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Blaze Audio PowerZone Connect 504

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Blaze Audio Power-Zone Connect 504

Under the name “Blaze”, the Danish manufacturer Pascal Audio, known for its power amplifier modules, is now launching its own series of power amplifiers for the installation market. The series includes two- and four-channel models with outputs from 60 W to 750 W per channel. In bridged operation, they can also be deployed for 100 V concepts. In itself, this is not unusual – and those who are familiar with Pascal Audio roughly know what to expect from the power amps. Interesting, however, is the integrated DSP system that offers several special features, both in terms of functionality and operation.

Copy and measurements: Anselm Goertz | Images: Anselm Goertz, Pascal Audio (1)

The target market for Pascal Audio's new Blaze amplifiers are fixed installations – excluding voice alarm applications – such as business premises, cafés, bars, hotels, shops, conference rooms, museums and others. These are where small to medium-sized loudspeaker systems are installed, and simple and fast set-up and operability are key. To achieve this, Blaze relies on an integrated web server that can be accessed using any browser – using a computer, a tablet or even a smartphone. The only requirement is that the device is connected to the TCP/IP network and within reach of the amplifier's IP range. The connection itself can be made to an existing network either via cable or via Wi-Fi. If no network is available, the amplifier's built-in wireless access point can also be used.

Once users have connected their device to the amplifier via the IP address, further operation is carried out via the PowerZone Control web interface, which is provided by the unit itself. Users do not have to download a specific app or other software and can start setting up their amp straight away.

Blaze series

Let us begin by taking a brief look at the PowerZone Connect series that consists of four compact 9.5"-/1-RU devices with a system power of 125 W to 500 W and four 19"-/2-RU power amplifiers with a system power of 1,000 W to 3,000 W. What all power amplifiers have in common is the DSP system. In addition to its Connect models, Blaze also offers three power amplifiers without DSP and network connection, with specified system outputs of 250, 500 and 1000 W.

For our review, we tested the 504, which – with its 9.5"/1 RU cabinet – is the largest amplifier in the PowerZone Connect series. Various accessories are available to install the amplifier, including a 19" rack extension, rack ears or connectors, allowing users to combine two devices into one 19" unit. For mounting outside of a rack, for example under a desk or on a wall, simple wall brackets are available that are attached to the underside of the housing. A small fan inside the unit sucks in air from the side at the front, which then exits the device at the rear.

All connections of the four inputs and outputs can be made via Euroblock terminals. In addition, the inputs can also be fed in unbalanced via RCA sockets. Digital S/PDIF signals can also be input, however only a maximum of two channels is possible. For further amplifiers, an S/PDIF output provides two channels of the A and B zones' signal from the internal matrix. Users can switch the amplifier on and off, put it into standby mode or muted it via eight GPIO pins – also on Euroblock connectors. Using the GPIO pins and with a control voltage from 0 to 3.3 V, users can additionally set a volume for the each of the four channels individually. 3.3 V are provided by the amplifier, so in the simplest case, users only have to connect a small device with a suitable potentiometer. Below the GPIO connections, one can see the small Wi-Fi antenna for the access point. ➔

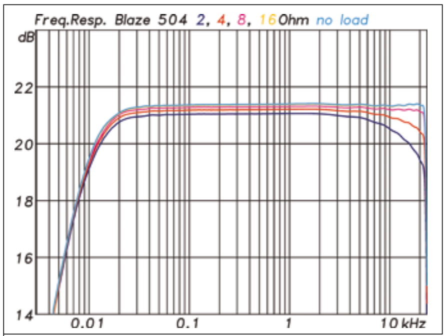


FIG. 01: Frequency responses measured with loads of 2, 4, 8 and 16 Ω and at no load

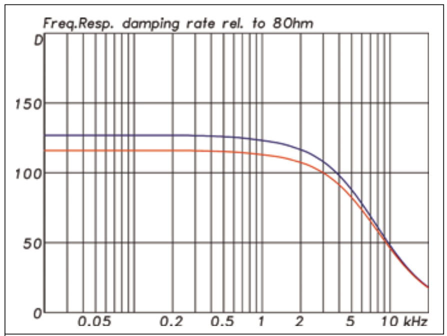


FIG. 02: Damping factor measured exemplarily for two channels, related to an 8-Ω load. The slightly different values might be caused by small contact resistances at the loudspeaker terminals

If one takes a look inside the tidy Blaze 504, one will find two Pascal Audio U-PRO2S amplifier modules, the DSP board and a small circuit to control the LEDs on the front. A divider behind the front panel partitions off the fan, which goes about its work largely unobtrusively.

