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Blaze Audio
PowerZone Connect 2004D

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Blaze Audio PowerZone Connect 2004D

With the two- and four-channel 2U models from the PowerZone Connect series, Blaze Audio now offers its well-equipped and easy-to-use amplifiers in a higher performance class: with 500 or 750 watts per channel. The basis is the L-Pro modules from Pascal, which also includes Blaze as an independent brand.

Text, measurements, and photos: Anselm Goertz

The Danish manufacturer Blaze Audio, which belongs to the Pascal Company, is currently presenting some new products in its PowerZone Connect series. These include four amplifier models with Dante interfaces, new functions of the integrated DSP systems and wall panels for operating the devices. The amplifiers with Dante interface are currently the models 122D, 504D, 2004D and 3004D. The last two mentioned belong to the large 19"/2U models with 500 or 750 W power per channel, of which the 2004D was available for our test. The internal amplifier modules are out of the well-known L-Pro series by Pascal Audio. They enjoy an excellent reputation among discerning high-end customers.

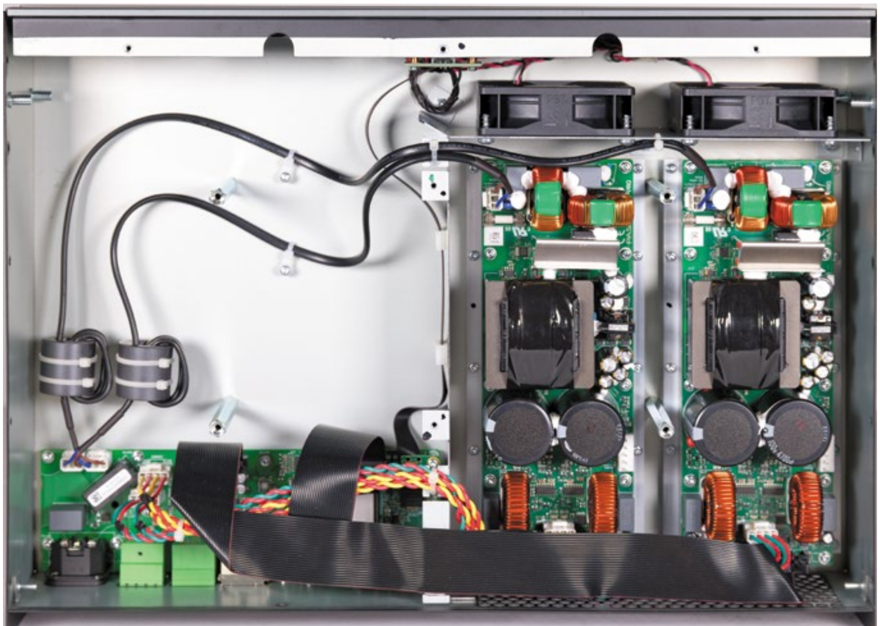
Integrated web server

The target group for those new amplifiers are permanent installations outside the area of voice alarms. This concerns business premises, cafés, bars, hotels, boutiques, conference rooms, churches, museums, and others where small to medium-sized loudspeaker systems are installed and where simple and quick setup and usability are important. To do this, Blaze relies on a web server which is integrated into the devices. It can be accessed with any browser, via PC, tablet or even smartphone. The only requirement is that you are in the TCP/IP network and IP range in which the amplifier is located. Fixed IP addresses or a DHCP server in the network may be used. Afterwards, the connection is established through an existing network via cable or WLAN.

If there is no network available, the amplifier's integrated WLAN access point can also be used. Once the amplifier is connected through the IP address, further operation takes place via the PowerZone Control Web Interface, which is provided by the device itself. A special app or other software is not required, so you can start setting it up straight away. All innovations and expansions of the DSP functions are automatically integrated into the user interface. ➔

Rear view

Back of the Blaze 2004D with inputs and outputs on Euro block connectors. Additional unbalanced inputs are designed with RCA connectors. Digital inputs and outputs are available in S/PDIF format or via the lower network socket via the Dante audio network. The upper network connection is used to configure and operate the Blaze 2004D.



Inside view

... of the Blaze 2004D with two two-channel Pascal amplifier modules Audio L-PRO

PowerZone Connect 2004D

Concerning the test device, the PowerZone Connect 2004D with Dante interface, the data sheet looks promising, with power values of 4 × 500W at both 4Ω and 2Ω, as well as 4 × 250W at 8Ω. Further key data include a universal power supply for mains voltages ranging from 100 to 240V and mains frequencies of 50 to 60Hz. The power supply also has a PFC (power factor correction) and a special standby converter with a power consumption of <0.5W. As with the smaller models, the front panel of the 2004D is kept very straight-forward: Five LEDs indicate the status of the amplifier, input and output signals present, and network connections via LAN or WLAN. The lower half of the front panel consists of a ventilation grille through which two internal fans direct the air flow through two cooling profiles in a temperature-controlled manner.

