



APPLICATION NOTES

POWER SHARING

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Power Sharing is a technology developed by Powersoft which allows customers to use the power of each amplifier channel asymmetrically. It is a standard feature of all Powersoft's DSP and Dante enabled amplifiers and does not need to be activated or requires any special firmware.

In normal amplifiers, power in each channel is symmetrically divided. For instance, in a 3000W, 4-channel amplifier, each channel normally delivers 750W. But with Power Sharing, one or two amplifier channels can be driven to deliver more than those symmetrical 750W, whilst reducing the available power in the other remaining channels.

However, this relationship between more and less power in specific channels is not constant and varies according to certain parameters. For this reason, Powersoft has developed the Power Sharing Tool to allow customers to understand, for each amplifier model, how they will behave according to the different loudspeaker configurations and/or ways to be connected to each amplifier channel; and if more power is needed or any headroom is still available.

Important note: while it is possible to increase the power delivered by some amplifier channels, the total power required may **not exceed the maximum specific power** of the amplifier.

Power Sharing is available in the following amplifier models:

8 Channels		4 Channels		2 Channels	
T Series		T304 T604		T302 T602	
Ottocanali Series	4k4 DSP+D 8K4 DSP+D 12K4 DSP+D	Quattrocanali Series	1204 DSP+D 2404 DSP+D 4804 DSP+D	Duecanali Series	804 DSP+D 1604 DSP+D 4804 DSP+D
X Series	X8		X4		

Table 1 – List of Powersoft amplifiers with Power Sharing available.



Power Sharing Tool

The Power Sharing Tool consists of a simple spreadsheet (Figure 1) containing three sheet tabs, one for each number of channels available in Powersoft amplifiers, i.e. 2-channel, 4-channel and 8-channel amplifiers.

User Input						
Amplifier model	T604					
V mains	230 V	I mains	20 Arms			
	Channel					
Loudspeaker data	1	2	3	4		
P AES (or Hi-Z tapping) per speaker	500 W	500 W	500 W	500 W		This should be the AES power for one cabinet or the tap value of a Hi-Z loudspeaker.
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z		Select how you want to drive the loudspeaker
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm		Only used if Lo-Z
#cabinets in parallel	1	1	1	1		Enter a number: e.g. 1/2/3/4, but could be as high as 40 for 70/100V speakers.
Profile	SW	SW	SW	SW		Select: SW / LF / MF / HF / FR
User limiter	0 dB	0 dB	0 dB	0 dB		Select full power (0 dB) or some reduced power with a negative dB value
Desired output from the amplifier						
	Channel				Total	Headroom
P burst	1000 W	1000 W	1000 W	1000 W	4000 W	1,8 dB
P average	80 W	80 W	80 W	80 W	318 W	4,2 dB
Peak voltage	126,5 Vpk	126,5 Vpk	126,5 Vpk	126,5 Vpk	126,5 Vpk	
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm		
Z min	6,2 ohm	6,2 ohm	6,2 ohm	6,2 ohm		This is an assumption to try to ensure that there is output current headroom in the impedance dips.
Possible power from the amplifier						
I mains limited to					2,4 Arms	7,9 dB
Possible vs desired (burst)	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	
Possible vs desired (average)	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	
Headroom	● 1,2 dB	● 1,2 dB	● 1,2 dB	● 1,2 dB	● 1,2 dB	
P loss					140 W	
BTU					476 BTU/h	

Figure 1 – Power Sharing Tool for a 4-channel amplifier.

The primary purpose of this tool is to illustrate the Power Sharing capability of amplifiers. In order to give an idea of the heat dissipation and the resulting cooling needs, as well as the current draw, this tool also contains a simplified model of the amplifier's behaviour and some estimates regarding the expected program content. It also makes assumptions regarding the reactive behaviour of the connected loudspeaker(s).

Both scenarios combined may lead to a lower estimate compared to the current draw and heat dissipation data sheets which have been previously published, as those have been produced using resistive dummy loads.

As Powersoft is not in control of the user input content, nor the precise loudspeaker behaviour, this document should be seen as a guideline, as the exact numbers cannot be guaranteed.



Procedure for Calculating Power Sharing

The Power Sharing Tool can be used either by first choosing the amplifier model, and then finding out which loudspeaker and/or way configuration is best suited for it; or by inserting the loudspeaker and/or way configuration first and then switching between different amplifier models to find the one that presents the best calculated performance.

To calculate the Power Sharing:

1. Start by selecting the appropriate sheet to work with: **8 Channels**, **4 Channels** or **2 Channels**.
2. In '**Amplifier model**', select the amplifier model from the drop-down list (Figure 2).



Figure 2 – Amplifier model selection.

