P R I M A R E

PRIMARE SPA22 INTEGRATED A/V AMPLIFIER

INTRODUCTION

The SPA22 is a 5x120W integrated A/V amplifier and digital controller and is the natural successor to the award-winning SPA21, which was recognised around the world for its ease of use and 'hi-fi' sound quality. As the first of a new generation of Primare home entertainment products however, the SPA22 represents a considerable evolutionary advance in terms of design, performance, user flexibility and versatility.

MODULAR DESIGN

The SPA22's comprehensively shielded heavy-duty steel chassis houses a newly developed modular design that allows for DSP, video and connections to be upgraded easily with proprietary Primare boards, incorporating thoroughly evaluated and optimised versions of the latest technologies and connectors. This makes the SPA22 an ideal surround and video processing platform for many years to come (for upgrade features see **inputs/outputs** section).

In every instance we have taken special care to keep signal paths short and layouts uncomplicated. Together with high performance FFC-wiring, these techniques give the unit an extremely high performance and the highest possible signal-to-noise ratio. The finest audio grade semiconductors and capacitors have been used whenever possible. All parts that are known to interfere with each other are isolated by shielding, dedicated signal paths and power supplies.

ULTRA FAST POWER DEVICE (UFPD) CLASS D AMPLIFICATION

The use of switch mode power electronics is gaining in popularity as the result of its lower energy consumption and as a way to squeeze more amplifier channels into smaller spaces. Unfortunately Class D amplifiers and their switch mode power supplies have traditionally deserved a reputation for poor audio quality because it is very difficult to produce a full range 'hi-fi' signal through them. A major source of distortion is the demodulation filter on the output which is affected by variations in loudspeaker impedance unless it's controlled by sufficient feedback. The failure to provide enough feedback results in the 'classic' Class D sound characterised by rising THD with frequency. While very dynamic and vivid initially, Class D amplifiers can sound tiring and uncontrolled in the long term, especially when driving complex loads like multi-driver speakers.

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Primare's UFPD (Ultra Fast Power Device) provides for the possibilities of an 'audiophile' Class D design. It is a Class D technology which has a consistent 26dB feedback loop gain across the entire audio range and is stable way beyond the audio band. This is quite easy to achieve in conventional linear 'continuous signal' amplifiers, but much more difficult in 'non-continuous' high speed switching amplifiers.

Rather than have the amplifier and then the filter as discrete stages, the UFPD design integrates the two, making control with feedback much more immediate and accurate. The UFPD amplifier actively adapts the loop gain to keep the total loop stable during start up, clipping and current limit. It senses the changes to the filter output and compensates by applying the precise amount of feedback. This adaptive pole control allows for several more dBs of constant loop gain across the audio band and maintains performance irrespective of load (impedance) variations.

Primare's UFPD treats all signals equally regardless of frequency or slew rate and has the ability to suppress the filter resonance entirely. Consequently THD is kept very low at all frequencies. With a very wide 'load independent' frequency response UFPD is able to drive any speaker while maintaining control and accuracy.

Primare has optimised the performance of its innovative UFPD design with the precise selection of circuit component values and quality, verifying the design with extensive measurement and listening.

Summary

UFPD displays:

- Wide bandwidth
- Flat frequency response
- Load independant frequency response
- Low output impedance in the entire audio band
- Low THD in the entire audio band
- Low noise

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Most Class D technologies display:

- Limited bandwidth
- Peaking frequency response
- Load dependant frequency response
- High output impedance at high frequencies
- High THD at high frequencies
- High noise

PFC Power Supply

In conjunction with UFPD, Primare uses an isolated PFC (Power Factor Control) technology in the power supply, which controls the current from the mains voltage so that it is a pure sine wave with the same frequency and phase as the mains voltage. This means that even if 1000W is taken from the mains, other equipment in the room will not be affected. Its presence becomes virtually invisible to the mains voltage! The isolating stage of the converter works in a ZVS mode and as a result, the switch flanks contain a lower quantity of harmonics, providing lower EMI and a clean environment for the amplifiers to work in.

OPERATIONAL VERSATILITY

Almost every parameter in the configuration of the SPA22 can be user defined. Any input can be assigned a name and associated with any audio and video source. Surround format, trigger activation and input sensitivity can be specified for the input. Individual levels, speaker types, crossover frequencies and delay configurations including bass management can be selected for each of the major surround formats. A 140mS global delay system, with dedicated DSP, is incorporated in order to achieve the best possible picture to sound synchronisation. For the highest possible installation flexibility, all the SPA22's functions can be controlled in three ways: from the front panel, IR or RS232.

INPUTS/OUTPUTS

The SPA22 offers three HDMI v1.3 inputs for audio and video, incorporating a user-selectable audio processing and bypass function (see Technical Information). **HDMI I/O capacity is improved via the video upgrade (see below)**. HDMI v1.3 capability is significant because it carries uncompressed multi-channel PCM audio from a Blu-ray player to the SPA22's DACs and beyond to the amplifiers and loudspeakers. This means that even without Primare's proprietary HD audio board, HD audio in its highest resolution can be processed through the SPA22.