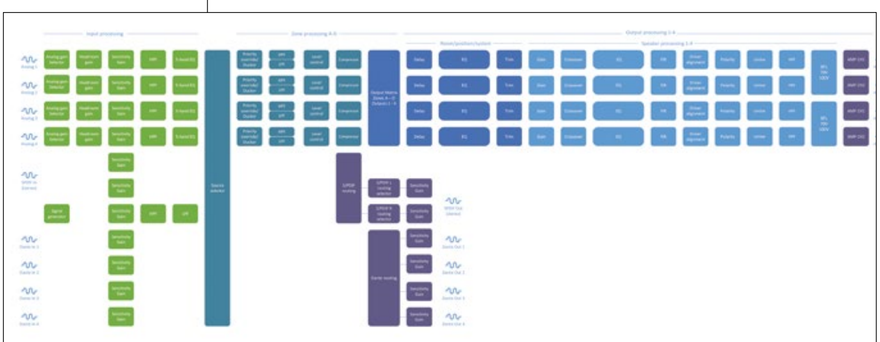
As is often the case, the back is "more interesting". The four inputs and outputs are connected via Euroblock terminals. In addition, the analog inputs may be connected asymmetrically via RCA connectors. Signals in digital S/PDIF format can also be fed in, but only with a maximum of two channels. An S/PDIF output can accept any signals from the internal matrix, supplying signals for additional amplifiers or other tasks, e.g. for straightforward recording purposes. The same applies to the four outputs via the Dante network; they can also be assigned any signals from the matrix. The amplifier can be switched on and off, put into standby mode or muted via eight GPIO pins on Euroblock connectors. It is also possible to create a volume setting for the four channels individually with a control voltage ranging from 0 to 3.3V via GPIO pins. The voltage of 3.3V is provided by the amplifier, so in the simplest case only a box with a corresponding potentiometer needs to be connected. Below the GPIO ports you can see the small WLAN antenna for your own access point. If the amplifier is to supply a 100/70V system, two channels must be operated in bridge (BTL), where 1,000W is then available. The loudspeaker signal is picked up between the minus and plus outputs of the two channels. The setting for the BTL mode can be accessed in the „output mode" menu's „speaker preset".

Fig. 1 shows a block diagram of the signal routing and processing with the four analog inputs, the S/PDIF input and a pink noise test tone generator. There are also four feed channels from the Dante network. These can either be assigned to the zones directly or via one of the four mixers (Fig. 3), which allow any mix of all input paths. Each zone has a level control and a compressor. The latter is particularly important when signals with large level fluctuations, e.g. from microphones, are to be expected. Also a new feature in

PowerZone series

In addition to the models with Dante interface, the PowerZone Connect series offers four additional compact 9.5"/1U devices without Dante. They deliver 125, 250 or 500W total power distributed over two or four channels. In the 19"/2U range, four devices are available without Dante as well, offering 1,000, 2,000 or 3,000W total power, also distributed over two or four channels. The models mentioned are equipped with DSP operation and are configured via their own web interface. If you don't need DSP functions, you can also use the simple PowerZone series without „Connect" in the name, which includes three amplifiers with 2 × 125W, 4 × 125W and 4 × 250W.

A special feature of these three models is that they can also control 70- or 100-volt systems without having to bridge two channels. With the „Connect" models, bridged operation of two channels is required.



Block diagram

Fig. 1: Features in Blaze 2004D

the DSP software is the ability to overwrite the signal assigned to the zones using a priority or ducking function, for example if a collective call should go to all zones and at the same time the signals running there should be muted or reduced in level.

In the subsequent output matrix, zones A to D can then be assigned to output paths 1 to 4, although of course one zone can also feed several output paths. This is followed by gain, delay and a fully parametric EQ with ten bands. The subsequent block with signal processing elements is called "speaker preset" and contains all the necessary functions for a typical speaker controller setup with X-Over, EQ, FIR filter, delay, polarity and limiter. You can either create your own speaker presets for the entire block or load ready-made presets from a library. More information on this at a later point.

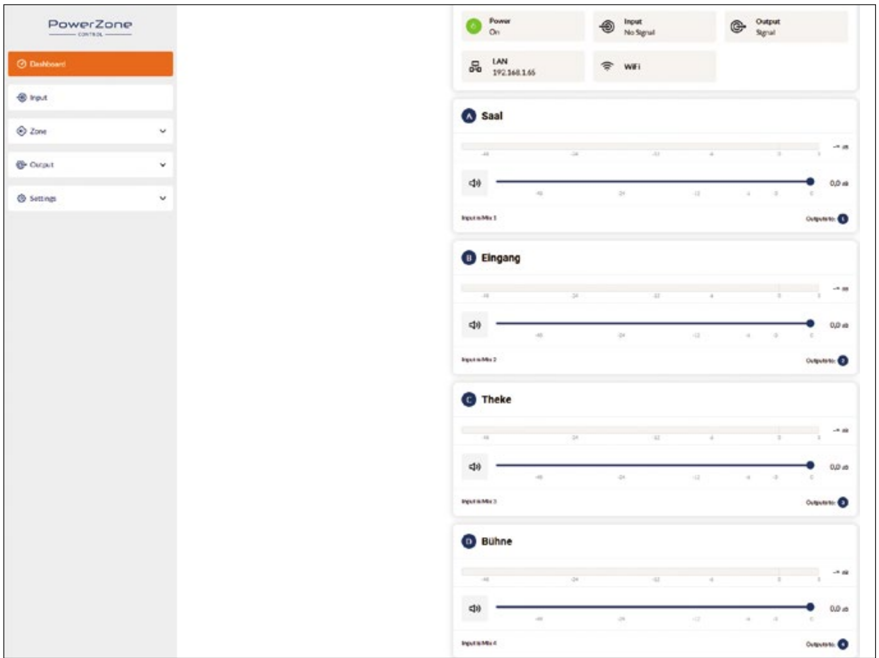
Configuration and operation

It is important for the executing and installing companies to be able to set up the systems quickly and safely on site and to enable the customer to use them easily without having to study manuals for a long time or do a lot of preparatory work. The PowerZone Connect devices make it easy from this point of view, as establishing a connection via LAN or WLAN is quick and you can then get started straight away with the well-structured web interface. If you work your way through the functions in the dashboard from above (Fig. 2), you can immediately see how to make the desired settings. All levels can also be labeled with meaningful names so that you can retrace later which signals are assigned where.

