# Primare A35.8 Design Brief


A35.8 Eight Channel Amplifier

The A35.8 is Primare's most powerful and flexible multi-channel amplifier, designed to serve the needs of virtually any high-performance two and multi-channel system through its ability for each pair of its eight channels to be bridged to mono for an incredible level of power delivery, up to 1500 watts in total.

- 8 channels, 150 watts per channel (all channels driven)
- Output stage based on Hypex NCore500 amp modules
- XLR and RCA inputs
- Each pair of channels is bridgeable to mono

Power Supply Section

Given the total power output of the A35.8 a switch mode power supply was the only choice in that it allows for rapidly varying demand, providing much more stable voltage, with ancillary capacitive storage to meet peak transient burst requirements.

To meet the need, a completely new power supply, the most powerful we have made, was designed to deliver the electrical power needed for the eight amplifier modules to produce the immense amount of musical power of which it is capable. For a point of comparison, the 200-watt per channel rated A35.2 uses a 900-watt power supply while the 1500-watt full output rated A35.8 uses a 1500-watt supply, effectively delivering more than 60% more power to the output modules. Dual outputs from the power supply mean that each group of four amplifier modules are provided with more direct and consistent power delivery by the shortest power path.

This newly developed Active Power-Factor Correction (APFC) supply is as much as 5% more efficient than past supplies and comprises dual PFC converters 180 degrees out of phase from each other. AFPC is used to avoid input current harmonics, thereby minimizing interference with other devices being powered from the same source. This reduces the total current ripple and improves EMC (Electromotive Compatibility), while current ripple at the output of the PFC converter is also reduced, which decreases stress within the circuit for prolonged life. Additionally, the supply operates in what is called "transition mode",

minimizing switching losses and improving overall efficiency in delivering power to the amplification module.

Control from Input to Output

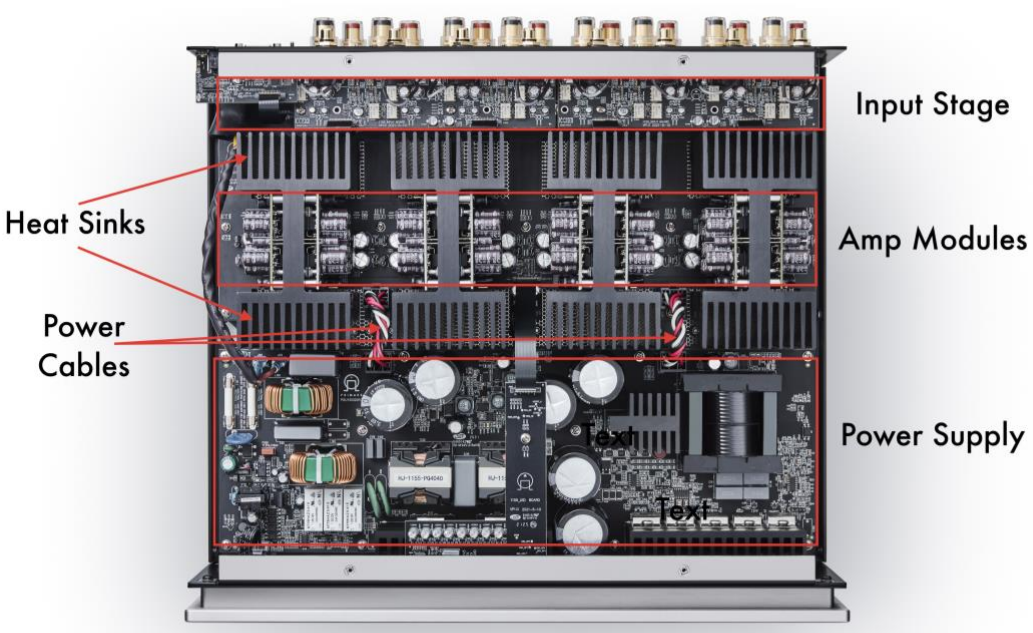
A35.8 features ultra-short signal path circuit design:

- four-layer circuit boards employed throughout to shorten signal path
- SMD devices used whenever possible to shorten signal path and avoid solder as electrical conductor of signal (large scale devices used when necessary)
- power amp module output directly connected to five-way binding posts without solder for shortest signal path and most efficient transfer of power
- Utilizing eight Hypex NCore500 class D output modules, with operation based on a non-hysteresis 5th order self-oscillating control loop taking feedback only at the speaker output, providing extraordinarily musical power delivery.

RCA and XLR balanced inputs options are offered for each channel and bridging capabilities for each pair of channels, with maximum power output of 1500 watts, providing the capability of delivering 185 watts at 1KHz of peak power per channel, all channels driven.

- Power output is rated as 150 watts into 8 ohms, 300 watts into 4 ohms, and 400 watts into 2 ohms at 1kHz.
- Each pair of outputs can be bridged, capable of producing 740 watts into 8 ohms (clipping protection limited), 750 watts into 4 ohms, and 450 watts into 2 ohms at 1kHz.

Circuit Layout




The modular design of the heatsink and paired output circuits assembly, utilize a multi-pin connector and secured by four screws, allowing for easy field replacement should service be required.

