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Camco Tecton 32.4

With the Tecton series Camco presents their second line-up of poweramps with switched-mode power supplies and these are priced below the Vortex. Out of the six new models we had a chance to test the very first unit of the 32.4 in the final production version.

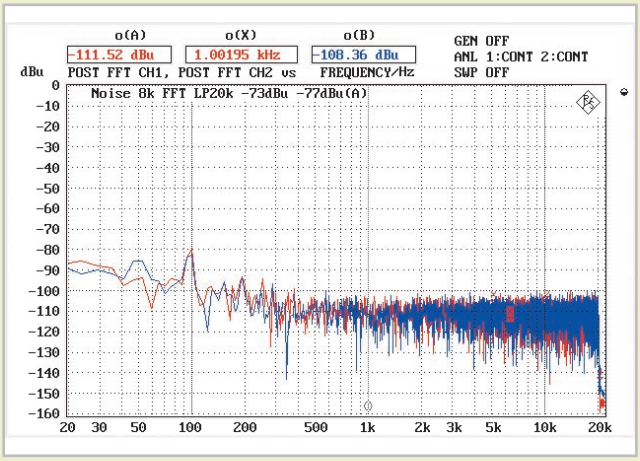
A bit more then three years have passed since the introduction of the Camco Vortex series, which is now well established and highly respected. The Vortex was a real breakthrough at Camco at that time, since these were the first amps with switched mode technology by Camco. Developer Carsten Wegner, who is also responsible for the new Tecton series, introduced several new limiter circuits with the Vortex which surpassed the functions of a traditional clip-limiter by simulating power fuses and respecting the switching characteristics of a class H amplifier.

Based on this experience, the company in Wenden-Gerlingen started development of a second series of amplifiers, which had to be below the Vortex in prices and power ratings while technologically being derived from these top models.

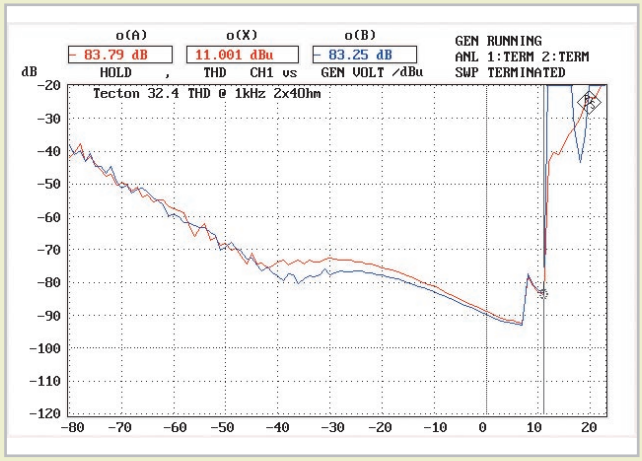
Tecton series

Camco is starting the Tecton series directly with six separate models, which are divided into the .2 and .4 groups. These group classifications follow the design for 2 Ohm or 4 Ohm use. For the internal circuits this means lower supply voltages, but higher current capacity for 2 Ohm use. The models 14.2, 22.2 and 28.2 deliver a total of 1400 W, 2200 W and 2800 W into the sum of two channels respectively at 2 Ohm loads. The 4 Ohm models are the 24.4 with 2400 W, the test model 32.4 with 3200 W and the biggest model 38.4 with a total power rating of 3800 W. Except for the two smallest models 14.2 and 22.2 all Tectons are built according to Class H with two stacked supply voltage stages. There is sometimes some confusion about the difference between the terms Class H and Class G technology. At Camco, poweramps with multiple stage supply voltages are referred to as Class H, but in some literature this type is called Class G, while Class H is only used for poweramps with continously adjusting supply voltages in these publications.