It should be noted that the web interface is only intended for device setup and not for user operation. There are several other options, such as simple volume control for the four zones using potentiometers on the GPIO pins. The new Wall-S1 devices are more flexible in this regard: They are connected via network and can be powered by a PoE switch or injector. The power consumption is 3.84W. The levels can be adjusted and the sources selected using the small graphic display and the incremental encoder. It is possible to define display color, brightness and standby time. For additional security, the control unit can be protected with a four-digit PIN code. To use the new functions - where mixers can be selected as sources for the zones - through the control unit, a firmware update of the Wall-S1 to the current version 1.1.0 is required.

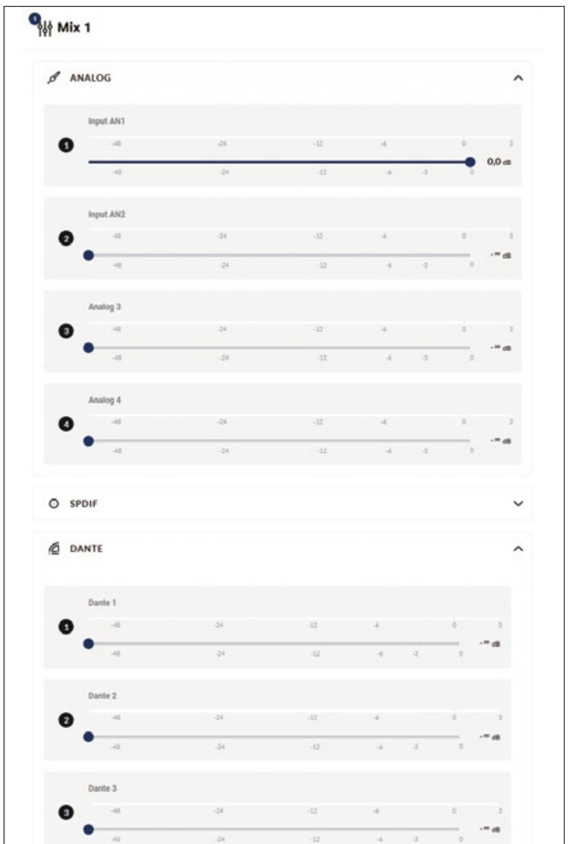
Measurements

For the analog inputs of the 2004, sensitivity can be adjusted individually using software. Four options are available: +14dBu, +4dBu, –10dBV and "Mic". These valu- →



Dashboard

Fig. 2: Access to the web interface via the dashboard



Mixer

Fig. 3: One of a total of four mixers in the DSP, with which the signals for the zones can be freely compiled from all inputs

WALL-S1

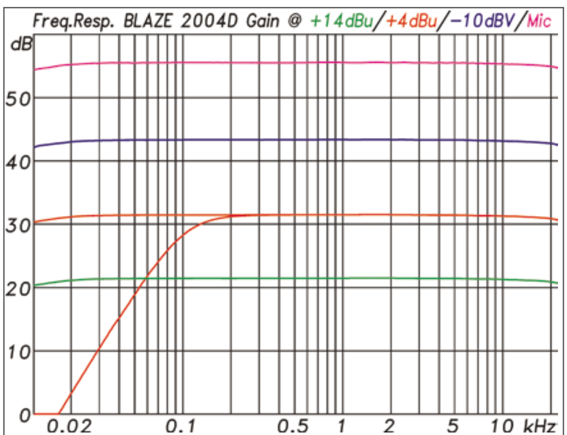
Control element for wall installation with small graphic display and incremental encoder; The connection and power supply take place via the network.

es refer to the minimum input level required for full scale operation. The default setting is usually +14dBu or +4dBu. The value -10dBV is suitable for sources with weak output levels. In the "Mic" setting, microphones can be connected directly. However, phantom power is not available, meaning only dynamic microphones can be connected. Fig. 4 shows the measured frequency responses and gain values for these settings.

If you measure the frequency response of the power amplifiers with different load resistances, you can determine the load dependency and the damping factor. Fig. 5 presents the frequency responses of the 2004 model, using various load resistances of 2, 4, 8, and 16Ω, for idle and for two complex loads, corresponding to typical 4Ω or 8Ω speakers. With the exception of the 2Ω load, the curves differ only slightly. The gain is around 31.5dB, and the corner frequencies are just under 10Hz at the lower end and around 23kHz at the upper end, the latter due to the DSP system's sampling rate of 48kHz. The latency is 1.16ms when using the analog inputs.