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Eight pairs of unbalanced analogue audio inputs are provided together with six digital audio inputs. Via the 'input settings' menu, any audio input can be assigned to any of the 3 Component, 3 S-Video and 4 Composite video inputs, for simultaneous output to the Component, S-Video and Composite analogue video outputs. 7.1 channel analogue audio inputs are also provided for the connection to DVD-A / SACD players. Unbalanced pre-amplified audio outputs (FL, FR, C, SUB, SR, SL, SBL, SBR) are provided for connection to any type of power amplifier. Front channels are re-routable in 7.1 Mode. Three 12V high current DC-triggers are provided, as well as IR and RS232 inputs.

HD audio and video upgrade features for SPA22:

Audio Upgrade (available now and on all new SPA22s)

- Onboard decoding of Dolby TrueHD and DTS-HD Master Audio Codecs.

Video Upgrade (availability TBA)

- HDMI up-scaling to 480P/576P, 720P, 1080i, 1080P, 1080P/24 over 24/50/60Hz
- Five HDMI inputs, two HDMi outputs (not simultaneous): the user selects which output to use (1 or 2).
- Analogue video up-conversion to HDMI with OSD. Setup menu available on HDMI. HD component input signals are supported. Analogue video conversion remains the same, composite, S-video and component to composite, S-video and component outputs.

BLU-RAY DISC AND HD AUDIO

Blu-ray players can be configured to output uncompressed multi-channel PCM from any Blu-ray Disc. The SPA22 will perform accurate D/A conversion on the multi-channel LPCM bit-stream.

- Blu-ray Disc is the only source of 5.1 or 7.1 channel HD audio currently available
- Most film soundtracks are mastered in 5.1-channel, 24-bit/48kHz PCM
- LPCM has the highest bit rate of all three lossless codecs*
- Currently 13% of Blu-ray discs carry a native multichannel PCM soundtrack+
- Most Blu-ray players can be set to decompress (unpack) Dolby and DTS HD audio formats and output them as uncompressed multichannel PCM audio. Even if the Blu-ray Disc doesn't carry the PCM soundtrack, it's still available from the player.

Blu-ray lossless audio formats*

Three are available currently: multichannel LPCM, Dolby TrueHD and DTS-HD Master Audio.

Multichannel LPCM – Linear Pulse Code Modulation: LPCM (often referred to as PCM) is used for the lossless encoding of audio data in the compact disc Red Book standard; has been defined as a part of the DVD and Blu-ray standards and is used by HDMI. On Blu-ray it offers a maximum bit rate of 27.648Mbps, up to 8 channels of 24bit/96kHz audio and up to six channels of 24bit/192kHz audio. Under the standard, players must have the capability to support LPCM.

Dolby TrueHD: lossless encoding of up to 8 channels of audio, built on MLP technology. It offers a maximum bit rate of 18.64Mbps, up to 8 channels of 24bit/96kHz audio and up to six channels of 24bit/192kHz audio. Under the Blu-ray standard, support is optional.

DTS-HD Master Audio: lossless encoding of up to 8 channels of audio. It offers a maximum bit rate of 24.5Mbps, up to 8 channels of 24bit/96kHz audio and up to six channels of 24bit/192kHz audio. Under the Blu-ray standard, support is optional.

Blu-ray and LPCM+

Currently 84% of all Blu-ray Discs offer lossless multichannel audio, split this way: 13% LPCM, 51% DTS-HD:MA, 20% TrueHD http://www.blu-raystats.com/Stats/Stats.php

SPA22 Technical information

Video circuit

All analogue video inputs are converted to digital by the Texas Instruments 10bit TVP5146 video encoder, where OSD from the Sanyo LC74763 OSD generator is added. The digital signal is then converted back to analogue by the 10bit Cirrus CS4955 decoder. By performing all the video conversion in the digital domain using 10bit processing we can maintain high quality video at all outputs and at all times regardless of the selected input source. This is a significant improvement over the SPA21, which could only switch component video and convert S-video to composite, entirely in the analogue domain.

HDMI

Prior to HD video upgrade, the SPA22 incorporates a three input HDMI repeater based around the Silicon Image SIL9135, which incorporates digital audio extraction over SPDIF or I2S format. It supports both multichannel PCM audio from Blu-ray, SACD or DVD-players and the more commonly used Dolby D and DTS formats, which are fed over high quality FFC cable to the DSP processor. A user selectable bypass function for HDMI audio is also available, telling the SPA22 either to process or forward HDMI audio to a display device. A user-configured default function addresses any other audio input source, if there is no signal on the defined HDMI input.