The Hypex NCore output module's standard aluminum heat sink plate is removed for direct connection of the amp module to the heatsinks for more efficient heat transfer. The heat sink arrangement provides shielding of amp sections for lower noise, meaning that the amp module is shielded from the power supply and the input module from the amp module while maintaining the shortest and most direct signal and power path.

To achieve the shortest signal path, a channel is cut out from the bottom of the heat sink to allow for direct circuit board connection from input to amp module and then from amp module to output stage without the use of signal carrying wires that might otherwise introduce noise and distortion.

System Configurations

The bridging capabilities of the A35.8 allow it to be used in a variety of system configurations, with or without the addition of a stereo amplifier, to suit most multi-channel system requirements. A few examples:

- 5.1 Channel System – bridge three pairs of outputs for Front Left, Right, and Centre speakers, with the remaining two outputs for a pair of rear speakers.
- 7.1 Channel System – bridge a pair of outputs for the Centre channel with remaining outputs for the remaining six speakers
- 5.1.2 Channel Atmos System – bridge a pair of outputs for the centre channel with remining outputs for the remaining six speakers
- 5.1.4 Atmos/DTS:X system - adds an A35.2 stereo amplifier for the Front Left and Right speakers, while using one bridged pair of outputs from the A35.8 for Centre, and the remaining outputs from the A35.8 for Surround Left and Right, Front Height Left and Right, and Rear Height Left and Right speakers.
- 7.1.2 Channel Atmos System – adding an A35.2 stereo amp for Front Left and Right speakers, bridge three pairs of outputs of the A35.8 for Centre, Rear Right and Left speakers, with the remaining pair of outputs for a pair of height speakers
- 7.1.4 Channel High Power System – three bridged A35.2 amps for Front Left, Right, and Centre speakers, and A35.8 for Rear, Surround, and Height speakers.
- 9.1.6 – two A35.8 amps, one pair of outputs bridged for Centre speaker, and remaining outputs for Rear, Surround, and Height speakers.
- 13.1 Auro 3D system - uses two A35.8 amplifiers, with bridged pairs of outputs for the Front Left and Right speakers, and the remaining 11 outputs for the Centre speaker, Front Left and Right Height speakers, Surround Left and Right speakers, Middle Left and Right Height speakers, Rear Surround Left and Right speakers, Rear Left and Right Height speakers, and Top speaker.

And for an extraordinarily powerful two channel bi-amplified system, one A35.8 all pairs of outputs bridged providing peak power of 4 x 375 watts or 750 watts per pair per channel at 8 ohms in a stereo system.

Additional convenience features include auto-sense turn-on from standby and auto-standby after an absence of input signal for twenty minutes, which can be turned off by holding down the front panel standby switch for five seconds allowing the A35.8 to remain on indefinitely.

At start up, eight internal red LED lamps, one for each channel's amp module, will light up inside the chassis confirming that the clipping sensing system is operational. These lights will extinguish once the unit goes into standby and is ready for operation. These LEDs will flash should clipping conditions occur, visible when looking from above into the amplifier through the top cover openings.

Additionally, an eight LED warning system is located under the top cover at the front of the amp that will indicate the following:

- On - DC is detected on the related amp module
- Flashing – overheating on the related amp module
- All lights cycling – power supply unit overheating

The A35.8 provides immediate and sustained high power output with very low distortion, instantaneous rise time and linear amplification across the entire bandwidth. This results in a naturally fast, clean, and agile sound over an ultra-wide frequency range and with exceptional headroom, capable of bringing to life even the most sophisticated systems, both multi-channel and bi-amped stereo.

**Design concepts and conditions**

Obvious questions regarding our design choices in creating the A35.8 eight channel bridgeable home cinema amplifier include:

- Why eight channels, and not three and/or five channels?
- Why Hypex output modules and not UFPD technology?
- Why has there been a price increase?

The information below hopefully answers those questions, allowing for a better understanding of how our experience and practical design philosophies inform all our development and design efforts.

First, we do not do anything for marketing purposes. And while it would have served our marketing purposes best to use UFPD 2 technology in our new multi-channel models it would not have allowed us to meet our goal of providing the best possible experience for the greatest number of people while improving on the performance of past models in every way.

It is not possible to gauge the sound quality of any Primare model based on a single part or circuit component, as this disregards the experience that our design team has gained in over thirty years of creating high performance electronics of good value following our practical design approach. And in the case of an amplifier, it is not the output module that determines the sound quality, but the total design, including the critical power supply and input stage, as well as careful voicing and tuning of the design in the final listening phase.

To that point, the lessons learned from that experience and our practical design approach are as follows:

- A30.3 – we learned from our design and launching into the market the A30.3 that there was insufficient interest in a three-channel amp, while the A30.5 and A30.2 amplifiers, essentially five and two-channel versions of the three channel A30.3, are among our most popular.