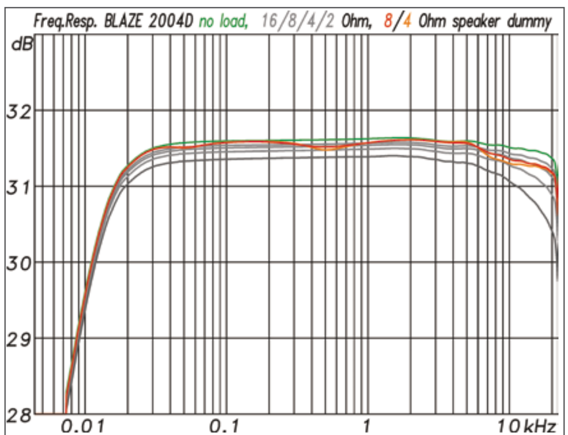
The frequency-dependent damping factor can be calculated from the measured frequency responses when idling and at a known actual load, in this case 8Ω. The curve in fig. 6 provides a value from just under 100 to approx. 1kHz and a decreasing curve beyond that. The cause of this behavior, which is typical for Class D circuits, lies in the low-pass filter in the output, which causes the internal resistance to increase slightly. Since a high damping factor is primarily important at low frequencies, this does not result in any relevant disadvantage.

The interference level to be measured at the output of the power amplifiers depends, among other things, on the selected inputs and, if they are the analog inputs, also on their sensitivity setting. If all gain values are set internally to 0dB, then the interference level at the output when using a digital input is -76.7dBu or 78.6dBu with A



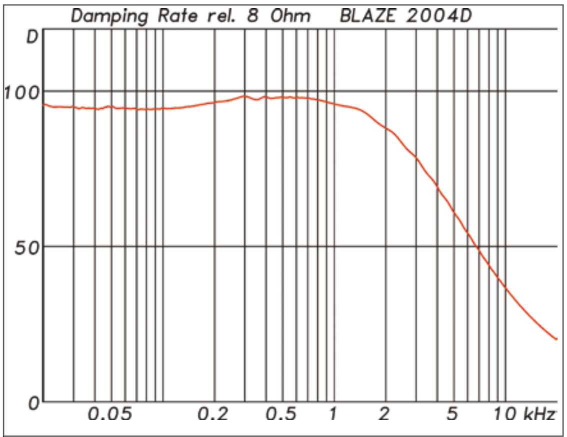
Gain values

Fig. 4: Frequency responses and gain depending on the selected input sensitivity. Possible settings are +14 dBu, +4 dBu, 10 dBV and Mic. The gain is then 21.1dB, 31.3dB, 43.1dB or 55.4dB. In addition, a 100Hz 2nd order high-pass filter can be activated in the inputs.



Frequency response

Fig. 5: Frequency responses measured with various loads of 2, 4, 8 and 16Ω at idle (green) and with speaker dummies for typical systems with 8Ω (red) and 4Ω (orange)

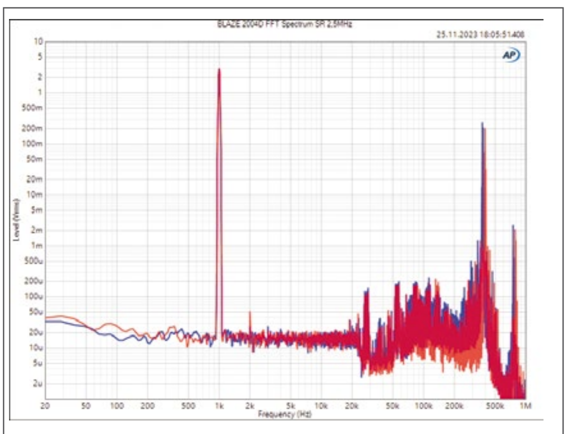


Damping factor

Fig. 6: Damping factor related to an 8 ohms load. At high frequencies the value drops due to the output filter.

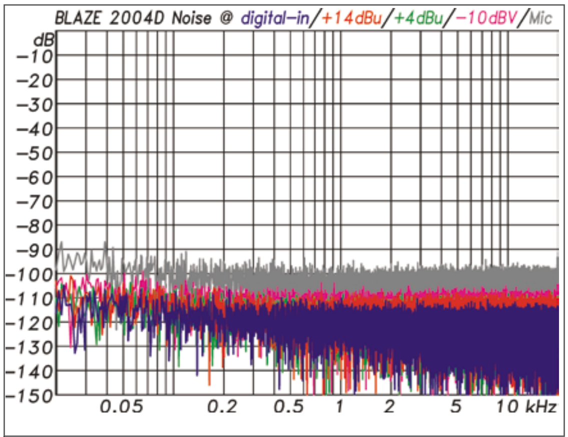
weighting. For the analog inputs, depending on the selected input sensitivity, the interference level is 73dBu at +14dBu and at +4dBu sensitivity and -60.5dBu for microphone signals. In contrast, there is a maximum output level of approx. 37dBu, which results in a very good dynamic range of up to 115.6dB. All measured interference spectrums from fig. 7 are also free of monofrequency components.

Another measurement for Class D amplifiers is the FFT analysis of the output signal with a very high sampling rate. Fig. 8 shows such a measurement of the 2004D with a sampling rate of 2.5MHz. With this type of measurement, both the Class D switching frequencies and possible interference within and outside the audio frequency



High-frequency signal components

Fig. 8: FFT spectrum of the output signal measured with 2.5MHz sample rate. The useful signal can be recognized at 1kHz. Remnants of the PWM switching frequencies can be found around 400kHz and integer multiples.