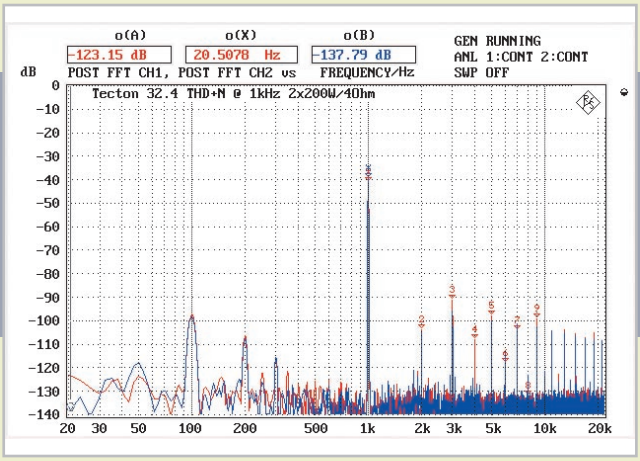
A basic difference between the Tecton and Vortex series is the use of only two instead of three stages of supply voltage control. To



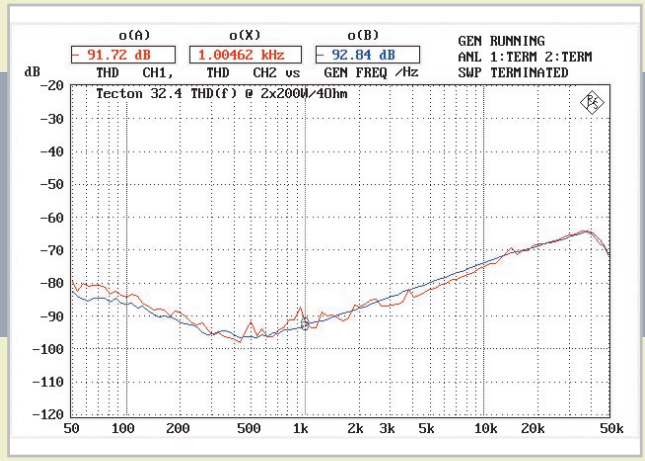
Pic. 1: Noise spectrum at output (CH1/CH2); -73dBu/-77dBu (A-weighted). Combined with a maximum output voltage of 85.6 V(eff) (041 dBu) this results in a very high dynamic of 114 dB or 118 dB (A-weighted) respectively.



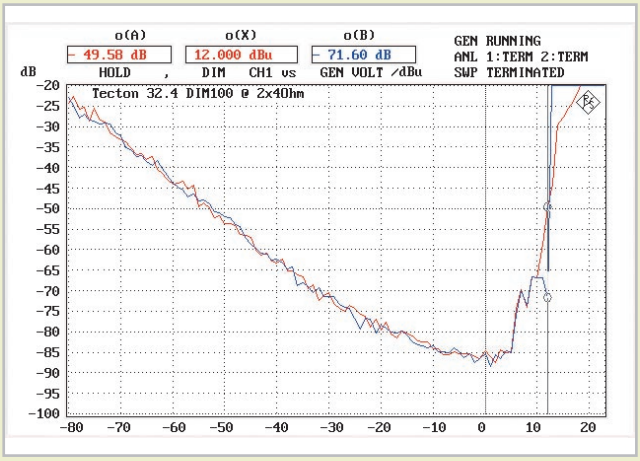
Pic.2: Total harmonic distortion (THD) at 1 kHz and 4 x 4 Ohm load (CH1,CH2). Red: with limiter (slow setting), blue: without limiter. (x-scale: input voltage in dbU at 26 dB gain). The curve falls to –92 dB then there is the typical jump at the switching point to a higher supply voltage. At a value of about 500 W the safety- and clip-limiter cut in, since the test signal is constant at this method of measurement. With deactivated limiter only (blue curve) only the safety limiter works (see text).



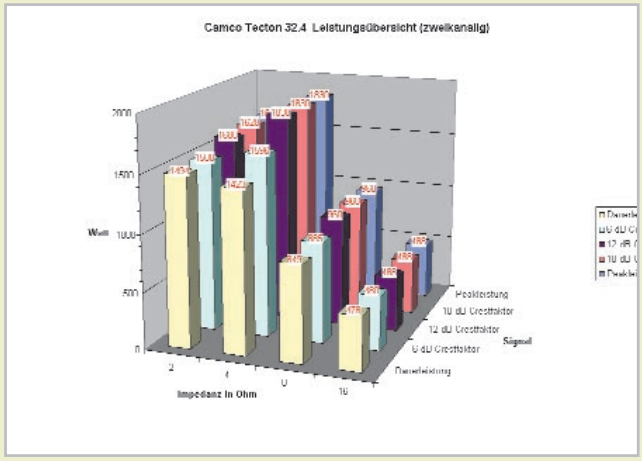
Pic. 3:Distortion spectrum at 1 kHz and 2 x 4 OHM LOAD (CH1,CH2) and 2 x 200 W into 4 Ohm (base wave damped by 40 dB at 1 kHz). The spectrum is dominated by uneven components, which only slightly fall off at higher degrees within the overall very low level.