The individual amplifier channels' maximum output voltage is specified as 70 Vpk. For use in a 100 V system, two channels must therefore be operated in bridge circuit.

Measurements

The first measurements focuses on the amplifier, initially without considering the DSP in detail. When measuring amplifiers, one starts with the frequency response, similar to how one would approach the measurement of loudspeakers. Here, however, the focus is not so much on assessing the frequency response as such – which is usually completely straight – but rather on recording the amplification as well as possible high-pass and low-pass filters in the signal path. If the frequency response is measured with different load resistances, then the load dependency and the damping factor can also be determined. FIG. 01 shows the 504's frequency responses for loads of 2, 4, 8 and 16 Ω and for no load. With the exception of the 2-Ω load, the curves differ only slightly. The gain is 21.2 dB and the cut-off frequencies are just below 10 Hz at the lower end and around 23 kHz at the upper end. The latter is due to the DSP system's sampling rate of 48 kHz. When using the analogue inputs, the latency is 1.16 ms. The curves for the damping factor in FIG. 02 are also a result from the curves at no load and at a load of 8-Ω. The slightly different values for the two channels measured as an example might be caused by small contact resistances

Blaze 504
LEDs for the amplifier's most important states

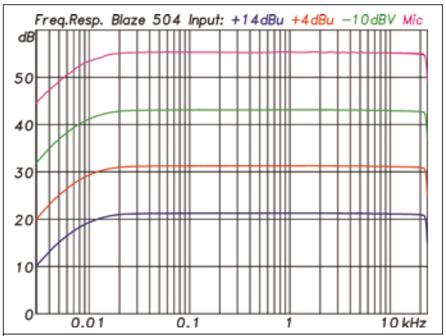


FIG. 03: Frequency response and gain depending on the selected input sensitivity. Possible settings are +14 dBu, +4 dBu, –10 dBV and mic (from bottom to top). The gain then is 21.1 dB, 31.3 dB, 43.1 dB or 55.4 dB

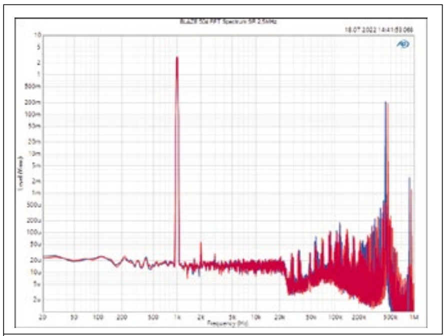


FIG. 04: Output signal's FFT spectrum measured with a sample rate of 2.5 MHz. The useful signal can be identified at 1 kHz. Remnants of the PWM switching frequency can be found at approximately 450 kHz and the integral multiples

at the loudspeaker terminals and are not relevant in practice.

It is possible to set the 504's input sensitivity individually via software. The options are +14 dBu, +4 dBu, -10 dBV and a mic setting. The indicated value refers to the input level required for full modulation. The default setting is +14 dBu or +4 dBu. A value of -10 dBV would be used for sources with a weak output level.

In the mic setting, microphones can be connected directly. However, phantom power is not available. As a consequence, only dynamic microphones can be directly connected.

Another fast measurement for Class D amplifiers is the FFT analysis of the output signal using a very high sampling rate. FIG. 04 shows such a measurement with a sampling rate of 2.5 MHz, the highest value possible with an Audio Precision APx555. With this type of measurement, both the Class D switching frequency and possible interference within and also outside of the audio frequency range become visible. For the measurement in FIG. 04, a 1 kHz useful signal was also added. For this measurement, its amplitude at the output was 3 V. The PWM switching frequency can be clearly seen at approximately 480 kHz with a voltage of 200 mV and its integral multiples just below the measurement limit at 1 MHz. All other noise components are 60 dB and more below and have no further significance.

