# APPLICATION NOTES

POWER SHARING

# POWER SHARING

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 more channels can be driven to deliver more than those symmetrical 750W 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 / X4L | | |
| **Mezzo Series** | | | 324 A / AD 604 A / AD | | 322 A / AD 602 A / AD |

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

# Power Sharing Tool

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

The primary purpose of this tool is to illustrate the Power Sharing capability of Powersoft amplifiers. It gives the user an idea of which model to select for system design purposes and/or live performance requirements while also looking at the average amplifier current draw, limit and expected headroom on a per channel basis. The tool also indicates suggested limiter thresholds for all loudspeaker profiles given (Figure 1).

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.



**POWER SHARING**

| User Input | | | | | Comments |
|---|---|---|---|---|---|
| Amplifier model | MEZZO 604 | | | | |
| Mains | 230 V | 16 A | | | The amplifier should only need 0.2A as an average over time. The amplifier is limited to 4.5A |
| | | | Channel | | |
| Loudspeaker data | 1 | 2 | 3 | 4 | |
| $P_{AES}$ (or Hi-Z tap) | 40 W | 40 W | 40 W | 40 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: Lo-Z / 100V / 70V / 25V / Unused |
| Z nominal | 4.0 ohm | 4.0 ohm | 4.0 ohm | 4.0 ohm | Nominal impedance (Only necessary if Lo-Z) |
| #Cabinets in parallel | 1 | 1 | 1 | 1 | Number of parallel speakers per channel |
| Profile | FR | FR | FR | FR | Select: SW / LF / MF / HF / FR |
| User limiter | 0 dB | 0 dB | 0 dB | 0 dB | Select full power (0 dB) or reduce power with a negative dB value |
| **Amplifier Output** | | | Channel | | |
| | 1 | 2 | 3 | 4 | |
| Power | 80 W | 80 W | 80 W | 80 W | Lo-Z speaker = $P_{AES}$ x 2, Hi-Z speaker = rated power |
| Z | 4.0 ohm | 4.0 ohm | 4.0 ohm | 4.0 ohm | Overall impedance |
| | | | | | Dipswitch setting for Canali series |
| Headroom | ✅ 2.7 dB | ✅ 2.7 dB | ✅ 2.7 dB | ✅ 2.7 dB | |
| **Suggested Limiters Treshold** | | | | | |
| Clip voltage | 27 Vpk | 27 Vpk | 27 Vpk | 27 Vpk | |
| Peak voltage | 20 Vpk | 20 Vpk | 20 Vpk | 20 Vpk | |
| Attack Time Range | 2 - 8 ms | 2 - 8 ms | 2 - 8 ms | 2 - 8 ms | |
| Release Time Range | 16 - 64 ms | 16 - 64 ms | 16 - 64 ms | 16 - 64 ms | |
| RMS voltage | 8 Vpk | 8 Vpk | 8 Vpk | 8 Vpk | |
| Attack Time Range | 0,3 - 0,8 sec | 0,3 - 0,8 sec | 0,3 - 0,8 sec | 0,3 - 0,8 sec | |
| Release Time Range | 0.5 - 2 sec | 0.5 - 2 sec | 0.5 - 2 sec | 0.5 - 2 sec | |

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

# 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 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).
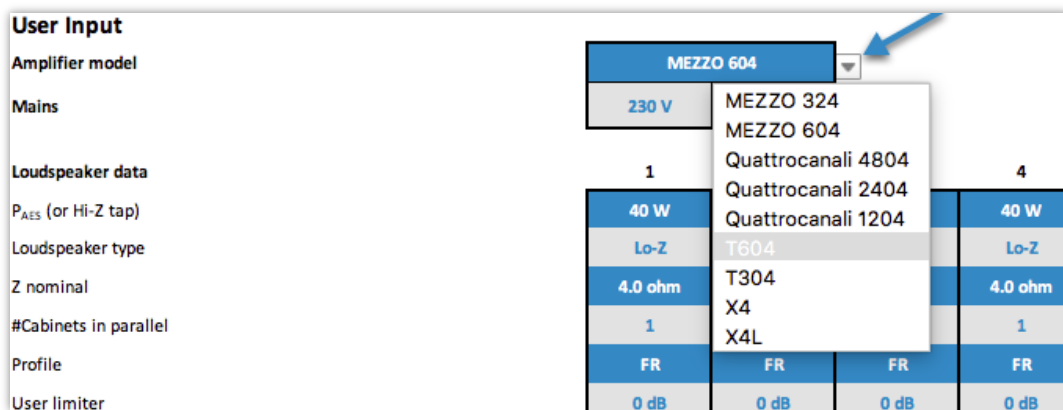


Figure 2 – Amplifier model selection.