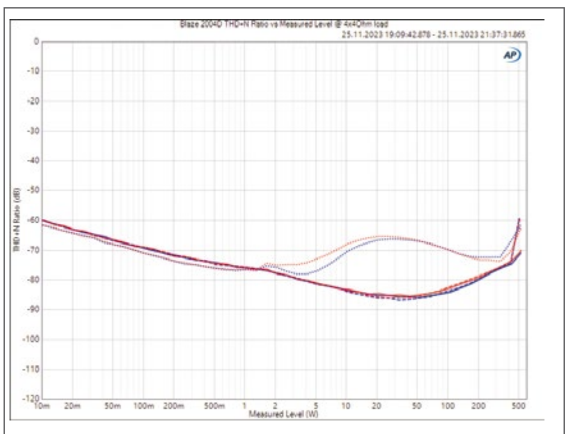
Noise level

Fig. 7: FFT spectrum of the interference signal at the outputs. Depending on the selected input sensitivity, the interference level is -73 dBu with +14dBu and +4dBu sensitivity as well as -60.5dBu for microphone signals (gray) at the input. If you choose a digital input as the source, the interference level is -76.7dBu (blue).

range are visible. For the measurement in fig. 8, an additional 1kHz signal was fed in. The amplitude of the signal at the output in this measurement was 3V. The PWM switching frequency at approx. 400 kHz with a voltage of 200 mV and its integer multiples up to just below the measurement limit at 1.25MHz can be clearly seen.

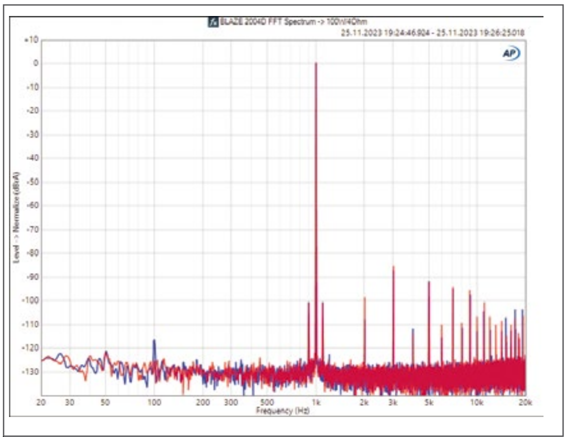
Distortion values

Three further measurements deal with the distortion behavior of the Blaze 2004D amplifier. Fig. 9 shows the THD+N values depending on the output power, measured at fre- ➔



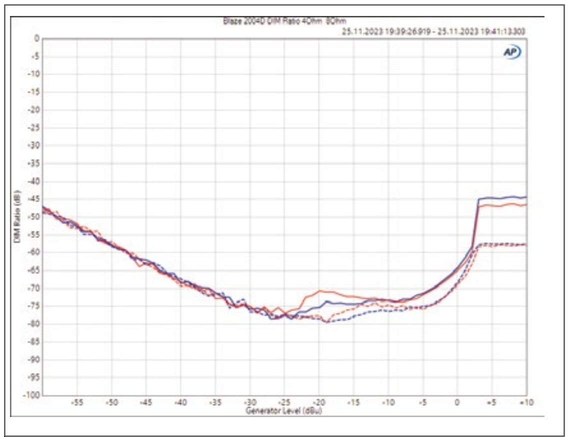
THD+N in relation to the output power at 4Ω

Fig. 9: Distortions (THD+N) as a function of the output power (x-axis in W) on a 4 × 4Ω load. Measurements at 100Hz (- - -), 1kHz (––) and 6.3kHz (…).



FFT spektrum at 100W at 4Ω

Fig. 10: THD spectrum as an example for ch 1 and ch 2 at 4 × 100W power on a 4 × 4Ω load.



Transient Intermodulation Distortion (TIM)

Fig. 11: Transient intermodulation distortion (TIM-100) as a function of the input level measured on a 4 × 4Ω (–––) and a 4 × 8Ω load (– – –).

quencies of 100Hz, 1kHz and 6.3kHz for a load of 4 × 4Ω with simultaneous operation of all four channels. At 100Hz and 1kHz the curves are in the order of 86dB (=0.005 %) and only rise slightly to -75dB just below the clip limit. Only at 6.3kHz are the THD+N values slightly higher at -66dB, but still in a good range.

The distortion spectrum from fig. 10 confirms the good properties. At a 4Ω load, all distortion components are below 85dB (0.0056%) and are therefore completely uncritical. Higher-order distortion components also fall off quickly.

The transient intermodulation distortions (fig. 11) were measured for loads of 4Ω and 8Ω. Here, too, there are very good values in an overall even progression. At +4dBu the clip limit is reached, where a limiter then intervenes and prevents the distortion from increasing further.

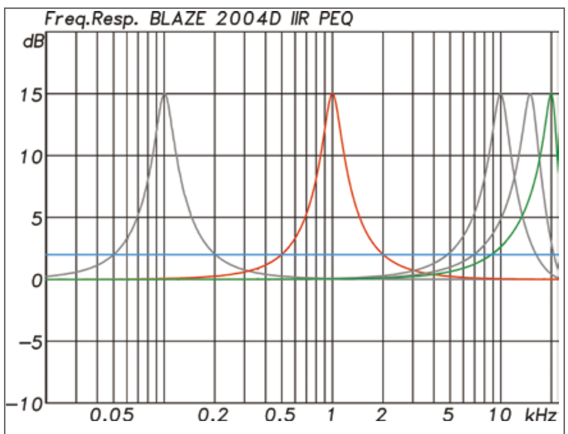
Filters

A variety of filters can be used in the DSP system of the Blaze amplifiers; as a result, not all the details can be discussed here. Filter banks with IIR filters can be found in the analog inputs (5x), in the output paths (10x) and in the speaker presets (15x). Fig. 12 shows an example of the filter bank's clean setting layout in the output paths, which can be used to adjust a loudspeaker to the room, for example.

