	- (7,6 V)
Dimensions (L x W x H in mm)	280 x 166 x 46
Others	14-channel DSP

Musway M10

Price	1200 Euro
Contact	Audio Design, Germany
Internet	www.musway.de/english/

Rating

Sound	40 %	★★★★★
Bass	8 %	★★★★★
Neutrality	8 %	★★★★★
Transparency	8 %	★★★★☆
Spatial imaging	8 %	★★★★★
Dynamics	8 %	★★★★★
Lab	35 %	★★★★½
Power	20 %	★★★★★
Damping factor	5 %	★☆☆☆☆
Signal-to-noise ratio	5 %	★★★★☆
Noise	5 %	★★★★☆
Practice	25 %	★★★★★
Features	15 %	★★★★★
Build quality electronics	5 %	★★★★★
Build quality mechanics	5 %	★★★★★

Absolute Top Class

★★★★★

CAR&HiFi INTERNATIONAL Germany 1/24

Price/performance: very good

"Powerful performance and versatile in use."

BLAUPUNKT

BLAUPUNKT AUTORADIO

RETRO CAR RADIO

THE LEGENDS ARE BACK!

FRANKFURT RCM 82 DAB

90s RETRO (from 1992)

New edition of the **90s** cult radio **FRANKFURT RCM 82** (from 1992)

High-End Codem IV RDS Tuner, DAB+, Bluetooth, 2× USB, microSD, Aux-In, iPod support, 2× 14-band equalizer, 4× 50 watts, 4-Channel Preamp-Out, Sub-Out, Variocolour (4,096 colours), short body (low installation depth)

BREMEN SQR 46 DAB

80s RETRO (from 1986)

New edition of the legendary **80s** **BREMEN SQR 46** (from 1986)

High-End Codem IV RDS Tuner, DAB+, Bluetooth, 2× USB, microSD, Aux-In, iPod support, 10-band equalizer, 4× 50 watts, 4-Channel Preamp-Out, Sub-Out, Variocolour (4,096 colours), short body (low installation depth)

HAMBURG SQM 23 DAB

80s RETRO (from 1983)

New edition of the **80s** classic **HAMBURG SQM 23** (from 1983)

High-End Codem IV RDS Tuner, DAB+, Bluetooth, 2× USB, iPod support, Sound Presets, 4× 50 watts, 4-Channel Preamp-Out, Sub-Out, Multicolour LCD, short body (low installation depth)

The Blaupunkt "**Retro Car Radio**" line revives old cult radios & speakers. These impress with the original look, but have many new features. The look of the retro line fits perfectly into vehicles from the 80s and 90s.

All information at: www.blaupunkt-automotive.de

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Blaupunkt Competence Center Car Multimedia

Enjoy it.

HX10 Evo – 25-centimeter subwoofer from Audio System

Bass at its finest

With the HX 10 Evo, Audio System is expanding its sound-trimmed HX series. Let's explore what the new Evo line offers.

SOUND AWARD
Top Class
CAR & HiFi
INTERNATIONAL 1/24


GERMANY
AUDIO SYSTEM
HX EVO
german sound

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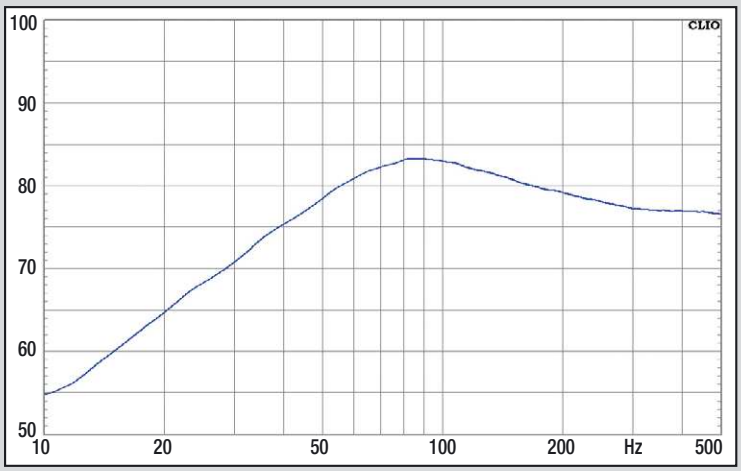


The HX 10 Evo runs in a sealed box with 48 Hz in-box resonance and 83 dB characteristic SPL

Audio Systems HX Evo subwoofers are available in the popular 8, 10, and 12-inch sizes; we have the medium-sized HX 10 Evo for testing in the editorial office. Within the Audio System subwoofer range, the HX Evo lies between the X and R series. While the R woofers are Audio System's universal subwoofers, the X woofers tend to be slightly more powerful. Our HX 10 Evo is the successor to the HX 10 SQ, and although the Sound Quality has been dropped from the name, there is plenty of SQ in the HX 10 Evo. The woofer looks simple; it doesn't flaunt a finger-thick cone or a giant triple magnet. Instead, it is well-proportioned and athletic. A sound-quality woofer is about more than just using the most massive components but rather about perfectly matching the individual parts. Therefore, the key data of the HX 10 SQ may appear unspectacular at first glance. Two 15-centimeter ferrite rings, 6.5 kilograms of fighting weight, a filigree aluminum basket – nothing that hasn't been seen before. The cone is typical for Audio System: lightly pressed from paper and coated with a waterproof plastic coating, it is stable and lightweight. For even more strength and as a visual highlight, there is a dust cap with a glass fiber mat. The spider is not of the cheap variety, Audio System relies on a mixture of cotton fibers and Nomex, which is reliably stable in the long term. The voice coil is designed as a 2 x 2 ohm double coil with a diameter of 2 inches. The motor has no pole piece ventilation, but the voice coil former is perforated to allow air to flow when the cone is deflected.