Pic. 4: THD against frequency at 2 x 200 Watt into 2 x 4 Ohm load (CH1,CH2). The curve is rising to the higher frequencies with the typical 20dB/decade.



Pic. 5: Intermodulation distortion DIM 100 (3.15 kHz and 15 kHz) and 2 x 4 Ohm load (CH1,CH2). Red: with limiter (slow); blue: without limiter. Up to the switching point exemplary low DIM100 values of –85 dB are reached, while the values stay at a still good level of about –70 dB up to the onset of the limiters.



Pic. 6: Power diagram for one channel with concurrent use of all channels and test signals of different crest factors from 3 to 18 dB and at peak power. The power into 2 x 4 Ohm with 6 dB crestfactor is only available for a maximum of 7 s. From a crestfactor of 9 dB continuous use is possible (2 Ohm use is not advised with the 32.4). All power ratings measured here are only availabe for short times below 2 s.

Backpanel of the power amp with switches for operating mode, gain and HP-filter for subwoofer/fullrange-cabinets.

be able to still use the amplifiers as effectively as possible and with a minimum of losses, the optimisation for 2 Ohm or 4 Ohm was introduced.

Design and features

The power supply of the the Tecton is an unregulated switched mode supply where the DC-current is first rectified before being re-assembled at a much higher frequency. There follows a mains transformer, which can be constructed much smaller and lighter for the higher frequency then would be possible at a mains frequency of 50 Hz. The two-staged symmetrical supply voltage of the amplifier is then controlled with four secondary voltages. For the small models there is only a simple symmetrical supply from the transformer.
The actual filtering and energy use is done behind the rectifier circuit at high voltages on the primary section of the transformer. Since the transformer transforms the capacity squared, rather small filters are needed in comparison to conventional power supplies. On the secondary section there are a few condensators for smoothing, which can be dimensioned quite small thanks to the much shorter cycles.
When opening the Tecton (via the bottom side) it directly strikes us that the insides are upside down. The circuit board covering the full plane is on the top of the unit and parts are hanging like bats down from this circuit. The advantage of this design is reduced buildup of residual dirt on the circuit board. In the middle we find a large heat sink covered by a ventilation channel. A ventilator mounted on the front panel blows cooling air sucked in from the front through the heat sink, finally releasing them through the back panel.

Controls and connections

The front panel of the Tecton is tidy. Two potentiometers allow adjustment of gain and above these you find three LEDs each per channel for Clip, Output Current and Signal Present status. The signal presence LEDs can show the event of the protect mode if ever necessary by switching colour to red. The output current indicator offers a rough idea about the output current and therefore offers an indication of faulty cables and speakers or shorts. Two additional LEDs inform about the working mode. If both are off, the amplifier is in normal stereo mode. Alternatives are MB (mono bridged) and PM (parallel mono) operation. The choice is made with sliding switches on the backpanel. The parallel mono mode is unusual and has both channels fed by input A with the outputs combined internally with a massive relay. The power amplifiers then can also drive 2 Ohm and 1 Ohm loads, but the manufacturer advises explicitly that parallel use of the outputs should not be left to the relay alone and the load should not be connected to one output only. When two 4 Ohm speakers should be driven in parallel with a Tecton used in parallel mono mode, it is the best solution to connect one speaker each to the outputs of channel 1 and channel 2.
The outputs of the Tectons are only available on safe Speakon-connectors, following German rules regarding safety at high output voltages. They have both channels crossed on each connector. The inputs are symmetrical XLR-connectors with link-outputs. All four XLR-connectors are mounted on a removable panel, which is also designed for optional modifications at a later date. Above the inputs we find six solid sliding switches for the choice of operating mode mentioned, a ground-lift, a high-pass switch per channel, the limited mode and for the input gain of the amplifier. The latter offers values of 26 dB and 32 dB as well as an input sensitivity of 1.4 V. This is fine for all eventualities. While the positions for 26 dB and 32 dB is clearly defined as twenty- or forty-fold amplification for all models, the choice of 1.4 V sensitivity means a slightly different gain value according to the output power for each model. The 32.4 has a maximum output power of 1830 W at 4 Ohm, equivalent to an output voltage of 85.5 V(eff), which should be reached at an input voltage of 1.4 V(eff). This is equivalent to 61-fold amplification or 35.7 dB. This is exactly the value we had as the result of our test (see pict.9). The function of the highpass-filter of the second degree with frequencies of 30 Hz and 50 Hz, which can be switched for each channel separately, can also be seen in picture 9. Those values were chosen since they are right for typical subwoofers (30 Hz) and larger fullrange cabinets (50 Hz).