The noise level measured at the 504's outputs is 71 dBu unweighted and -73.2 dBu with A-weighting. The interference signal's FFT spectrum displayed in FIG. 05 shows only equally distributed noise without any monofrequency components. If the maximum output vol- ➔

Inputs and outputs on Euroblock connectors

Additional unbalanced inputs with RCA sockets are available. Digital inputs and outputs are also included and use the S/DIF format. The network connection is used to configure and operate the Blaze 504, but not to transmit audio signals

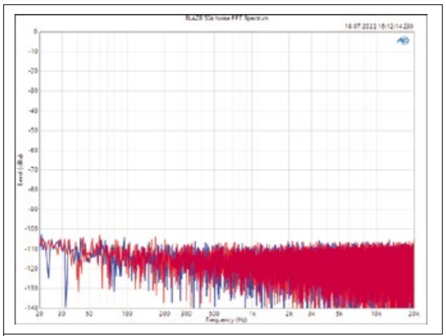


FIG. 05: Interference signal's FFT at the outputs. On all four channels, the interference level is -71 dBu or -73.2 dBu with A-weighting. The maximum output voltage is 63 Vpk. This results in a good S/N of 108.4 dB with A-weighting. When using the digital inputs, the value improves by another 5 dB

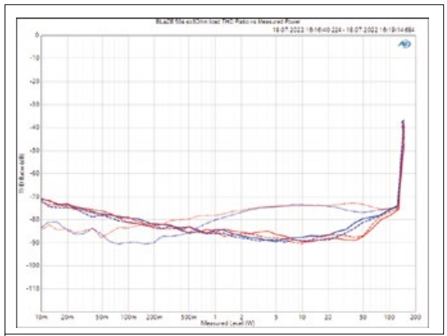


FIG. 06: Total harmonic distortion (THD) as a function of output power (x-axis in W) at a load of 4 × 8 Ω. Measurements at 100 Hz (– – –), 1 kHz ((–––) and 6,3 kHz (···)

tage of 63 Vpk at a load of 4 × 8 Ω is put into relation, this results in an S/N (signal-to-noise ratio) of a good 108.4 dB with A-weighting. When using the digital inputs, the value improves by another 5 dB.

Distortion

Three further measurements examine the Blaze amp's distortion behaviour. FIG. 06 shows the THD as a function of the output power, measured at frequencies of 100 Hz, 1 kHz and 6.3 kHz for a load of 4 × 8 Ω with simultaneous operation of all four channels. At 100 Hz and at 1 kHz, the curves are located around -90 dB (=0.003 %) and rise only slightly to -75 dB a few dB below the clip limit. With -72 dB, the THD are slightly higher only at 6.3 kHz, but remain in a good range regardless of the amplifier type.

The distortion displayed in FIG. 07 confirms these good

Two amplifier modules
Interior view of the Blaze 504 with two Pascal Audio U-PRO2S

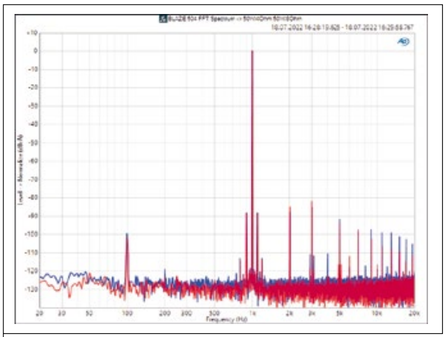


FIG. 07: Exemplary distortion spectrum for Ch1 at 4 × 50 W power at a load of 4 × 4 Ω (blue) and of 4 × 8 Ω (red). All distortion components are below -80 dB (0.01 %) and are therefore completely uncritical

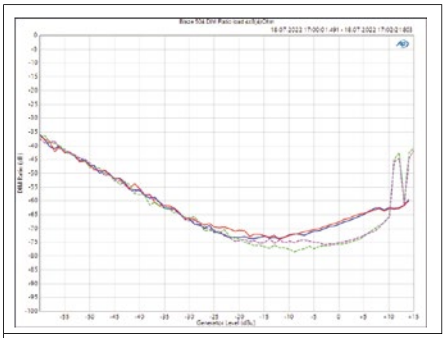


FIG. 8: Dynamic intermodulation distortion (DIM100) as a function of the input level measured at 4 × 4 Ω (blue, red) and at 4 × 8 Ω (green, magenta)

properties. At 8 Ω as well as at 4 Ω, all distortion components are below -80 dB (0.01 %) and are thus completely uncritical. Higher-order distortion components also fall off quickly.

The transient intermodulation distortions shown in FIG. 08 were also measured for loads of 8 Ω and 4 Ω.

Here, too, the results are good to very good and have an overall even curve. The jumps in the curves for the 8-Ω measurements above +10 dBu input level are caused by the intervention of the clip limiter. When measuring with a 4 Ω load, an RMS limiter already intervenes beforehand so that the clip limiter does not have to intercede.

DSP system with PowerZone Control

Once users have connected their device to the amplifier's PowerZone Control web interface, they have all the functions for operation at their disposal. The interface is designed in such a way that, regardless of the device used (tablet, smartphone, etc.), the overview is always remains unchanged and users can intuitively operate it without further assistance.