Measurements and Sound

The voice coil is wound so high that it has a linear excursion of 13 millimeters. Its moderate diameter contributes to the fact that the HX 10 Evo has a moving mass of only 118 grams, which is light for a 10-inch subwoofer. The free-air resonance is in the lower mid-range and, together with the low Q, allows the woofer to run in sealed and vented enclosures. In the spirit of an SQ woofer, we prefer the sealed box and take a generous volume of 30 liters, which acknowledges this measure with a low In-box Q of 0.6. The

Machined top plates and a double ferrite drive the two-inch voice coil

The HX 10 Evo relies on an internal ventilation system, so there is no pole piece ventilation

woofer would also run at half the volume and even sound a little fatter – every buyer of a single chassis has this choice. In any case, the sound of our speaker is convincing. The HX sounds mega clean and delivers powder-dry kicks when the bass drum is kicked hard. It has no problems following the music, even with rapid bass runs. There's plenty of low-end, always very clean and without booming. We don't get scared at the maximum level, but the ten-inch speaker is always sufficient for proper music listening. If you want it louder, Audio System has plenty of alternatives.

Conclusion

The HX 10 Evo is a very accomplished woofer that produces first-class sound without forgetting to produce bass. It is a beautiful ten-incher that is also affordable at EUR 275.

Elmar Michels

Specifications

Basket diameter	25,8 cm
Mounting diameter	23,6 cm
Mounting depth	14,5 cm
Magnet diameter	15,0 cm
Weight	6,5 cm
Nominal impedance	2 x 2 Ohm
DC resistance Rdc	4,22 Ohm
Voice coil inductance Le	2,94 mH
Voice coil diameter	50 mm
Diaphragm area	308 cm²
Resonant frequency fs	37 Hz
Mechanical quality Qms	4,94
Electrical quality Qes	0,50
Total quality Qts	0,45
Equivalent volume Vas	20,7 l
Moving mass Mms	118 g
Rms	5,57 kg/s
Cms	0,16 mm/N
B x l	15,30 Tm
Sound pressure 1 W, 1 m	83 dB
Recommended power	200 – 400 W
Test enclosure	g 30 l
Port dimensions (d x l)	–

Audio System HX10 Evo

Price	275 Euro
Contact	Audio System, Germany
Internet	www.audio-system.de

Rating

Sound	50 %	★★★★★
Bass	12,5 %	★★★★★
Pressure	12,5 %	★★★★★
Purity	12,5 %	★★★★★
Dynamics	12,5 %	★★★★★
Lab	30 %	★★★½☆
Frequency response	10 %	★★★★★
Efficiency	10 %	★★☆☆☆
Maximum level	10 %	★★★★☆
Processing	20 %	★★★★★

Top Class

★★★★½

CAR & HiFi INTERNATIONAL Germany 1/24

Price/performance: very good

" Well-balanced subwoofer for sound enthusiasts."

Musway MG8 + MG10 + MG12 – New top woofers in a triple test

Sound Quality Subwoofer

Musway surprises us with a brand-new subwoofer series at the top of its product range. We test what the MG subwoofers are all about.


MUSWAY
BEST PRODUCT
Upper Class
CAR&HiFi
INTERNATIONAL 1/24
SOUND AWARD
Top Class
CAR&HiFi
INTERNATIONAL 1/24

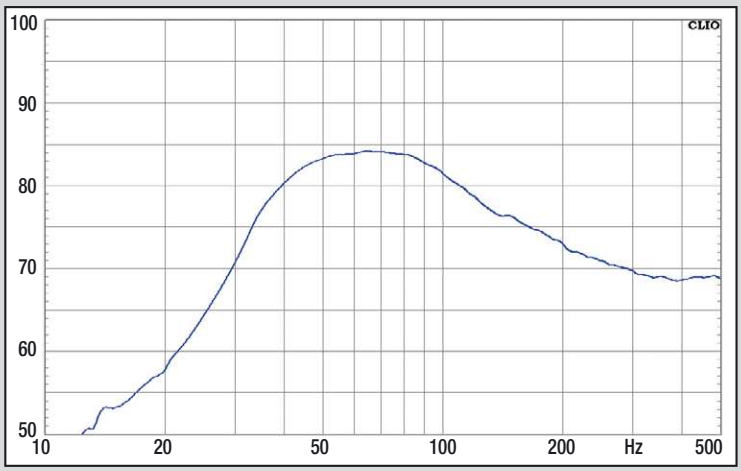
Musway was on the radar for their digital power amplifiers or vehicle-specific speakers. However, one would have looked for high-end subwoofers elsewhere. So far, the chassis range has consisted of flat woofers and a handy 6“ woofer, so it is not necessarily the material for hard-boiled bass freaks. However, Musway has already set an exclamation mark with the MG loudspeaker series; the component kits with aluminum cones and frames have made a lasting impression. Now Musway is flanking the MG loudspeakers with the MG subwoofers, which are intended to be the perfect playing partners: Power and musicality at the same time. And the three models, MG8, MG10, and MG12, look powerful straight away. The die-cast aluminum baskets are newly developed and not off-the-peg; there is no spilling the beans here. Massive struts and large