Limiter

Of special interest is the limiter switch, which is labeled clip-limiter and has the positions off, slow and fast. The limiter limits the power of the amplifier to the maximum value possible depending on

Inside seen from below with bottom cover removed.

power rating 20 Hz - 20 kHz 1 % THD

	8 Ω	4 Ω	2 Ω
Tecton 38.4	1136 W	1900 W	N/A
Tecton 32.4	918 W	1595 W	N/A
Tecton 24.4	698 W	1216 W	N/A
Tecton 28.2	517 W	920 W	1420 W
Tecton 22.2	355 W	660 W	1140 W
Tecton 14.2	226 W	420 W	730 W

the dynamics in time. The maximum power is allowed for short bursts of up to 2 seconds in length, preventing only a clipping of the power amps. In fast mode the signal is reduced to the maximum power for an overload of 6 dB after 0.8 ms. In slow mode this takes 7 ms. The release time of the limiter is at 40 to 50 ms.

Seen over a longer period, the RMS value of the current taken from the mains is also reduced to the point that about 500 W RMS power is possible per channel. This limiter is called a security limiter by Camco, since it prevents burning up of the mains fuse in the amplifier.

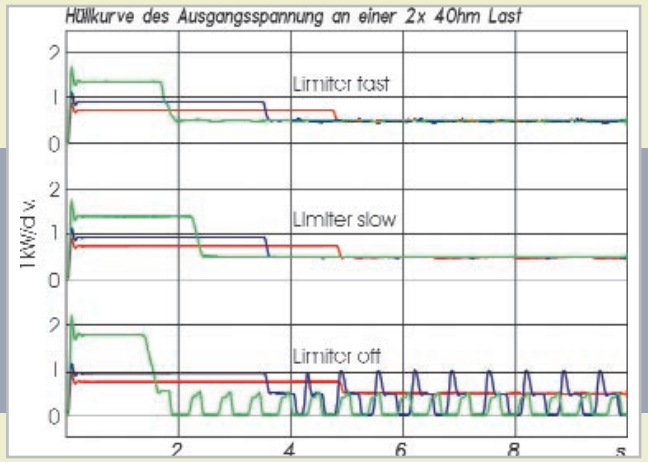
In practical use this means that music signals with a crest factor of 9 dB and more can be handled with full power without problems in peaks up to 1830 Watt. If a constant sine wave was applied, this power would be available for about 2 s before a reduction to 500 W per channel would be forced. Picture 7 shows the time behaviour for several power values – showing very well the power that can be expected as a RMS value for which duration before the onset of the limiter. The difference between fast and slow modes can be seen primarily in the fine structure of the curve which has stronger fluctuations in the fast mode. The limiter acts a little jumpy here and tries repeatedly to open before realising that the high level is still there. This case of a constant sinus wave should be purely hypothetical and would not come up with musical material. But just in case – like a bass-feedback through the turntables of a DJ - the limiting to a power of 500 W per channel is the only reaction to save the speakers from death by overheating. The thermo-limiter is already integrated with this function by Tecton for typical bass speakers with 2 x 18" drivers, constituting a valuable advantage. The lower curves in pict. 7 show the results with clip-limiters completely shut off. The only control left in this case is the safety limiter which regulates the current intake of the transformer to avoid blowing the mains fuse in the amplifier. This mains fuse has only one function – final safety in case of a defect within the amplifier.

To make this as improbable as possible there are a group of safety circuits to protect the power amplifier as well as the connected speakers. The transistors of the power amp are watched over by a SOA Protection (Safe Operation Area) and also protected against impedance falling short of minimum values with a current limiter. There is also a protection circuit against DC of more then 3V voltage at the output. It switches the power amp into „mute" first and then activates standby-mode in the case of longer duration of DC power. The thermo protection controls the ventilator, which runs almost without noise at temperatures below 40° C and only rises to fast turns at high values. If 96° C is reached inside, the power amp is put into mute-mode until the values have stabilized.