3. In '**V Mains**', select the voltage at which the amplifier will be powered from the drop-down list (Figure 3).

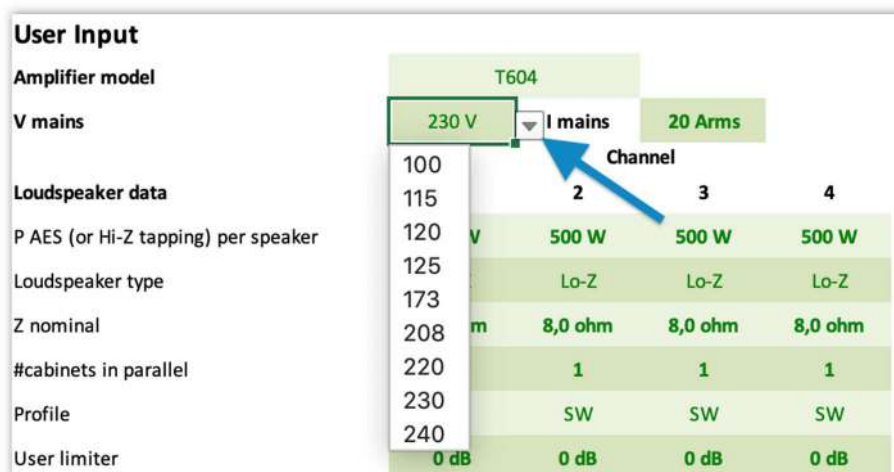


Figure 3 – Mains voltage selection.

4. Under '**I mains**', a limitation of the current drawn from the mains can be manually inserted. This limitation may be necessary when using a breaker/fuse with a trip point below what the amplifier can theoretically draw, and/or when finding a way for more amplifiers to share the same breaker/fuse.

The following values should be used if no limitation to the mains current is desired:



- 32 ARMS for 8-channel amplifiers;
- 20 ARMS for 4-channel amplifiers;
- 15 ARMS for 2-channel amplifiers.

User Input				
Amplifier model	T604			
V mains	230 V	I mains	20 Arms	
	Channel			
Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	500 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	8,0 ohm	4,0 ohm	8,0 ohm	8,0 ohm

Figure 4 – Configuration of mains current limit.

Important note: if a current limitation is inserted in the Power Sharing Tool, this limitation needs to be reflected in the amplifier, in order to ensure the calculations will display the correct amplifier's behaviour and how much it will require from the electrical panel. This can be with the 'Mains Limit' function from ArmoníaPlus (Figure 5).



Figure 5 – Mains Limit function in ArmoníaPlus.

5. Under 'P AES', specify the power required by each channel in Watts (Figure 6). This should be the 'AES Power' for one cabinet or the tap value of a Hi-Z loudspeaker. The 'AES Power' can be found in most loudspeaker datasheets. Alternatively, it can be calculated as 1/2 of the program power and 1/4 of the peak power.

User Input				
Amplifier model	T604			
V mains	230 V	I mains	20 Arms	
	Channel			
Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	550 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm

Figure 6 – Configuration of AES Power required per channel.



- In '**Loudspeaker Type**', select how the channel is used so that the tool can correctly calculate the power needed (Figure 7).

The available options are:

- **Lo-Z**: for low impedance loudspeakers – the tool works with any values between 2 – 64 Ohms;
- **100V, 70V, 25V**: for Hi-Z loudspeakers;
- **Unused**: for channels not in use (instead of setting the power to 0).

Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	550 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	Lo-Z	8,0 ohm	8,0 ohm	8,0 ohm
#cabinets in parallel	100V	1	1	1
Profile	70V	SW	SW	SW
User limiter	25V	0 dB	0 dB	0 dB
	Unused			

Figure 7 – Loudspeaker type selection.

- Under '**Z nominal**', enter the nominal impedance for each loudspeaker (or way); e.g. 4, 8 or 16 Ohms (Figure 8). These cells can be ignored for 25/70/100V loudspeakers.

Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	550 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm
#cabinets in parallel	1	1	1	1
Profile	SW	SW	SW	SW
User limiter	0 dB	0 dB	0 dB	0 dB

Figure 8 – Configuration of Z nominal.

- In '**#Cabinet in parallel**', enter the number of loudspeakers to be connected to each channel (in parallel). This number can be as high as 40 for 70/100V loudspeakers.

Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	550 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm
#Cabinets in parallel	2	1	1	1
Profile	SW	SW	SW	SW
User limiter	0 dB	0 dB	0 dB	0 dB

Figure 9 – Number of cabinets in parallel.



9. In '**Profile**' choose the bandwidth for that loudspeaker or way from the drop-down list. Options available are Subwoofer (SW), Low-Frequency (LF), Mid-Frequency (MF), High-Frequency (HF) and Full Range (FR).

Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	550 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm
#Cabinets in parallel	2	1	1	1
Profile	SW	SW	SW	SW
User limiter	SW	0 dB	0 dB	0 dB
Desired output from the amplifier	Channel			
		2	3	4
P burst	W	1000 W	1000 W	1000 W
P average	W	80 W	80 W	80 W
Peak voltage	132,7 Vpk	126,5 Vpk	126,5 Vpk	126,5 Vpk

Figure 10 – Profile selection.

Additional note: The Profile refers to the crest factor of the test signal and it also tries to estimate the average effect of the reactive behaviour of the loudspeaker. The sum of these two values is used to find the expected average power requirement. In the Power Sharing Tool, the following values are used:

Profile	Crest Factor	Reactive Savings	Peak vs Average
Subwoofer (SW)	12.0 dB	+ 2.0 dB	= 14.0 dB
Low-Frequency (LF)	14.0 dB	+ 1.4 dB	= 15.4 dB
Mid-Frequency (MF)	16.0 dB	+ 1.2 dB	= 17.2 dB
High-Frequency (HF)	19.0 dB	+ 0.8 dB	= 19.8 dB
Full Range (FR)	16.0 dB	+ 0.8 dB	= 16.8 dB

Table 2 – Crest factor of each Profile.

In real life, the loudspeaker will also heat up leading to power compression. This effect typically comprises a further 1 dB or more reduction to the average power, but it has been ignored in this tool as a safety margin.

10. '**User limiter**' can be used when a specific channel does not need to supply all the power specified to it (Figure 11). A power reduction can be applied to a specific channel by inserting **negative values** in dB to this field. For full power, the user limiter should be left as '0 dB'.



User Input				
Amplifier model	T604			
V mains	230 V	I mains	20 Arms	
	Channel			
Loudspeaker data	1	2	3	4
P AES (or Hi-Z tapping) per speaker	550 W	500 W	500 W	500 W
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm
#Cabinets in parallel	2	1	1	1
Profile	SW	SW	SW	SW
User limiter	0 dB	0 dB	0 dB	0 dB
Desired output from the amplifier	Channel			
	1	2	3	4

Figure 11 – User limiter.

Additional note: When a user limiter is used, this lowered power configuration should be reflected in the 'Shading' function in ArmoníaPlus (Figure 12) in order to match the settings and ensure correct results.

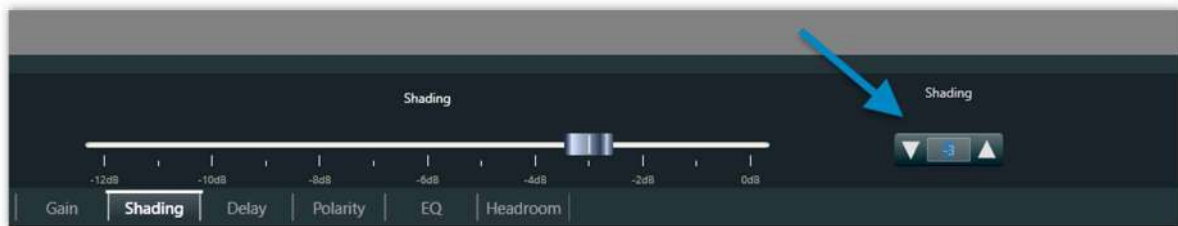


Figure 12 – Shading Function in ArmoníaPlus.

- Once all the steps above have been followed, the Power Sharing Tool will display the various calculated parameters under 'Desired output from the amplifier' (Figure 13). Double-check that all results are in line with those expected and that no parameters present unusual values. For example, if headroom numbers in the far-right column are positive, then the total power required from the amplifier is appropriate.

Desired output from the amplifier	Channel				Total	Headroom
	1	2	3	4		
P burst	2200 W	1000 W	1000 W	1000 W	5200 W	0,6 dB
P average	175 W	80 W	80 W	80 W	414 W	3,1 dB
Peak voltage	132,7 Vpk	126,5 Vpk	126,5 Vpk	126,5 Vpk	132,7 Vpk	
Z nominal	4,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm		
Z min	3,2 ohm	6,2 ohm	6,2 ohm	6,2 ohm		

Figure 13 – Desired output from the amplifier.



Reading Power Sharing Results

In the 'Possible power from the amplifier' section (Figure 14), traffic lights will tell how the Power Sharing is working (Figure 15). It is possible to verify the 'Possible vs. desired (Burst and Average)' for each channel, as well as whether there is any headroom left in the amplifier or whether a more powerful amplifier is needed.