FIG. 09 shows a block diagram of the signal routing and processing with the four analogue inputs, the S/PDIF input and a pink noise test tone generator. These can be assigned to zones A to D via the input selection; however, sums are not possible. In addition, each zone has a level control and a compressor. The latter is especially important when signals with large level fluctuations, for example those of microphones, can be expected.

In the subsequent output matrix, zones A to D can then be directly assigned to output paths 1 to 4. Gain, delay and a fully parametric EQ with ten bands follow. The signals from zones A and B are also available in digital form at the S/PDIF output; a loss-free transmission to the S/PDIF input of other amplifiers is therefore possible.

The subsequent block with signal processing elements is called "Speaker Preset". With X-Over, EQ, FIR filter, delay, polarity and limiter, it contains all the necessary functions for a typical speaker controller setup. Users can either create their own speaker presets for the whole block or load ready-made ones from a library.

The X-Over function (FIG. 10) enables Butterworth filters with a steepness of 6 to 48 dB/Oct, Linkwitz-Riley filters with 12 to 48 dB/Oct and also Bessel filters with 12 to 48 dB/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 filter types can be used to equalise the speakers' frequency response. FIG. 11 shows an example of the complex equalisation including the phase curve that is already possible with the FIR filter. The FIR filter's coefficients can be easily 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. The amp features a peak limiter and an RMS limiter, both of which can be parameterised independently. For effective protection of the loudspeakers, the combination of both limiters is indispensable, as the RMS and peak power handling are usually far apart, something one limiter could not handle by itself. If one were to set this to the peak value, the loudspeaker would be severely at risk, for example, through thermal overload should feedback occur. On the other hand, signal peaks would be limited too early if the RMS load capacity were taken as the benchmark for the peak limiter.

A number of measurements were carried out on the limiters using a 10 s sine signal with a +20 dB level jump from 1 s to 5 s. FIG. 12 shows an example of this, where the peak limiter was set to a threshold of 30 Vpk with a very short attack time and the RMS limiter was set to 14 Vrms with a long attack time. The peak limiter sets →

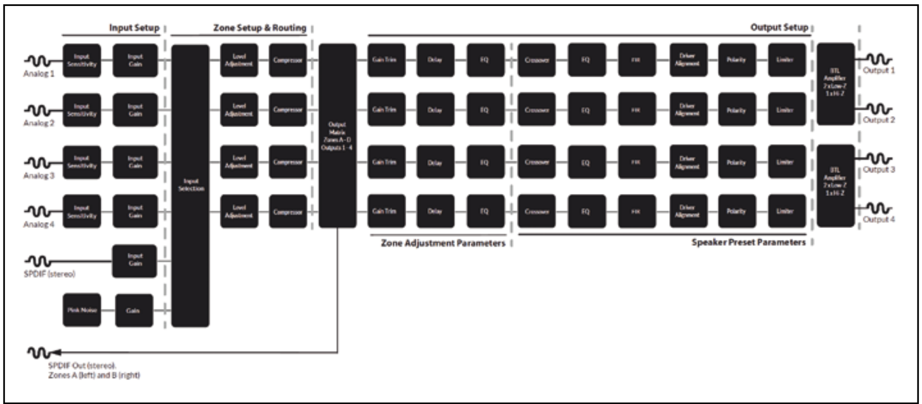


FIG. 09: Block diagram of the Blaze 504's functions

on very quickly and only allows a short peak to pass at the beginning. After that, the limit is a peak value of 25.8 Vpk and thus somewhat too much. Nearly a second later, the RMS limiter also kicks in and regulates to 21 Vpk or 14.8 Vrms. At the end of the burst, the RMS limiter opens up again with a release time of 3 seconds. All values are freely adjustable for both limiters.

As a last step, the entire block with all parameters can be saved as a speaker preset. Using the export function (FIG. 13), users can determine which values are to be included and whether they should be changeable or protected. Users thereby have all the functions at their disposal to create complex loudspeaker controller functions or to use ready-made ones.