A standard measurement for digital filters concerns the possible compression of the filter curve at high frequencies as one approaches half the sampling rate. The cause of this effect lies in the transformation of the infinitely extended analog frequency axis to the frequency axis in the digital level limited by half the sampling rate. Although this does not result in any distortion of the signal itself, the filters behave a little differently in terms of sound

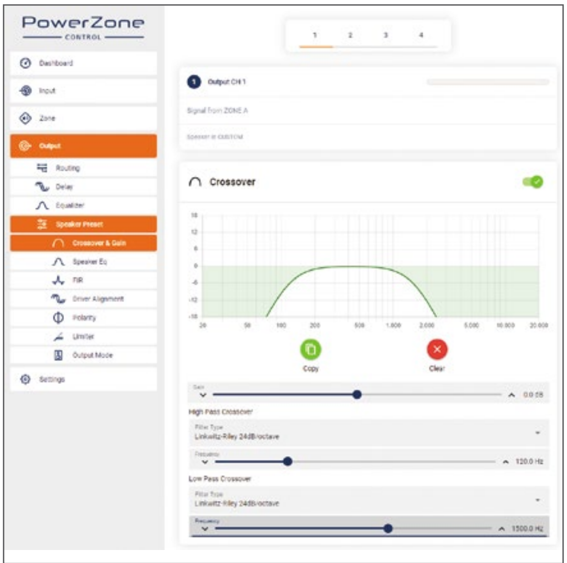
Filter settings in the output paths

Fig. 12: In addition to the speaker presets, each output contains another ten freely configurable EQs, whichh can be used e.g. for room adjustment.



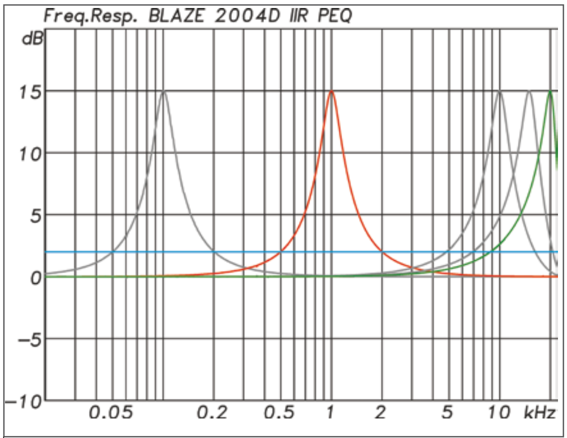
Perfectly compensated filter curvers

Fig. 13: The parametric IIR filters are compensated in an exemplary manner so that the filter curves are not compressed near half the sampling rate and are as similar as possible to the curve of an analog filter.



Speaker settings for the outputs

Fig. 14: Power Zone Control interface in the browser with all functions for creating a loudspeaker controller setup



Perfectly compensated filter curves

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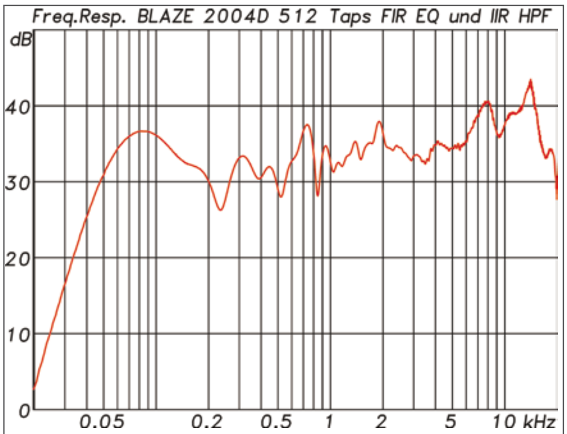


FIR filter

Fig. 15: Example of an FIR filter for amplitude and phase equalization with 512 taps at 48kHz sample rate; The high-pass filter at 60Hz was also set as an IIR filter.

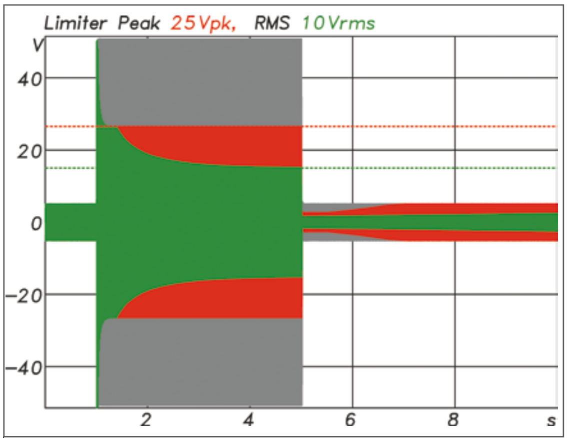
than their analogue counterparts. To avoid this effect, you can either choose a higher sampling rate (96kHz, for example) or compensate the filters as much as possible. That is exactly what was done here in an exemplary manner. Fig. 13 shows a Bell filter of constant quality with center frequencies from 100Hz to 20kHz. Without compensation, the filter curves above 10kHz would have been significantly compressed, which is avoided here thanks to the compensation.

Speaker presets

In the four output paths of the DSP system, directly before the signal goes to the power amplifiers, you can see the functions labeled „speaker processing" in the block diagram in Fig. 1. With X-Over, EQ, FIR filter, delay, polarity and limiter, all the necessary tools for a typical speaker controller setup can be found here. You can either create your own speaker presets for the entire block or load ready-made presets from a library. Blaze now has a considerable list of renowned manufacturers who have already stored presets for their speakers here.