Possible power from the amplifier	Channel	Total	Headroom
I mains limited to		3,1 Arms	6,9 dB
Possible vs desired (burst)		 0,0 dB	
Possible vs desired (average)		 0,0 dB	
Headroom			 0,8 dB
P loss		165 W	
BTU		561 BTU/h	

Figure 14 – Possible power from the amplifier.










 -2,2 dB	 -0,9 dB	 0,0 dB
 0,0 dB	 0,0 dB	 0,0 dB
 -2,2 dB	 -0,9 dB	 1,2 dB

Figure 15 – Coloured signals.

The traffic lights colour coding is as follows:

Green: DONE! There is still enough headroom for signal peaks, as well as for the continuous average. With this configuration the amplifier will not be operating at its limit and the output signal will not be affected.

Yellow: The Power Sharing configuration **slightly exceeds** the amplifier’s specifications. It is still within a range in which the amplifier can operate but limiting may occur.

Red: The amplifier specifications have been **exceeded**. In this case, it is strongly recommended to do at least one of the following:

- change the 'Amplifier model' for this configuration of speakers and ways;
- change the configuration of speakers or ways;
- change the cabinets in parallel count or combination;
- change the 'User limiter' to get out of this situation.

Figure 16 below displays an example of a correct Power Sharing application, where a T604 4-channel amplifier is asked to deliver 2400W at 4Ω on channel one. This is considerably more power than the usual 1500W at 4Ω per channel it would normally provide symmetrically.



User Input							
Amplifier model	T604						
V mains	230 V	I mains	20 Arms				
	Channel						
Loudspeaker data	1	2	3	4			
P AES (or Hi-Z tapping) per speaker	1200 W	500 W	650 W	500 W			
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z			
Z nominal	4,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm			
#Cabinets in parallel	1	1	1	1			
Profile	SW	FR	LF	MF			
User limiter	0 dB	0 dB	0 dB	0 dB			
Desired output from the amplifier	Channel				Total	Headroom	
	1	2	3	4			
P burst	2400 W	1000 W	1300 W	1000 W	5700 W	0,2 dB	
P average	191 W	42 W	75 W	38 W	346 W	3,9 dB	
Peak voltage	138,6 Vpk	126,5 Vpk	144,2 Vpk	126,5 Vpk	144,2 Vpk		
Z nominal	4,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm			
Z min	3,2 ohm	6,2 ohm	6,2 ohm	6,2 ohm			
Possible power from the amplifier							
I mains limited to						2,5 Arms	7,8 dB
Possible vs desired (burst)	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	
Possible vs desired (average)	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	
Headroom	● 0,4 dB	● 1,2 dB	● 0,0 dB	● 1,2 dB		● 0,0 dB	
P loss						125 W	
BTU						428 BTU/h	

Figure 16 – Example of correct Power Sharing configuration.

Figure 17 below displays an example of a not recommendable Power Sharing application. In this configuration, channel one is asked to deliver more power than it can provide with Power Sharing. At least one of the solutions mentioned above should be applied to correct the issue.

User Input							
Amplifier model	T604						
V mains	230 V	I mains	20 Arms				
	Channel						
Loudspeaker data	1	2	3	4			
P AES (or Hi-Z tapping) per speaker	1000 W	800 W	500 W	200 W			
Loudspeaker type	Lo-Z	Lo-Z	Lo-Z	Lo-Z			
Z nominal	8,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm			
#Cabinets in parallel	2	1	1	1			
Profile	SW	LF	MF	HF			
User limiter	0 dB	0 dB	0 dB	0 dB			
Desired output from the amplifier	Channel				Total	Headroom	
	1	2	3	4			
P burst	4000 W	1600 W	1000 W	400 W	7000 W	-0,7 dB	
P average	318 W	92 W	38 W	8 W	457 W	2,6 dB	
Peak voltage	178,9 Vpk	160,0 Vpk	126,5 Vpk	80,0 Vpk	178,9 Vpk		
Z nominal	4,0 ohm	8,0 ohm	8,0 ohm	8,0 ohm			
Z min	3,2 ohm	6,2 ohm	6,2 ohm	6,2 ohm			
Possible power from the amplifier							
I mains limited to						3,2 Arms	6,7 dB
Possible vs desired (burst)	● -2,2 dB	● -0,9 dB	● 0,0 dB	● 0,0 dB	● -2,2 dB	● -2,2 dB	
Possible vs desired (average)	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	● 0,0 dB	
Headroom	● -2,2 dB	● -0,9 dB	● 1,2 dB	● 5,2 dB		● -2,2 dB	
P loss						154 W	
BTU						525 BTU/h	

Figure 17 – Example of an incorrect Power Sharing configuration. Too much is asked from the amplifier in terms of burst (program) power, for both channel 1 and total power.



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