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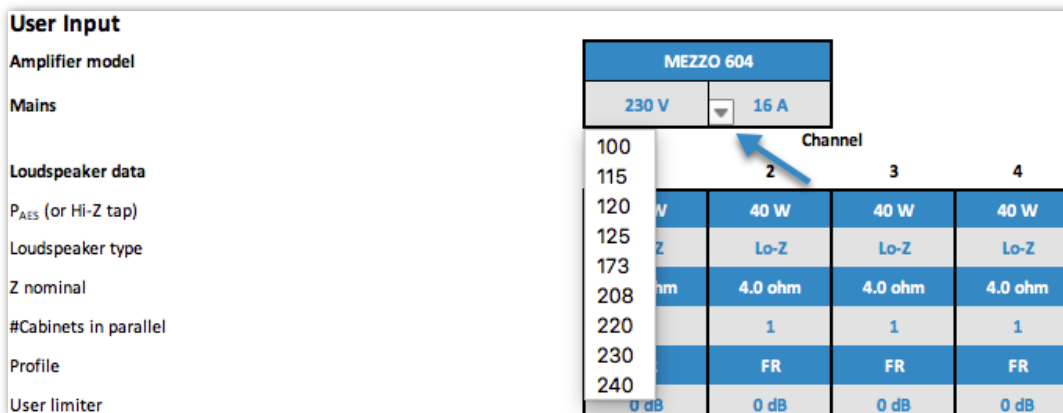


Figure 3 – Mains voltage selection.

4.  Under **'Mains'**, a limitation of the current draw to 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 (Figure 4).



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 into the amplifier, in order to ensure the calculations will display the correct behaviour from the electrical panel. This can be done with the 'Mains Limit' function in 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.



Figure 6 – Configuration of AES power required per channel.

6. 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).



Figure 7 – Loudspeaker type selection.

7. 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 | Channel | | | |
| --- | --- | --- | --- | --- |
| | 1 | 2 | 3 | 4 |
| $P_{AES}$ (or Hi-Z tap) | 600 W | 600 W | 300 W | 300 W |
| Loudspeaker type | Lo-Z | Lo-Z | Lo-Z | Lo-Z |
| Z nominal | 4.0 ohm | 4.0 ohm | 8.0 ohm | 8.0 ohm |
| #Cabinets in parallel | 1 | 1 | 1 | 1 |
| Profile | SW | SW | FR | FR |
| User limiter | 0 dB | 0 dB | 0 dB | 0 dB |

Figure 8 – Configuration of Z nominal.

8. In '**#Cabinets in parallel**', enter the number of loudspeakers to be connected to each channel in parallel (Figure 9). This number can be as high as 128 for 25/70/100V loudspeakers.

| Loudspeaker data | Channel | | | |
| --- | --- | --- | --- | --- |
| | 1 | 2 | 3 | 4 |
| $P_{AES}$ (or Hi-Z tap) | 15 W | 600 W | 300 W | 300 W |
| Loudspeaker type | 70V | Lo-Z | Lo-Z | Lo-Z |
| Z nominal | 4.0 ohm | 4.0 ohm | 8.0 ohm | 8.0 ohm |
| #Cabinets in parallel | 128 | 1 | 1 | 1 |
| Profile | FR | SW | FR | FR |
| 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 (Figure 10). Options available are Subwoofer (SW), Low-Frequency (LF), Mid-Frequency (MF), High-Frequency (HF) and Full Range (FR).



Figure 10 – Profile selection.