- A30.7 – while as popular as the A30.5, the difficulties and costs related to scaling down in size the UFPD module and design the incredibly robust power supply required, combined with our limited production needs, confirmed that this was not the most effective approach for a new cost effective multi-channel design. Additionally, some customers who needed only five channels of amplification expressed their dissatisfaction with having to pay for amplification they did not need nor want.

- 15 Series - because of our great success with implementing the UcD102 Hypex modules in our 15 series amplifiers, we elected to use a similar Hypex module, the UcD250LP, in the SPA25 Prisma, and the somewhat more sophisticated NCore Hypex modules in the A35.8 eight channel amplifier.

  Note that when initially demonstrating the new range of amplifiers, we found that after first demonstrating the UFPD 2 based I35 amp and then demonstrating the Hypex based I15, we had to play the I35 amp again to confirm for our somewhat confused audience that the I35 was in fact superior sounding, as many felt that the smaller amp may have been as good sounding as the bigger and more powerful amp. In many ways this pleased us, as we work very hard to maintain the Primare "sound" in every amp we build, and this confirmed that we had succeeded as the difference is mostly in an increasingly greater sense of ease in producing a much larger and detailed soundstage as you move up the line of amplifiers.

- Class D design – due to the strict constraints imposed by class D amplification design there are only a limited number of things that can be done to produce the best sound. Our efforts over the years, in cooperation with our amplifier module consultant, Patrik Bostrom (now Chief Technology Officer at ICEpower), using various patents he holds, have resulted in our UFPD, and now UFPD 2 amplifier technology. In general, but not necessarily in detail, these mirror the design steps taken by Bruno Putzeys at Hypex and now Purifi. These are in brief:
  - higher oscillation frequencies, allowing for less intrusive output filtering characteristics, which leads to more linear gain across the frequency bandwidth
  - a complete feedback loop circuit allowing for greater control and ultra-low output impedance
  - and attention paid to avoid unnecessary hysteresis effects

  In fact, NCore is similar to UFPD (both have 300 MHz oscillation frequencies for example), as Eigentakt is to UFPD 2 (both with 500 MHz oscillation frequency).

- Pricing - while we still believe in the superior performance capabilities of our UFPD and UFPD 2 amplifier modules, we are constrained by the economies of scale that mean the costs for our very limited production modules are far greater than for more mass-produced yet thoroughly designed and engineered modules from companies such as Hypex. Combine those inherent costs with the additional design and engineering efforts required to effectively miniaturize the amp modules to fit in reasonably sized amp chassis, means that for all practical and performance purposes the choice of the Hypex modules makes the most sense, allowing us to continue our tradition of delivering high performance at a more reasonable price.

- Current conditions - further impacting our decision-making process, is that the pandemic has further increased the effects of the already existing global semi-conductor shortage, causing all component parts pricing to be at an all-time high, with extended delivery times of a year or more for those higher priced parts, resulting in spot market prices for more immediate delivery being as much as 30x higher than normal.

Therefore, we determined to build a high performance configurable eight channel amp that could serve multiple system needs, in partnership with the A35.2 stereo amp, at as reasonable a price as we can given the circumstances.

However, it should not be inferred that the A35.8 is compromised or inferior in any way by using the NCore output modules, as during the listening and final voicing phase of the design we frequently compared its sound to our A35.2 amp to be sure that they shared the same sonic signature. In fact, we often compared the two just to be sure that the multi-channel amp did not actually sound better than the UFDP 2 based reference stereo amp. For the record, it does not, but it is close, which is why it the two can work together so effectively in the variety of configurations listed above, taking advantage of the bridging capabilities of the both the A35.8 and A35.2.

**A35.8 Specifications**


Amplification

Amplifier module: Hypex NCore500

Power supply: Primare APFC, soft clipping

Inputs per channel:

- 1 x RCA (L&R)
- 1 x XLR (L&R)

Input Impedance: RCA 15kΩ; XLR 36kΩ

Input Sensitivity: RCA 150W 8Ω = 1.7V; XLR 150W 8Ω = 3.4V

Gain: RCA 26dB; XLR 20dB

Output impedance: <0.02 Ω

Number of channels: 8, with each pair bridgeable

Output Power

- Single channel - 1500 watts maximum total output all channels driven
  - 400 watts at 2 ohms
  - 300 watts at 4 ohms
  - 150 watts at 8 ohms

- Bridged channel - 1500 watts maximum total output all channels driven
  - 450 watts at 2 ohms
  - 750 watts at 4 ohms
  - 740 watts at 8 ohms*

    *clipping protection circuit limited

Frequency Response: 20Hz – 20kHz +0.2/-0.5dB

THD + N: < 0.005%, 20Hz – 20kHz, 10W AES 17at 8Ω

Signal to Noise: >115 dB

General

Control:

- Trigger in/out
- RS232
- Auto Sense: on/off
- Input: RCA/XLR
- Gain: +6db bridge mode only

Power Consumption: Standby: <0.5W; Operate: <65W

Dimensions (wxdxh):

- 430 x 400 x145 mm with knobs and connectors
- 430 x 382 x145 mm without knobs and connectors

Weight: 15 kg

Colour Options: Black and Titanium

Note: features and specifications are preliminary and subject to change.

13 May 2022