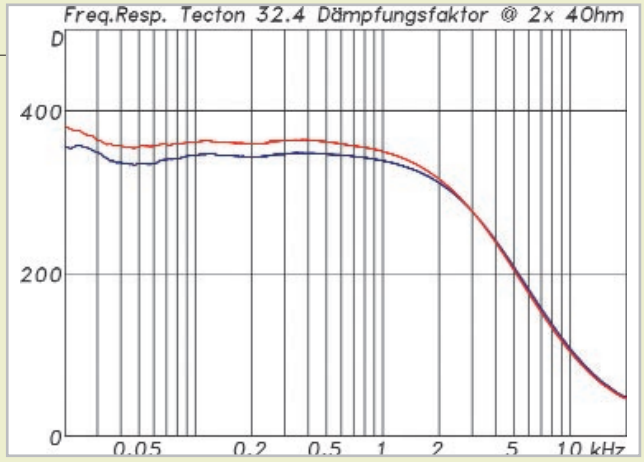
The mains unit of the Tecton begins with a current limiter as a matter of course, since otherwise the (empty) primary condensers would go into the mains as a kind of short-time short-circuit. The mains itself is also watched, so that the poweramplifier is automatically switched off at more then 267 V or the missing of two mains periods (40 ms). When normal conditions return, the Tecton goes online again automatically with a softstart.

Test results

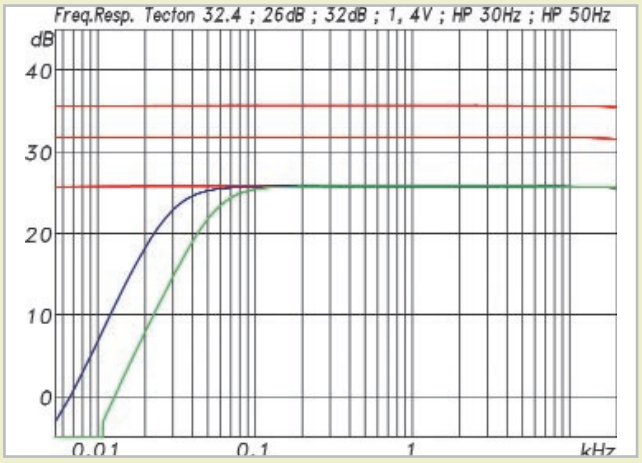
Leaving the rich and usefull features behind, which should enable safe operation under any circumstances, we move on to the test results, starting with noise and dynamics. The noise spectrum showing low noise and a low hum value around 100 Hz, which only shows because of the very low noise values, is shown in picture 1. The total level for the range between 20 Hz and 20 kHz is at –73 dBu or A-weighted at –77dBu. Seen with a maximum outputlevel



Pic. 7: Characteristics of the limiters in the Tecton 32.4. X-scale: time in seconds. Y-scale: power in kW per channel (RMS value); all tests were done with two-channel load. Top = limiter „fast“: the clip limiter works in fast-attack-mode and limits power in combination with the safety limiter for a constant sinus wave of 500 W per channel. The reaction is faster with short strong overload then in the slow mode. The curve is subject to stronger changes as can be seen in the more jumpy flow compared with the slow mode. Looking at the details the signal stays clean and undistorted in the peaks.
Mid graph is limiter „slow“: the clip limiter works in slow attack mode and limits the power together with the safety limiter for a constant sinus wave of 500 W per channel. The signal stays clean and undistorted in the peaks.
Lower graph is limiter „off“: the clip limiter is completely deactivated and only the safety limiter is active, which takes down the amp at extreme values and then periodically tries to start it. The shows that the signal is clipped hard in the peaks.