The protective grilles fulfill their purpose and look good

There is plenty of space under the double spider for ventilation and cone travel

ventilation windows look indestructible, as do the thick cones made of air-dried paper. The enclosed protective grilles are also very sturdy and create a unique look. The cones are surrounded by high-profile foam surrounds that are narrow but high to allow long cone travel without stealing too much cone area. A double spider that controls the moving masses performs the lower guide work. The motor seems oversized on all three models. Musway has yet to skim here and gave the MG woofers fat double ferrite magnets. Even the eight-inch model‘s back plate and pole piece are so massive that you think more of SPL than sound quality. The top plates of the MG10 and MG12 are beautifully machi-

CAR&HIFI Laboratory



The MG8 plays well below 50 Hz in 17.5 liters of bass reflex and achieves 84 dB/1 W

The MG woofers have been fitted with new die-cast baskets and individually dimensioned motors

ned and faced; only the MG8 must make do with a stamped pole plate. The voice coil diameters are nicely staggered according to size; at 2, 2.5 and 3 inches, the voice coils are very generous, namely one to two sizes more than with ordinary woofers.

Measurements and sound

The voice coils are large in diameter and provide plenty of excursion reserves; we measured 20 and 40 millimeters of mechanical excursion up to the stop and 14 millimeters of linear excursion, i.e., voice coil overhang. The measurement of the Thiele-Small parameters reveals, above all, stiff suspensions and correspondingly small equivalent volumes. The fat magnets ensure high magnetic flux densities in the air gap, but the dream of monster bass from tiny cabinets is still shattered due to the high resonance frequencies and Qs. This does not mean the MG woofers need large cabinets; they are not space-saving woo-

Specifications

Basket diameter	22,1 cm
Mounting diameter	18,5 cm
Mounting depth	13,8 cm
Magnet diameter	15,0 cm
Weight	5,6 cm
Nominal impedance	2 x 2 Ohm
DC resistance Rdc	3,70 Ohm
Voice coil inductance Le	2,08 mH
Voice coil diameter	50 mm
Diaphragm area	255 cm²
Resonant frequency fs	58 Hz
Mechanical quality Qms	9,28
Electrical quality Qes	0,88
Total quality Qts	0,80
Equivalent volume Vas	7,0 l
Moving mass Mms	97 g
Rms	3,82 kg/s
Cms	0,08 mm/N
B x l	12,21 Tm
Sound pressure 1 W, 1 m	84 dB
Recommended power	200 – 400 W
Test enclosure	BR 17,5 l
Port dimensions (d x l)	7 x 22 cm

Musway MG8

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

Rating

Sound	50 %	★★★★★
Bass	12,5 %	★★★★★
Pressure	12,5 %	★★★★★
Purity	12,5 %	★★★★★
Dynamics	12,5 %	★★★★★
Lab	30 %	★★★½☆
Frequency response	10 %	★★★★★
Efficiency	10 %	★★☆☆☆
Maximum level	10 %	★★★★☆
Processing	20 %	★★★★★

Upper Class

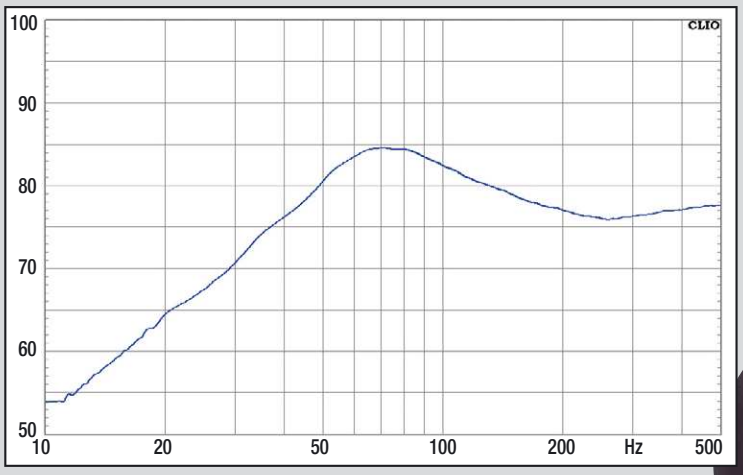
★★★★½

CAR&HIFI INTERNATIONAL Germany 1/24

Price/performance: very good

„ Power and sound – the MG woofers offer both.“

CAR&HIFI Laboratory



The MG12, with a good 30 liters of closed volume, offers a great compromise between space usage and bass yield

The MG woofers are equipped with 2 x 2 ohm double voice coils

fers anyway due to their mounting depths. MG10 and MG12 work best in closed or vented boxes. We put the MG12 in a 32-liter closed cabinet, where it feels right at home with 45 Hz resonance and 0.8 In-box Q. The MG10 works well in a „standard cabinet“ (30-liter bass reflex, port 10 x 30 cm), but it also works well in a 19-liter closed cabinet. We have only given the small MG8 an adequate reflex cabinet, precisely 17.5 liters. Incidentally, this makes the MG woofers a prime example of the rule of thumb that the bass reflex volume of the smaller woofer is roughly equal to the closed volume of the one size larger. The MG8 then conjures up a picture-book frequency response right down to the low bass, and that is exactly how it sounds. The MG8 is much larger than the visual impression suggests, but its sound is fat and powerful. Thanks to its solid construction and long excursion, even the small MG can produce high SPLs. And just as it should be for a small