DSP

The SPA22's DSP is performed by a Freescale DSPC56371 24bit processor, which is able to fast lock and decode all the commonly used multichannel formats (with up to 192kHz sampling frequency). A slave Freescale DSPB56367 24bit processor handles all delay functions, including the global 140mS delay used for perfect synchronising of picture and sound. Analogue signals for Dolby Pro Logic IIX or DTS NEO processing are first converted to digital by a Burr Brown PCM4202, which incorporates an automatic level sensing circuit eliminating the need for manual ADC adjustments, as used in the SPA21.

DACs and analogue circuits

The audio DACs are 24bit, 192kps WM8740s from Wolfson, used in conjunction with Burr Brown OPA2134 and Texas Instruments NE5532 operational amplifiers for the analogue, semi-balanced, DC-servo controlled, buffering and filtration circuits. These feed the purified audio signal into an eight-channel low distortion, half passive volume control CS3318 from Cirrus. Lesson learned from the SPA21: for the SPA22 we have located all the gain stages and DC-servo circuits before the volume control in order to achieve a much better signal to noise ratio. An eight and 2-channel analogue bypass mode bypasses the DSP completely, are still available, for the analogue fans.

SPA22 features (including HD Audio upgrade)

- **Modular design architecture**
- **1080p/1080/24 HDMI Switching (3 in / 1 out)**
- **Component / Composite / S-Video**
- **5 x 120 Watts**
- **Multi-channel PCM compatible**
- **Dolby True HD, DTS-HD MA, Dolby® Digital, Prologic IIX, EX 7.1, dts®, dts-ES 6.1, Neo6**
- **Re-Routable Front Channels in 7.1 Mode**
- **DVD-A & SACD 7.1 Input.**

- **Fully Configurable & Format independent Bass Management**
- **Discrete IR & Full RS232 Operation.**
- **Programmable Triggers**
- **Dimensions W x D x H mm: 430 x 385 x 180**
- **Available in Black or Titanium.**

Technical Specifications (including HD Audio upgrade)

General			**Video**	**10 bit digital video conversion system supporting NTSC/PAL, Component, S-video and Composite, with OSD.**
Output power	**5 X 120W 8Ω**			
Analogue Inputs	**8 RCA, incl. 7.1 inputs**			
Digital Inputs	**3 RCA, 3 TOS-Link**		**Other out-/inputs**	**1 IR Input**
Video Inputs	**3 HDMI, 3 Component, 3 S-Video, 4 Composite**			**3 12v outputs (triggers)** **1 RS232**
Analogue Outputs	**Front (left and right)** **Center, Sub,** **Surr (left and right)** **Surr back (left and right)**		**Power Consumption operate:**	**800W at 1K, 8R ,120W all channels driven**
			Power consumption Standby:	**<5W**
Analogue Record Output	**1 RCA (left and right)**		**Analog Preamp Data**	
Analog Zone2 Output	**1 RCA (left and right)**		**THD**	**<0.005%, 20 Hz-20kHz**
			Signal-to-Noise	**-110 dB**
Digital Output	**1 RCA, 1TOS-Link**		**Frequency Response**	**10 Hz-100 kHz, 1dB**
Video Output	**1 HDMI, 1 Component, 1 S-Video, 1 Composite**			
Video Output Zone2	**1 S-Video,1 Composite**		**Input Impedance**	**47 KΩ, unbalanced**
			Output Impedance	**47 R unbalanced**
Modes	**Stereo** **Bypass** **Party** **Dolby Prologic IIx Music** **Dolby Prologic IIx Moive** **DTS NEO:6 MUSIC** **DTS NEO:6 CINEMA**		**Power Amp Data**	
			Output power 1Khz, one channel driven.	**8R 150W THD+N <1%** **4R 300W THD+N <1%** **AP AUX0025 Filter**
			Output power 1Khz, all channels driven	**120W 4/8R THD+N <0.1%** **AP AUX0025 Filter**
Decoding Formats	**Dolby TrueHD** **Dolby Digital** **Dolby Digital EX** **Dolby Prologic II** **Dolby Prologic IIx** **DTS-HD MA** **DTS** **DTS ES** **DTS Neo:6** **DTS 96/24** **MULTI/2 CH** **PCM/LPCM**		**THD**	**<0.01% 20-20Khz 1W 8R** **AP AES17 Filter**
			Signal-to-noise	**80dBr, AP AES17 filter, ref 2.828Vrms.**
			Frequency Response	**20 Hz-20 kHz -0.2dB 1W 8R**

Samping rates	**32KHz,44.1KHz,48KHz, 88.2KHz,96KHz,192KHz (AES/EBU)**		**Digital Data** **Frequency Response** **THD+Noise** **Dimensions (WxDxH)** **Weight**	 **20 Hz-20 kHz± 0.2dB** **0,005% @1 kHz(AES17 filter)** **430 x 385 x 180 mm** **15Kg**

Ends 17 March 2011