**Additional note:** The Profile refers to the crest factor of the test signal and it also estimates 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 (Table 2). 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'.



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.
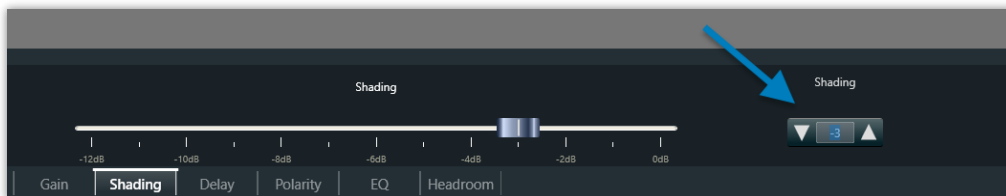


Figure 12 – Shading function in ArmoníaPlus.

11. Once all the steps above have been followed, the Power Sharing Tool will display the calculated power, impedance and headroom under 'Amplifier Output' as well the 'Suggested Limiters Threshold' for each loudspeaker Profile. (Figure 13). Double-check that all the results are in line with those expected and that no parameters present unusual values. The 'Suggested Limiters Threshold' values can be entered through the 'DSP View' within the 'Ways EQ' of the modelled amplifier in ArmoniaPlus (Figure 14).

| Loudspeaker data | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| $P_{AES}$ (or Hi-Z tap) | 900 W | 600 W | 300 W | 300 W |
| Loudspeaker type | Lo-Z | Lo-Z | Lo-Z | Lo-Z |
| Z nominal | 4.0 ohm | 4.0 ohm | 8.0 ohm | 8.0 ohm |
| #Cabinets in parallel | 1 | 1 | 1 | 1 |
| Profile | SW | LF | FR | FR |
| User limiter | 0 dB | 0 dB | 0 dB | 0 dB |
| **Amplifier Output** | Channel | | | |
| | 1 | 2 | 3 | 4 |
| Power | 1800 W | 1200 W | 600 W | 600 W |
| Z | 4.0 ohm | 4.0 ohm | 8.0 ohm | 8.0 ohm |
| Headroom | ✓ 0.6 dB | ✓ 1.5 dB | ✓ 1.5 dB | ✓ 1.5 dB |
| **Suggested Limiters Treshold** | | | | |
| Clip voltage | 126 Vpk | 103 Vpk | 103 Vpk | 103 Vpk |
| Peak voltage | 96 Vpk | 78 Vpk | 78 Vpk | 78 Vpk |
| Attack Time Range | 16 - 32 ms | 8 - 16 ms | 2 - 8 ms | 2 - 8 ms |
| Release Time Range | 128 - 384 ms | 64 - 256 ms | 16 - 64 ms | 16 - 64 ms |
| RMS voltage | 42 Vpk | 32 Vpk | 29 Vpk | 29 Vpk |
| Attack Time Range | 2 - 4 sec | 1 - 2 sec | 0,3 - 0,8 sec | 0,3 - 0,8 sec |
| Release Time Range | 4- 8 sec | 2 - 4 sec | 0,5 - 2 sec | 0,5 - 2 sec |

Figure 13 – Amplifier Output and Suggested Limiters Threshold.



Figure 14 – Suggested Limiters Threshold value entry point within ArmoniaPlus.

# Reading Power Sharing Results

In the 'Amplifier Output' section within 'Headroom' (Figure 15), traffic lights will show how the Power Sharing is functioning and verify as to whether there is enough headroom left in the amplifier and whether a more powerful amplifier or loudspeaker or ways combination is required.

| Amplifier Output | | Channel | | | |
|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** |
| Power | | 2000 W | 3300 W | 2600 W | 600 W |
| Z | | 4.0 ohm | 4.0 ohm | 8.0 ohm | 8.0 ohm |
| Headroom | | ✅ -1.5 dB | ⚠️ -2.1 dB | ❌ -3.0 dB | ✅ -1.5 dB |

Figure 15 – Possible Headroom from the amplifier.

The traffic lights color coding is as follows:

✅ **Green**: WELL 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 will 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 resolve 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.