Specifications

Basket diameter	27,6 cm
Mounting diameter	14,0 cm
Mounting depth	16,2 cm
Magnet diameter	15,5 cm
Weight	7,3 cm
Nominal impedance	2 x 2 Ohm
DC resistance Rdc	3,64 Ohm
Voice coil inductance Le	2,29 mH
Voice coil diameter	64 mm
Diaphragm area	333 cm²
Resonant frequency fs	39 Hz
Mechanical quality Qms	8,20
Electrical quality Qes	0,76
Total quality Qts	0,70
Equivalent volume Vas	16,9 l
Moving mass Mms	153 g
Rms	4,58 kg/s
Cms	0,11 mm/N
B x l	13,40 Tm
Sound pressure 1 W, 1 m	84 dB
Recommended power	300 – 500 W
Test enclosure	g 19 l
Port dimensions (d x l)	–

Musway MG10

Price	300 Euro
Contact	Audio Design, Germany
Internet	www.musway.de

Rating

Sound	50 %	★★★★★
Bass	12,5 %	★★★★★
Pressure	12,5 %	★★★★★
Purity	12,5 %	★★★★★
Dynamics	12,5 %	★★★★★
Lab	30 %	★★★½☆
Frequency response	10 %	★★★★★
Efficiency	10 %	★★☆☆☆
Maximum level	10 %	★★★★☆
Processing	20 %	★★★★★

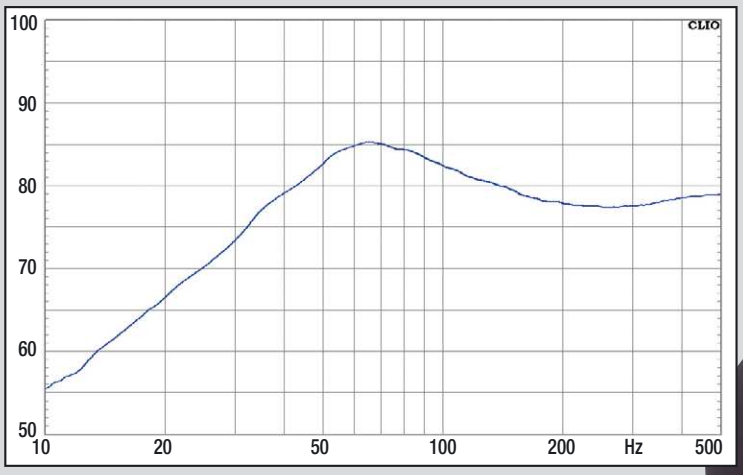
Top Class

★★★★½

CAR&HiFi INTERNATIONAL Germany 1/24

Price/performance: very good

„ Power and sound – the MG woofers offer both.“



The amplitude response of the MG10 looks lean but works excellent in the car

The MG 12 proudly features a 3 inch voice coil

woofer, the MG8 also plays exceptionally precisely. When switching to the closed MG10, we are torn as to which sounds crisper and pushes more. Both play excellently and will make SQ fans happy, that is for sure. Our decision falls in favor of the MG10, which goes a little more confidently and, at the same time, sounds drier than the small reflex woofer. But when the MG12 plays, it becomes clear that there is more to it regarding pressure and SPL. Without sounding impure, the MG12's cone area adds another shovelful of SPL. Spontaneously, you could say that the MG10 is the golden middle, but everyone must decide for themselves at their Musway dealer.

Conclusion

Musway's MG subwoofers are really well-made. The prices of 250 to 350 EUR are reasonable for the quality impression and the performance.

Elmar Michels

Specifications

Basket diameter	32,4 cm
Mounting diameter	28,5 cm
Mounting depth	18,1 cm
Magnet diameter	17,0 cm
Weight	9,3 cm
Nominal impedance	2 x 2 Ohm
DC resistance Rdc	3,70 Ohm
Voice coil inductance Le	2,52 mH
Voice coil diameter	76 mm
Diaphragm area	491 cm²
Resonant frequency fs	33 Hz
Mechanical quality Qms	7,74
Electrical quality Qes	0,65
Total quality Qts	0,60
Equivalent volume Vas	34,5 l
Moving mass Mms	228 g
Rms	6,10 kg/s
Cms	0,10 mm/N
B x l	16,41 Tm
Sound pressure 1 W, 1 m	85 dB
Recommended power	300 – 700 W
Test enclosure	g 31 l
Port dimensions (d x l)	–

Musway MG12

Price	350 Euro
Contact	Audio Design, Germany
Internet	www.musway.de

Rating

Sound	50 %	★★★★★
Bass	12,5 %	★★★★★
Pressure	12,5 %	★★★★★
Purity	12,5 %	★★★★★
Dynamics	12,5 %	★★★★★
Lab	30 %	★★★½☆
Frequency response	10 %	★★★★★
Efficiency	10 %	★★☆☆☆
Maximum level	10 %	★★★★☆
Processing	20 %	★★★★★

Top Class

★★★★½

CAR&HIFI INTERNATIONAL Germany 1/24

Price/performance: very good

„ Power and sound – the MG woofers offer both.“

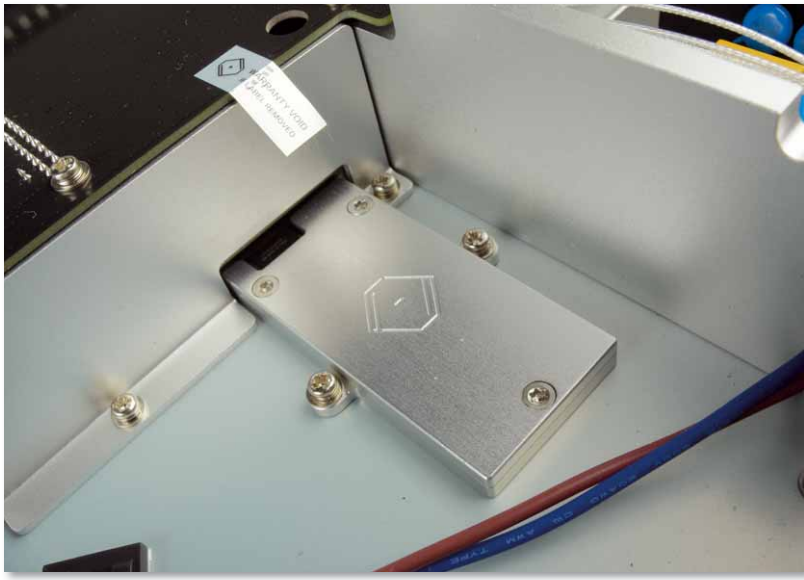
High-end audio streaming with Silent Angel Munich MU, Bonn NX and Genesis GX