The X-Over function enables Butterworth filters with 6 to 48dB/Oct slope, Linkwitz-Riley filters with 12 to 48dB/Oct and also Bessel filters with 12 to 48dB/Oct. The X-Over filters are followed by an EQ bank with 15 fully parametric filters and an FIR filter with a maximum of 512 taps. Both types of filters can be used to equalize the frequency response of the speakers. Fig. 15 shows an example of the complex equalization including the phase progression that is already possible with the FIR filter. The coefficients of the FIR filter can easily be loaded as a .CSV or .TXT file. The last function before the actual power amplifier is the limiter. Here too, everything necessary has been thought of. There is a peak limiter and an RMS limiter, both of which can be parameterized independently of each other. To effectively protect the speakers, the combination of both limiters is essential, as the RMS and peak load capacities are usually far apart, which cannot be achieved with just one limiter.

A measurement of the limiter in fig. 16 shows its behavior. The set limiting values of both the peak and RMS limiters are perfectly adhered to. The same applies to the set attack, hold and release time constants, with which the limiters can offer reliable protection for the speakers. →



Limiter functions

Fig. 16: Reactions of the limiter to a +20dB level jump of 1–5s (gray curve). The threshold for the RMS limiter was 10 Vrms and for the peak limiter it was 25Vpk. Both values as well as the time constants are maintained exactly.

Performance values

Power measurement for the Blaze 2004D was only performed in Low-Z mode for 2Ω, 4Ω, and 8Ω loads. If two channels work bridged in 100V mode, then the values of the 4Ω measurement double.

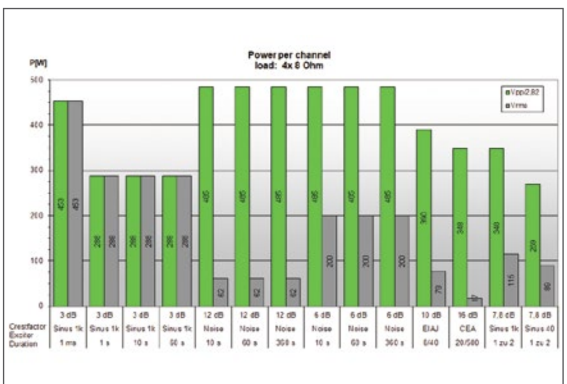
The following diagrams show the performance values for simultaneous operation of the four channels with loads of 8Ω (fig. 17), 4Ω (fig. 18) and 2Ω (fig. 19). To be comparable with the manufacturer's data, we carry out a number of different measurements according to different standards, which are listed in the graphics.

Several statements can be derived from the bar graphs. The manufacturer's specifications of 250W per channel at 8Ω and 500W at 4Ω and 2Ω are correct and are sometimes even exceeded. With a sine signal, the values are achieved for at least 10s. The short-term possible power for signals with a crest factor of 12dB reaches twice the value with 485W at 8Ω and 950W at 4Ω and 2Ω. It can therefore be said that the 2004D consistently achieves or exceeds the specified performance values and also has plenty of headroom for short-term signal peaks.

A closer look at the bar graphs reveals the ratios of the power calculated from the peak values and the average power values for the measurement signals with a 6dB crest factor. Purely mathematically, the peak value should correspond to twice the average. However, at 4Ω you can see values of 905W at the peak and 279W at the average. The peak value is therefore not twice as high, but rather 3.2 times higher. The situation is similar with the 2Ω load. At 8Ω the values approach the calculated ratio. Two effects play a role here: On the one hand, the crest factor of a test signal changes as a result of the transmission of the filters in the ADC, DAC and other filters in the signal path, even if they do not directly affect the transmission range, so that a signal with an original 6dB crest factor also can become 7-8dB. As a second important influence, current limitations and internal limiters also play a role at full load, especially at high currents, which can change the signal shape and thus increase the crest factor.

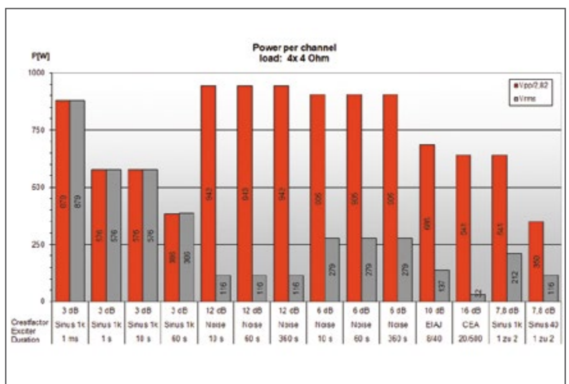
Network load

The load on the power grid is an issue that should not be neglected, even with smaller power amplifiers. Important aspects are the efficiency, the network load (the keyword here being power factor) and, especially in the case of continuous operation in fixed installations, the standby power consumption. Without a signal, the power consumption of the 2004D is approx. 23W. If the power amplifiers are fully controlled on all four channels with a 12dB crest factor signal, then the power supply is at a low-level power consumption of 560W. The maximum value under full load



Power values for a load of 4 × 8Ω

Fig. 17: Performance values of the Blaze 2004 at 8Ω per channel with simultaneous load on all channels. Values for different signal types. (Power scale 0–500W)