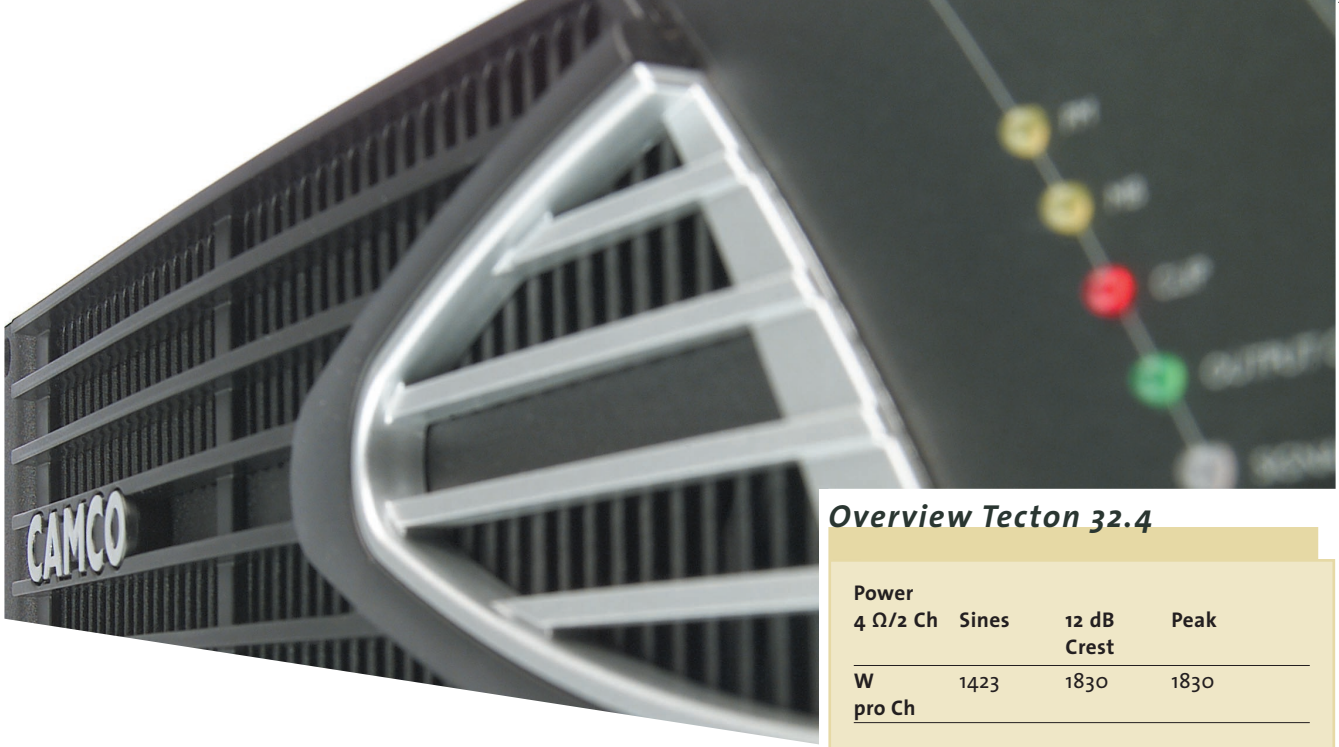


Pic. 8: Damping depending on the frequency at a load of 4 Ohm. The values of 350 reached here are at the limit technically possible at all if the test is done with the normal connectors and is not taken directly at the circuit board. The remaining resistance at a damping factor of 350 is 11 mOhm!



Pic. 9: Frequency response of the Tecton for gains 26 dB, 32 dB and 1.4 V sensitivity (35.7 dB). Additional highpass-filters of the second degree with cutoff frequencies of 30 Hz and 50 Hz can be activated with switches on the back panel. These frequencies are (if desired or necessary) designed for typical use with subwoofers or fullrange cabinets respectively.