Streaming 2.0

Music streaming in the car is usually limited to playing music from a smartphone or from Internet sources such as Spotify & Co. Here, however, we are dealing with a high-end version with components that are uncompromisingly tailored for sound and the best possible sources.


MUNICH
GENESIS
BONN
GX

The power supply board with an encapsulated power supply



The Munich MU offers a slot for an optional SSD, which is mounted under the aluminum lid using thermal paste

With the triumph of the smartphone, our beloved CDs suddenly looked damn old. The quality was ok, but today no one wants to be a disc jockey and have to constantly think about what music is on board. The headunit as a high-quality audio source has also lost its importance, the aftermarket only offers a few hand-picked, sound-oriented head units, and only very few head units offer digital outputs. After all, today's head units offer great ease of use even when streaming from a smartphone and, at least in Europe, terrestrial radio DAB+ is very popular. The actually promising concept of the car PC as a control center for a wide variety of music sources also failed to catch on. The real hardcore audiophiles who are looking for music sources with uncompromising sound quality have fallen by the wayside.

These solutions are available for the living room at home in the form of music servers, streamers and a whole range of audiophile helpers, where hi-res music can also be enjoyed unhindered. The concept is a control center that manages a wide variety of sources, be it services like Tidal or Qobuz, but also network storage or smartphones. Such music streamers are basically "just" computers, except that they are fundamentally optimized for music playback. You would love to take something like this into your car, but the power supply usually causes problems because the power in the car doesn't come from the socket.

Home audio with 12 volts

This is where the components from the Taiwanese company Silent Angel come into play, which can (partly) be supplied with 12 volts DC. This applies to our Munich MU, Bonn NX and Genesis GX components, so they can be installed in any vehicle. We are dealing with a streamer (MU), a network switch (NX) and a word clock (GX), which together form a networked high-end system that plays music from all possible sources and all possible formats. At a total of over 9,000 euros, this system will be overpriced for most mere mortals, after all, the rest of the hi-fi system with amplifiers, speakers, subwoofers and then of course a DSP is still missing. In addition, very few car drivers are likely to want to

All units can be powered with AC or 12 V DC

The Munich MU is a bit thicker than the two other units

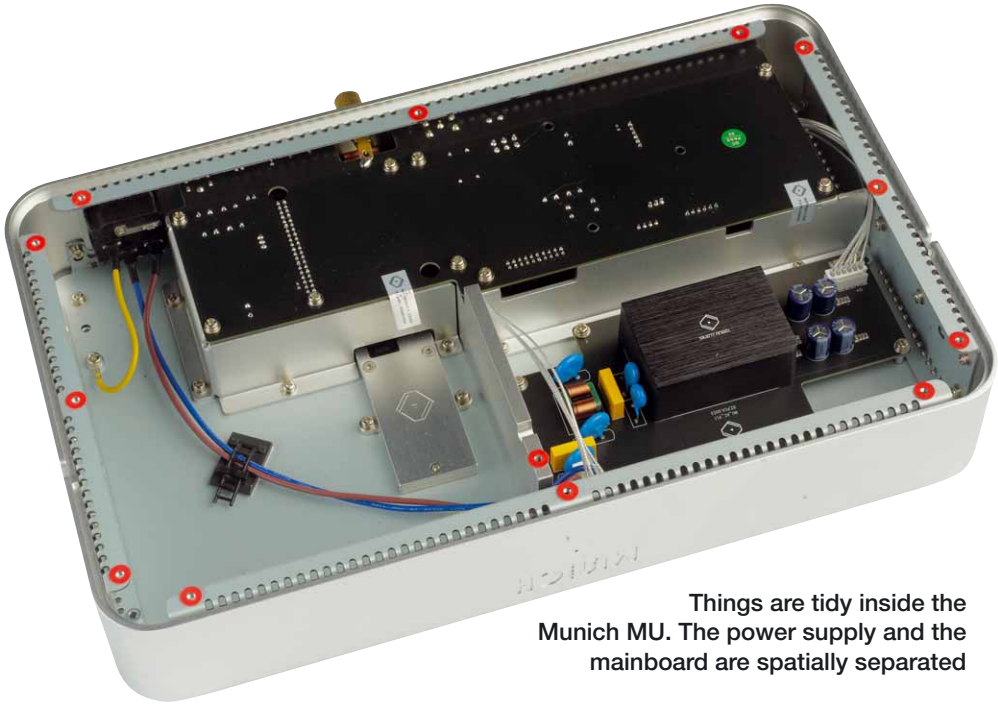
install a complete network in the car – but for these, Silent Angel offers components such as music servers that work independently with the smartphone.