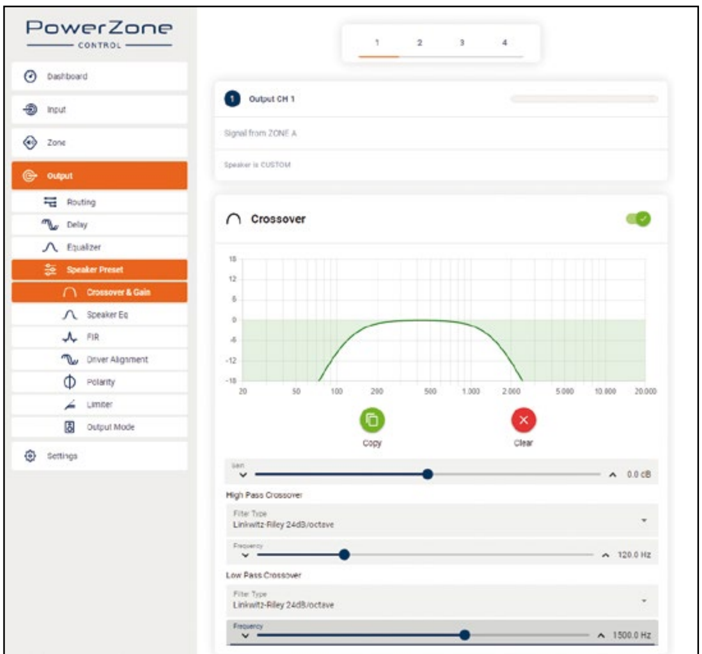


FIG. 10: "PowerZone Control" interface in the browser with all functions for creating a speaker-controller setup

Performance

The Blaze 504's power measurement was carried out only in low-Z mode for loads of 4 Ω and 8 Ω. If two channels are bridged in 100 V mode, the values are doubled.

The following diagrams show the power values for simultaneous operation of the four channels with loads of 8 Ω (FIG. 14) and of 4 Ω (FIG. 15). To enable comparison with the manufacturer's data, we carried out a number of different measurements according to different standards. The following values were determined in detail:

- Pulse power for a 1 ms single duration of a 1 kHz sine signal
- Sine power for a constantly applied 1 kHz sine signal after one second, after 10 seconds and after one minute
- Power with a constantly applied noise with a crest factor of 12 dB after 10 seconds, after one minute and after 6 minutes
- Power with a constantly applied noise with a crest factor of 6 dB after 10 seconds, after one minute and after 6 minutes
- Power according to EIAJ measured with a pulsed 1 kHz sine signal with a duration of 8 ms every 40 ms. The signal has a crest factor of 10 dB.
- Power according to CEA 2006 with a 1 kHz sine signal, the level of which experiences a level jump of +20 dB every 500 ms for 20 ms. The signal has a crest factor of 16 dB.
- Power for a periodically repeating 1 kHz burst with a length of 33 ms followed by a rest phase of 66 ms. This signal has a crest factor of 7.8 dB.

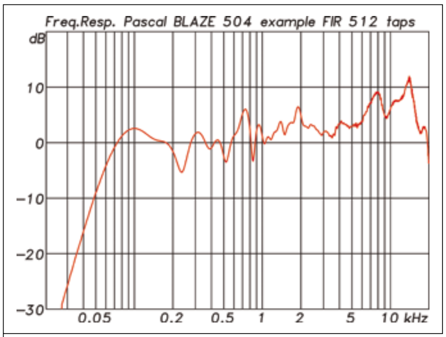


FIG. 11: Example of an FIR for amplitude and phase equalisation with 512 taps at a sample rate of 48 kHz