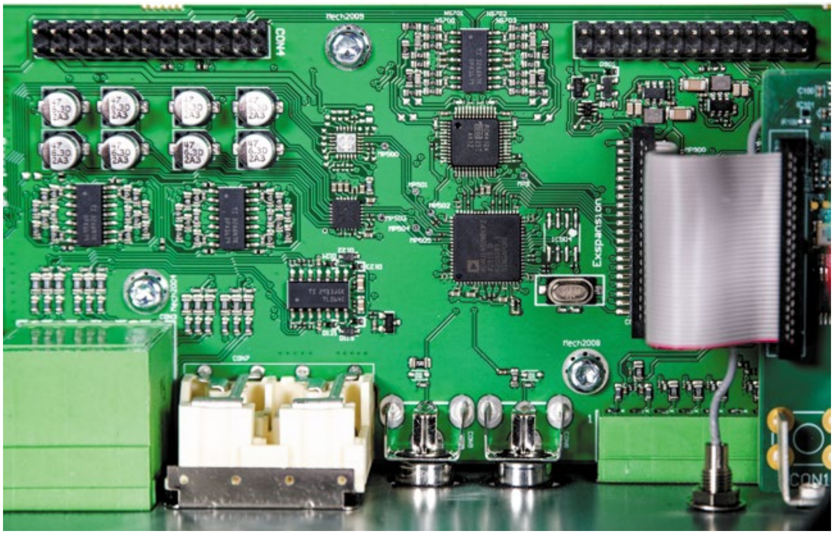


Power values for a load of 4 × 4Ω

Fig. 18: Performance values of the Blaze 2004 at 4Ω per channel with simultaneous load on all channels. Values for different signal types. (Power scale 0–1,000W)

with a sine wave signal is 2300 W. The overall efficiency reaches around 75%. If you subtract the base load, the value increases to a very good 80 to 85%.

The current drawn from the power network should also follow the voltage as far as possible and the output stage should therefore behave like an actual resistance as a load for the power network. Deviations arise from displacement reactive currents (capacitive or inductive) and from distortion reactive currents (harmonic component). How closely the current curve approximates the voltage curve is expressed in measurement terms by the power factor (PF = power factor). Fig. 20 shows the measurement of the 2004D at full load. The blue curve for the current is slightly distorted compared to the voltage (red), but is not disturbed by charging peaks. The power factor is 0.98. Expressed as a distortion percentage (THD), the value is 12.6%.



DSP system

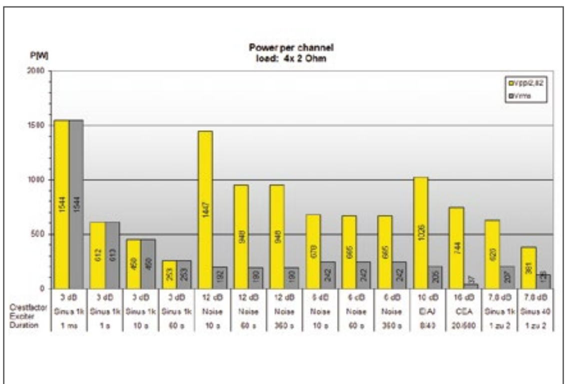
The DSP system in the Blaze PowerZone Connect 2004D: In the middle you can see the Analog Devices SigmaDSP ADAU1452, above it a BurrBrown PCM1404.

PowerZone Connect 122D	€ 899
PowerZone Connect 504D	€ 1,199
PowerZone Connect 2004D	€ 2,099
PowerZone Connect 3004D	€ 2,499
Wall-S1 (all variants)	€ 199 each

Prices (RRP net plus VAT)

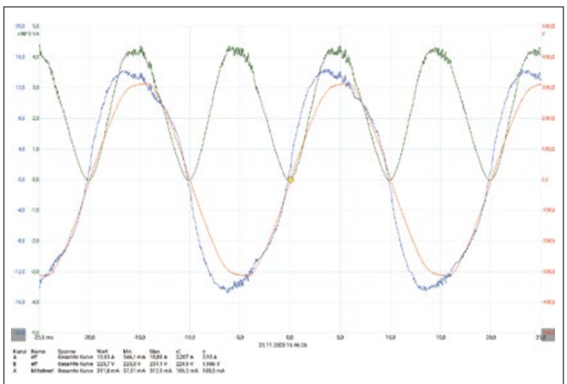
Conclusion

The Danish manufacturer Blaze Audio, which is part of the Pascal Company, is upgrading its current range of PowerZone Connect power amplifiers with various new features. Four models are now available with a Dante interface, which provides additional feed and play channels. With four integrated mixers and a priority function, the range of functions of the internal DSP system and important functions have also been expanded. On the hardware side, there are new wall panels that are easily connected via Ethernet to operate the systems and are supplied with power via PoE. In the 2004D model tested, all of this is found together with four power amplifier channels from the Pascal Audio L-Pro series, which offer solid performance with excellent technical data. A look at the RRP list shows a net amount of €2,099 for the 2004D with 4 × 500W and €2,499 for the larger model 3004D with 4 × 750W.



Power values for a load of 4 × 2Ω

Fig. 19: Performance values of the Blaze 2004 at 2Ω per channel with simultaneous load on all channels. Values for different signal types. (Power scale 0–2,000 W)



Current and voltage curve

Fig. 20: Course of mains voltage (red), mains current (blue) and the power consumption calculated from this (green). The PFC does its job well. The amount of distortion in the recorded current is just under 13%.