High end in the motorhome

However, our three-piece combination MU, NX and GX is the absolute top line in Silent Angel's range, and if you are the proud owner of a larger motorhome or even a luxury variant, the whole thing looks different. Today, a decent SIM card router belongs in every RV, because who wants to do without comfortable and fast internet that supplies televisions, tablets and smartphones without each individual having to worry about it. The internet and network are already on board, and the network streamer Munich MU is fully in its element. Simply connect to the router using an ethernet cable, connect your smartphone to the WiFi and stream the music using the app.

Munich MU

The MU is the heart of music streaming, it controls playback from all sources. Local storage on the network or directly from USB can be connected, although storage media with music on it can be used in the same way as audio USB from a computer or smartphone. With the-



Things are tidy inside the Munich MU. The power supply and the mainboard are spatially separated

Silent Audio Munich MU

Price	**2,500 Euro**
Distribution	Silent Angel
Internet	www.silentangel.com

Specifications

Music server

Dimensions 360 x 220 x 73 mm

Inputs
- 1 x LAN
- 1 x USB Audio
- 3 x USB memory

Outputs
- 1 x digital S/PDIF coaxial
- 1 x digital I2S
- 1 x digital AES/EBU
- analogue XLR stereo
- analogue RCA stereo

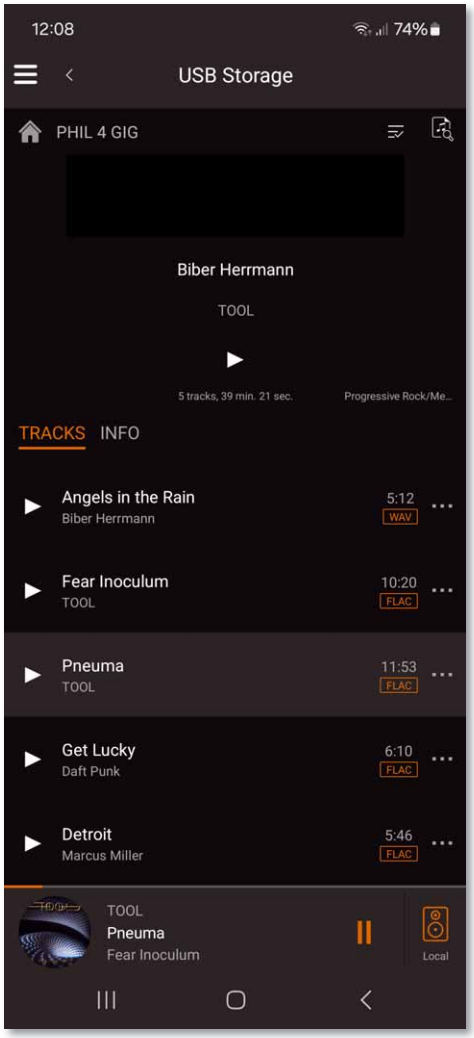
Interfaces
- Word Clock GX
- SA Link
- PCIe bus for optional internal SSD

Control
- VitOS Orbiter app for Android and IOS

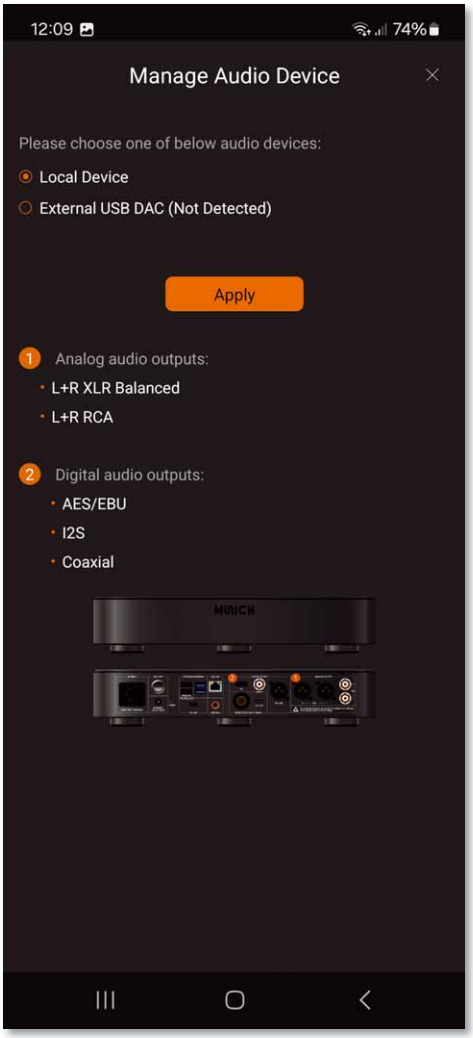
Sources
- Network (SSD), Internet (Spotify, Tidal, Qobuz, MQA, dlna, Internet radio, etc.)
- internal SSD, USB storage, computer/smartphone