Figure 17 displays an example of a not recommendable Power Sharing application. In this configuration, channel one is asked to deliver more burst power (program) 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 | | | |
| Mains | 208 V | 16 A | | |

| Loudspeaker data | Channel 1 | Channel 2 | Channel 3 | Channel 4 |
|---|---|---|---|---|
| $P_{AES}$ (or Hi-Z tap) | 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 |

| Amplifier Output | Channel 1 | Channel 2 | Channel 3 | Channel 4 |
|---|---|---|---|---|
| Power | 2400 W | 1000 W | 1300 W | 1000 W |
| Z | 4.0 ohm | 8.0 ohm | 8.0 ohm | 8.0 ohm |
| Headroom | ✓ -0.7 dB | ✓ 0.2 dB | ✓ 0.0 dB | ✓ 0.2 dB |

**Suggested Limiters Treshold**

| | Channel 1 | Channel 2 | Channel 3 | Channel 4 |
|---|---|---|---|---|
| Clip voltage | 145 Vpk | 133 Vpk | 151 Vpk | 133 Vpk |
| Peak voltage | 111 Vpk | 101 Vpk | 115 Vpk | 101 Vpk |
| Attack Time Range | 16 - 32 ms | 2 - 8 ms | 8 - 16 ms | 2 - 8 ms |
| Release Time Range | 128 - 384 ms | 16 - 64 ms | 64 - 256 ms | 16 - 64 ms |
| RMS voltage | 48 Vpk | 38 Vpk | 47 Vpk | 38 Vpk |
| Attack Time Range | 2 - 4 sec | 0,3 - 0,8 sec | 1 - 2 sec | 0,3 - 0,8 sec |
| Release Time Range | 4 - 8 sec | 0,5 - 2 sec | 2 - 4 sec | 0,5 - 2 sec |

Figure 16 – Example of correct Power Sharing configuration.



**User Input**

| | | | | |
|---|---|---|---|---|
| Amplifier model | T604 | | | |
| Mains | 208 V | 16 A | | |

| Loudspeaker data | Channel 1 | Channel 2 | Channel 3 | Channel 4 |
|---|---|---|---|---|
| $P_{AES}$ (or Hi-Z tap) | 1300 W | 800 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 | LF | MF | HF |
| User limiter | 0 dB | 0 dB | 0 dB | 0 dB |

| Amplifier Output | Channel 1 | Channel 2 | Channel 3 | Channel 4 |
|---|---|---|---|---|
| Power | 2600 W | 1600 W | 1000 W | 1000 W |
| Z | 8.0 ohm | 8.0 ohm | 8.0 ohm | 8.0 ohm |
| Headroom | ✗ -3.0 dB | ✓ -0.9 dB | ✓ -0.1 dB | ✓ -0.1 dB |

**Suggested Limiters Treshold**

| | Channel 1 | Channel 2 | Channel 3 | Channel 4 |
|---|---|---|---|---|
| Clip voltage | 214 Vpk | 168 Vpk | 133 Vpk | 133 Vpk |
| Peak voltage | 163 Vpk | 128 Vpk | 101 Vpk | 101 Vpk |
| Attack Time Range | 16 - 32 ms | 8 - 16 ms | 2 - 8 ms | 0,5 - 2 ms |
| Release Time Range | 128 - 384 ms | 64 - 256 ms | 16 - 64 ms | 8 - 32 ms |
| RMS voltage | 71 Vpk | 52 Vpk | 38 Vpk | 35 Vpk |
| Attack Time Range | 2 - 4 sec | 1 - 2 sec | 0,3 - 0,8 sec | 0,15 - 0,3 sec |
| Release Time Range | 4 - 8 sec | 2 - 4 sec | 0,5 - 2 sec | 0,3 - 0,8 sec |

Figure 17 – Example of an incorrect Power Sharing configuration.

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## Powersoft S.p.A

Via E. Conti, 5 – Scandicci (Fi) 50018 – Italy
TELEPHONE: +39 055 7350230

General Enquires: info@powersoft.it
Sales: sales@powersoft.it
Application & Technical Support: support@powersoft.it
Service & Maintenance: service@powersoft.it

**www.powersoft.com**