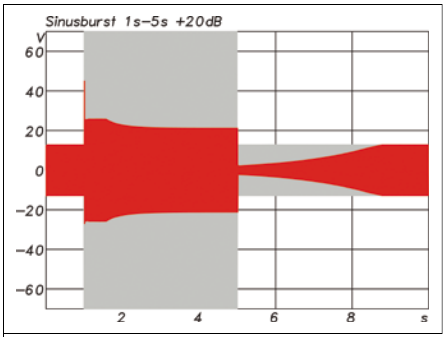
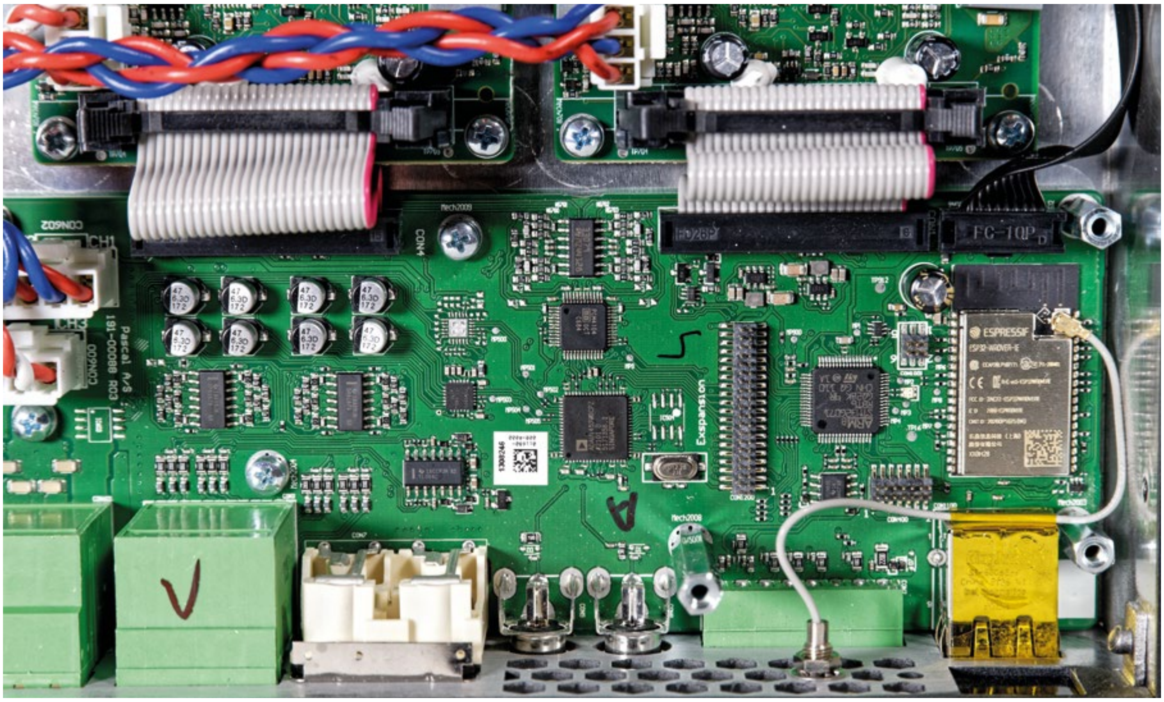


FIG. 12: Reactions of the limiter with separate parameters for an RMS and a peak limiter to a +20 dB level jump of 1–5 s (grey curve)

- Power for a periodically repeating 40 Hz burst with a length of 825 ms followed by a rest phase of 1650 ms. This signal also has a crest factor of 7.8 dB.

The evaluation for the sine measurement signals is simple: the effective value is recorded and the power is calculated based on this value. The sine wave should not yet be visibly distorted. Two values can be determined for the sine burst signals according to EIAJ or CEA: on the one hand, the short-term RMS during the duration of the burst and, on the other, the overall RMS that includes the signal pauses. The ratio of the two values is 7 dB for the EIAJ signal and 13 dB for the CEA signal. The crest factor, which describes the ratio of the burst's peak value to the overall effective value, is 3 dB larger in each case and is therefore 10 dB and 16 dB respectively. For the burst measurement methods, the overview shows the power calculated from the burst's short-time effective value and the overall effective value. Another burst measurement method operates with 33 ms long 1 kHz bursts followed by 66 ms long rest phases. Here, the crest factor is 7.8 dB. Based on this measurement, the burst's frequency was reduced by a factor of 25 to 40 Hz and the time span was extended by a factor of 25, especially with regard to a power amp's capabilities in low frequency reproduction, where tones are often present for longer periods.

It cannot be generally said which of the burst measurements is better or more meaningful. However, it is ➔



DSP board with ADAU1452 DSP from Analog Devices
A Burr Brown PCM1840 is used as an ADC. The DAC is a PCM4104, also from Burr Brown

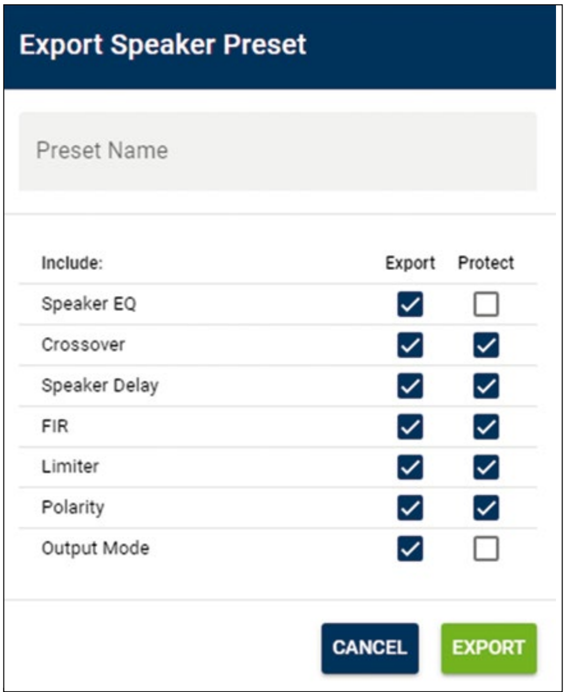


FIG. 13: Users can define which parameters are to be included in the created speaker presets

important to compare only those measurements that are based on the same measurement method.