Formats
- FLAC, WAV, DSD, AAC, M4A, MP3, OGG, ALAC, AIFF, CUE, WMA, APE, WAV64

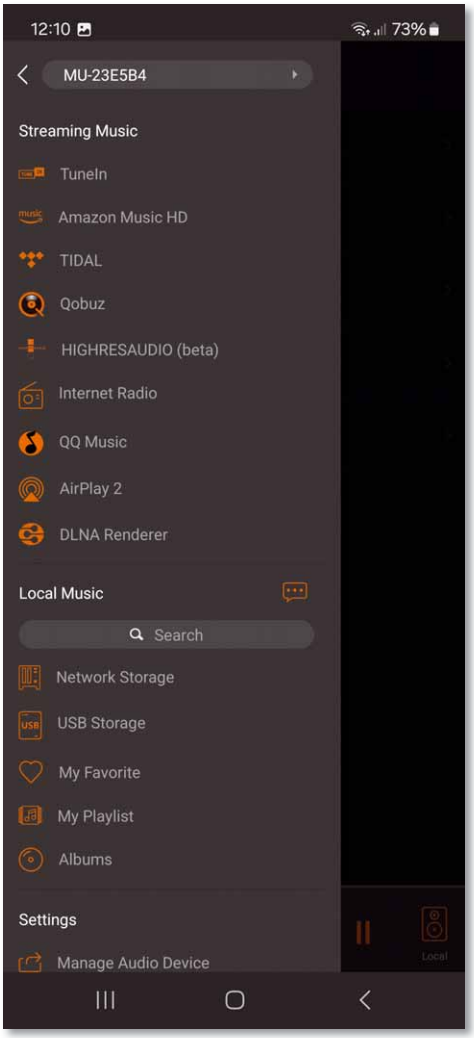
Features
- solid two-layer housing
- Power supply either AC or 12 V DC
- internal TXCO Clock or Genesis GX
- Ground contact
- internal DAC and preamplifier
- Roon ready
- Control (exclusively) via Ethernet/ WIFI router
- convenient and configurable source management
- Player with cover/tags, info (format/resolution)



Within a folder, the music tracks are presented as a list



All devices on the network can be displayed and configured



You can choose what will be played in the source menu

se sources you then have the option of playing hi-res music, with all formats from PCM to DSD supported.

Music comes into the MU via ethernet or USB

An internal SSD can also be retrofitted as an option; the special thing here is that Silent Angel uses the latest transmission protocol NVMe. The advantage is parallel access to the memory via PCIe port, which is faster than serial transfer via USB. In addition, the entire Internet is available to the user, starting with Internet radio and streaming services such as Spotify & Co. Anyone who has an account with services with high-quality content such as Qobuz or Tidal will get the quality they are used to at home with a good router with the appropriate data rate played directly into the network. The whole thing is controlled via the VitOS Orbiter app, which can configure all devices in the network and presents all sources in a clear and easy-to-use manner. The usual Internet suspects are already pre-installed, so you can have everything under control with one app. In our test, installation and handling worked wonderfully, only the Tidal implementation was still in progress, so we had to use Tidal Connect, i.e. control the music with the Tidal app.

Let's move on to the hardware of the MU. As with the NX and GX, the first thing that stands out is the extremely solid construction. All three components have a two-layer housing, which is made of fine cast alumi-

All three units come in massive double layered housings

The Bonn NX is a network switch for up to eight ethernet devices

num on the outside, while the inner layer is made of sheet steel with a shielding. The entire structure is designed to minimize vibrations and electromagnetic influences, and no effort has been spared on the electronic side. All components are selected for the best possible sound, and Silent Angel is one of the companies where critical decisions are made in many tests and also in listening tests.

Expansion with NX and GX

The Munich MU streamer already works well on its own for first-class music playback, but Silent Angel believes that even more is possible, especially with the highest product line. That's why there are devices like the Clock Genesis GX or the Switch Bonn NX that don't make music on their own, but rather support the Munich MU. Both are basically about optimal transmission of music information, which is a time-critical matter in the network. Every digital data transmission is susceptible to jitter, i.e. timing-related inaccuracies that cause undesirable distortions when playing music. Therefore, the Streamer MU and the Switch NX already have high-precision clocks built in. These TCXO are temperature-compensated oscillating crystals that provide a highly precise clock and already offer low latencies and little distortion. It's easy to imagine that the additional Clock GX can only be developed with immense effort in order to get a little bit of additional quality. Strictly speaking, we are dealing with four independent clocks that specify two different time cycles. That's what's special about Silent Angel, that not only the usual 10 MHz is available, but also 25 MHz. The 10 MHz originally comes from another, equally time-critical area, namely GPS, hence its widespread use. To clock the components used in devices like the NX, 25 MHz makes more sense because 25 MHz represents the native frequency of the built-in components. This eliminates the need for frequency conversion, which fundamentally entails inaccuracies. What remains is the Bonn NX network switch, which helps bring the music from the vastness of the network into the streamer as correctly as possible. With the NX, the Silent Angel engineers attached great importance to the best possible internal power supply, which is structured in multiple stages and offers extremely little noise. Separate supplies for the internal clock and the actual switch work for the best transmission with high channel separation and dynamic range.

The switch and the clock can be combined with the streamer inde-

Silent Audio Bonn NX

Price	3,500 Euro
Distribution	Silent Angel
Internet	www.silentangel.com

Specifications

Network switch

Dimensions 440 x 250 x 63 mm

Interfaces

- 8 x LAN
- Word Clock GX
- SA Link

Features

- solid two-layer housing
- Power supply either AC or 12 V DC
- internal TXCO Clock or Genesis GX
- Ground contact
- extremely precise internal power supply
- audiophile design for maximum signal fidelity and minimal noise
- Roon ready