of 40,86 dBu there is a dynamic of 114 dB even unweighted. With A-weighting the Tecton reaches 118 dB, a value rarely reached even by high-end HiFi amplifiers.
The THD-curves in picture 2 are typical for a power amplifier with multiple stage supply voltage, which can be seen in the jump of the curve at exactly half of the maximum output voltage. This value is reached at an input voltage of about +7.5 dBu with the Tecton 32.4. The limiter starts working from an input voltage of +11 dBu, since the sinus signal is constant in the tests and the power is accordingly limited to about 500 W RMS per channel. The red curve shows the characteristic with clip-limiter activated and the blue curve is without clip-limiter, where the safety limiter starts to close down the amp to periodically after a certain time. The related distortion spectrum, measured at 200 W output power per channel into 4 Ohm, shows the spectral distribution of distortion, which primarily consists of uneven partials and only falls off slowly to higher degrees. This happens at such a low level that it is not relevant. The THD values seen with the frequencies in picture 4 are normal with the typical rise of 20 dB/Dec. to the higher frequencies, where the counter-coupling of the amplifier is reduced. The same effect is mirrored in the damping in picture 8, where extremely good values of 350 referred to 4 Ohm are reached at 1 kHz and the curve then recedes to the higher frequencies. But even at 10 kHz a value of 100 is still reached. Which is equivalent to an inner impedance of only 40 mOhm. Better values then the 350 reached here can hardly be reached in practice – unless the signal is taken directly from the circuit board of the power amp without the influence of internal connectors and the speakon connectors. It has to be considered that a damping factor of 350 is equivalent to an internal resistance of only 11mOhm. Well coming back from this little sidetrip about damping we sum up the distortion tests with transient intermodulation distortion (DIM100) in picture 5. These values fall easily to –85 dB and only rise at the switching point to a still good value of –70 dB. Just before clipping the limiter influences the test, since this is also tested with a constant signal.



Power

The complete power profile was run for the Tecton 32.4 even though use with 2 Ohms is not advised, meaning that these values are just hypothetical information and should not seduce the user into using the amplifier with a 2 Ohm load, which would lead to overheating and therefore a switch-off in the long run. For loads of 16, 8 and 4 Ohm the Tecton proves to be very tough in respect to the power supply, since each halving of the load results in a almost twice the power. If we assume the realistic power value to be at 12 dB crestfactor, then 1830 W can be achieved from the 32.4 into 4 Ohm. The amplifier is suitable for large subwoofers with this. This power rating is also very good for typical 15/2 cabinets that often can handle 900 W program power without problems and are also protected against overheating as a side-effect by the safety limiter of the Tecton. A similar case would be four smaller 16 Ohm systems connected in parallel. The big advantage is that you don't have to worry about limiters whenever the loudspeaker rating is about right for the power, since the combination of clip- and RMS-limiter of the Tecton should take care of most common speakers.

Conclusion

With the Tecton series Camco is directly introducing six models in the class below the Vortex series. The power-range extends from 2 x 700 W to 2 x 1900 W. The features are very good, especially regarding the very complete and well designed protection circuits. Special attention is deserved by the limiters, which are perfectly tuned to everyday use with clip- and RMS-character and not only prevent clipping of the power amp, but also offer solid protection for the connected speakers. The test results are excellent in all respects and do not have to hide behind the bigger Vortex. Connectivity, ease of use and quality are completely up to the usual quality of Camco. The pricing of the Tectons is pleasingly moderate and anyhow you could never go wrong with a Camco poweramp as an investment and regarding resale value.

Text and tests: Anselm Goertz
Translation: Alex Merck
Photos: Petia Chtarkova

Overview Tecton 32.4

Power 4 Ω/2 Ch	Sines	12 dB Crest	Peak
W pro Ch	1423	1830	1830

Noise	dBu	dBu(A)	
	-73	-77	
Dynamics	**dB**	**dB(A)**	
	114	118	
f[Hz]	**20**	**1 k**	**20 k**
Gain dB (switchable to 26 dB, 32 dB or 35,7 dB (=1,4V Sens.))	25,7	25,8	25,6
Phase °	7°	-3°	-55°
HP-Filter	<5 Hz (30 Hz, 50 Hz)		
TP-Filter	60 kHz		

f[Hz]	100	1 k	10 k
CTC dB	-87	-86	-68
CMRR dB	76	76	73
DF rel. 4Ω	350	340	105

THD(f) @ 200W/4Ω	-83	-92	-73

	Min.	vor Clip
THD 1kHz	-92	-83
DIM100	-87	-70
SMPTE 60/7k	-80	-73
DFD IEC268	-112	-90

Power/Weight	407 Watt/kg
Price/Power	0,643 g/Watt
Weight kg	9
Height HE	2
Price	ca. 2.355 Euro
S.Nr.	27362
Remote	Win Cai (zukünftig optional)

All power measured with 2 channels running. Power/Weight and Price/Power ratings for both channels summed into 4 Ohm at 12 dB crestfactor. Dynamics calculated from peak power into 4 Ohm and noise level. CTC at 10 Watt, CMRR, DF damping referred to 4 Ohm.