The measurement with noise signals with a crest factor of 12 or 6 dB is somewhat different. With these signals, the amplifier is driven to its clip limit and then permanently loaded. The signal's peak-to-peak value (Vpp) and the effective value (Vrms) are measured after 10 seconds, after one minute and after 6 minutes. From this, comparable to the burst measurement, a power value is calculated based on the voltage's effective value and another power value is calculated based on the peak-to-peak value divided by 2.82. The values are thus comparable to those of the burst measurements.

With a sine signal, the power specified in the data sheet with 125 W at 4 Ω or at 8 Ω is just reached or slightly exceeded and also stably held for at least 10 s. Somewhat later, there is a shutdown due to overload. This, however, is not unusual and also not problematic, as the amplifier is not intended and certified to be part of a voice alarm control panel according to EN54-16, where a minimum operating time of one minute with a sine signal at full load is required. In all conceivable AV system applications, a shutdown due to overload will therefore probably never occur in this form. Should it nevertheless occur, the amplifier will automatically become active again a short time later.

Signals with a crest factor of 12 dB or 6 dB are transmitted in a permanently stable manner. For a typical signal with a crest factor of 12 dB, the amplifier delivers a peak power of 325 W at 4 Ω and 291 W at 8 Ω. If the crest factor is reduced to 6 dB, the amp still delivers 131 W at 4 Ω and 150 W at 8 Ω. The average power then is approximately 50 W per channel. For music and speech signals, the amplifier therefore has sufficient reserves to transmit even signal peaks without distortion.

Mains load

For power amplifiers with high power and/or long operating time, the load on the power grid is an important issue. Directly or indirectly related to this are the installation costs, the operating costs and ultimately also operational safety. If a power amplifier is in constant operation, then its power consumption in idle mode without signal is an important factor. The Blaze power amplifiers feature a differentiated power management that enables users to set standby and mute timers and to select different versions for the "Auto On" function via the audio signal or a special trigger. A distinction is made as to whether the network interface remains active (<2W power consumption) or is switched off (<0.5W power consumption). If the latter is the case, then the amplifier cannot be activated via the network.

When idle, the Blaze 504's power consumption is 13 watts. For the extreme case of full modulation with a sine signal – a case, which probably occurs rather rarely in practice – the mains load is a maximum of 600 W. If all four channels are fully modulated with a signal with a crest factor of 12 dB, the mains load is 217 W and the output power is 162 W.

In addition to the absolute values, the power drawn from the mains should follow the voltage as closely as possible and, like a real resistor, the amplifier should thus behave as a load for the mains. Deviations are caused by displacement reactive currents (capacitive or inductive) and by distortion reactive currents (harmonic component). How well the current curve approximates the voltage curve is expressed metrologically by the power factor (PF). FIG. 16 shows the measurement of the Blaze 504 at full load. The power factor is 0.95 and the cos ρ value that describes the phase relationship of voltage and current to each other is 0.98. Both values indicate effective mains utilisation without major reactive currents or harmonic components. There are no high-frequency disturbances.

Price

These prices are quoted by Blaze for the Audio PowerZone Connect series (RRP net plus VAT):

PowerZone Connect 122	2x 60W	€ 599,-
PowerZone Connect 252	2x 125W	€ 699,-
PowerZone Connect 254	4x 60W	€ 799,-
PowerZone Connect 504	4x 125W	€ 899,-

Summary

Under the Blaze brand name, the Danish manufacturer Pascal Audio has launched an amplifier series that is primarily aimed at deployment in fixed installations that do not have the security-relevant functions of a voice alarm system. With two or four channels and outputs from 60 to 750 W per channel, a wide range of applications is possible, including 100 V mode. The integrated DSP system offers all the necessary functions, including a two-stage limiter and FIR filter, with enable the setup of even complex loudspeaker controllers. The simple operation with any browser via the integrated web server and, if required, also via the device's built-in wireless access point, enables an immediate intuitive start to the Blaze amp's configuration. While the integrated web server concept does not yet allow for more complex configurations with networking and monitoring of several amplifiers, more work is being done on new extended functions, which users can then easily install via a firmware update. In addition, a 1-zone controller in EU format with colour display and power supply via PoE is expected to be released in September 2022. It will be available in white and in black enclosures.