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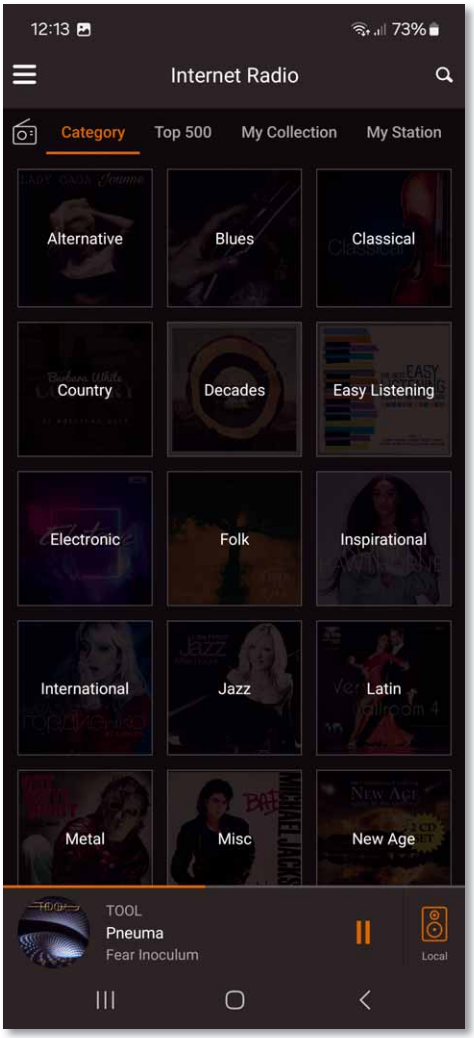
„Your choice for uncompromised music streaming."

The track played is presented with title, cover and file information

This settings section is about the compatibility of the internal DAC



If you want to listen to internet radio, you will find a wide selection of stations across all genres

pendently of each other, preferably both together of course. A third helper specifically for 12-volt operation is already being planned: The F1C will be a sound-oriented power supply from 12 volts to 12 volts, and Silent Angel wouldn't be Silent Angel if some sound performance wasn't achieved by eliminating fluctuations in the on-board voltage supply. Finally, it should be mentioned that the two highly sensitive timing components NX and GX need a correct environment to work optimally. The temperature compensation of all the clocks via TCXO does not work indefinitely, that is completely in the nature of the thing. The devices require a range of 0 to 30° C during operation and -20 to 70° C when stored. This shouldn't be a problem in motorhomes, but parking a car in Death Valley for two weeks is something to not really think about.

Sound check

In a typical car environment, the Munich MU works with any power amplifier thanks to the preamp outputs, but who listens in the car with a Class A amp and a pair of full-range speakers? Therefore, the predestined playing partner is a DSP, namely one with a coaxial digital input. The top models from premium manufacturers offer this, and it would be completely wrong to combine anything other than a top signal processor or DSP amplifier with the Silent Angel. With DSP power and a very good active system we are getting closer to the matter. We tried out the MU with an active studio monitor from Finland in the listening room and were thrilled. The preamplifier output of the MU already ensured happy faces with its very balanced and harmonious sound. However, after switching to digital coaxial, the sound improved even more. The sound tightened and the coziness of the analog output gave way to an athletic tightness. Dynamic passages gained in

The Genesis GX word clock is a heavyweight with 7.5 kg

The GX can clock two devices with 10 MHz and another two with 25 MHz

vehemence, attacks sounded more concise and the finest details in the treble were brought out more precisely. The reproduction of voices was perfect right from the start, the digital output didn't change the tonality, but rather ensured a kind of directness, of course perfectly supported by our speakers. The music came from USB and NAS, where plenty of high-resolution audio files were just waiting to be heard, including the excellent 96 kHz/24 bit version of Tools' (still) new album Fear Inoculum. We deliberately selected tracks that are available in the best quality from Tidal so that they could be compared in the VitOS app after changing the source. The result was initially sobering, even if good streaming services don't have to hide from a CD. Without comparing it to the hi-res material, streamed Tidal sounds really great - but no Internet weed can compete with a hard drive on a wire.

You could have safely called it a day here, but things got even more exciting when NX and GX were activated. The differences to the already excellent MU weren't so obvious at the beginning, and you need really good program material. But somehow everything suddenly sounded more right and more fluid. The matter-of-factness was the really great cinema, our chain let the music into the listening room in a very casual way, with this matter-of-factness that could not be attributed to deeper bass or more clarity. Rather, the room changes, or better: the atmosphere. There's this quality with really good music reproduction where you sit down and everything is just right, from the first note, and it just keeps getting better.

The MU features a DAC and a preamp

Conclusion

Silent Angel's streaming components are an unusual solution on the long road to perfect sound. Certainly not for everyone, but they appeal to uncompromising audiophile listeners who want to hear music from all sources in the best possible quality. The setup tested here is perfect for a luxurious motorhome, but could also be used in a car if you want.

Elmar Michels

Silent Audio Genesis GX

Price	**3,300 Euro**
Distribution	Silent Angel
Internet	www.silentangel.com

Specifications

Word Clock

Dimensions 440 x 250 x 63 mm

Interfaces

- 2 x Clock 10MHz
- 2 x Clock 25MHz

Features

- solid two-layer housing
- Power supply either AC or 12 V DC
- Ground contact
- 4 independent, temperature-compensated clocks

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„Your choice for uncompromised music streaming."

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 considerated 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

MULTIPLE AWARDS

HX-PHASE

SPEAKER

BEST PRODUCT
Absolute Spitzenklasse
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Absolute Spitzenklasse 1,1
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- 3 Ohm Impedance

HX 100 PHASE ACTIVE EVO 3
- 2x 100 WRMS
- 3 Ohm Impedance

HX 130 PHASE EVO 3
- 2x 125 WRMS
- 3 Ohm Impedance

HX 130 PHASE ACTIVE EVO 3
- 2x 115 WRMS
- 3 Ohm Impedance

HX 165 PHASE EVO 3
- 2x 175 WRMS
- 3 Ohm Impedance

HX 165 PHASE ACTIVE EVO 3
- 2x 165 WRMS
- 3 Ohm Impedance

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