The Blaze amps' measurements and their workmanship are excellent and fulfil all requirements for the aforementioned fixed installation applications. For the Blaze 504 presented here, with its 4 × 125 W power, the official price list specifies € 899 net. This is, without question, an excellent price/performance ratio. Performance must not only to be understood as pure amplifier power, but also with regard to the functional scope of the integrated DSP system. •

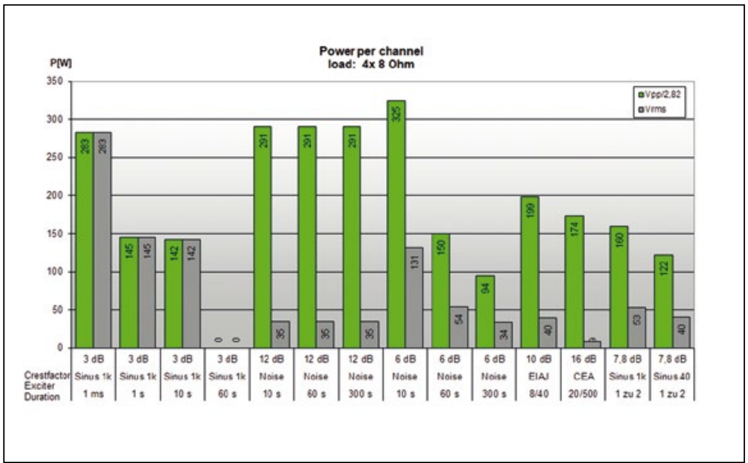


FIG. 14: The Blaze 504's power at 8 Ω per channel with simultaneous load of all channels; results for different signal types (power scale 0–350 W)

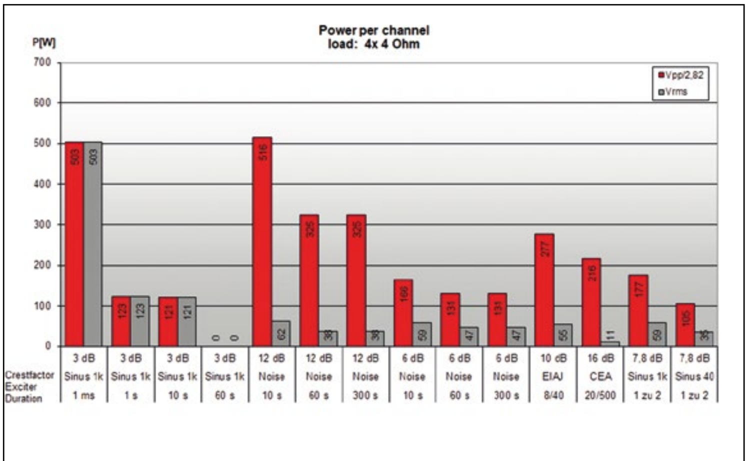


FIG. 15: The Blaze 504's power at 4 Ω per channel with simultaneous load of all channels; results for different signal types (power scale 0–700 W)

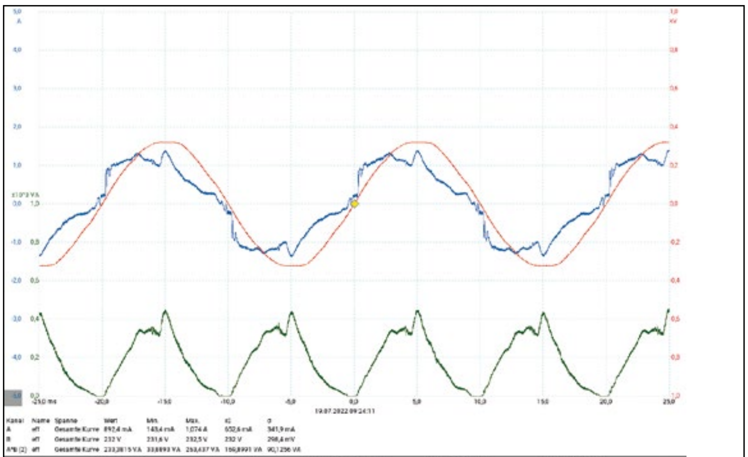


FIG. 16: Course of the mains voltage (red), mains current (blue) and the power consumption calculated