P R I M A R E

CDI 10 Compact Stereo System CD Player / DAB / FM Tuner / Pre-Power Amplifier

Combining a high performance CD player, DAB / FM tuner, state-of-the-art digital amplification and lustrous Primare design, Primare's ultra-compact CDI 10 introduces great sound, simple convenience and a beautifully understated Scandinavian style to the compact system market.

By sharing the same CD transport as the award wining CD31, the CDI 10's CD replay is of an exceptionally high standard. Advanced 24-bit/196kHz conversion is made available to both CD and DAB tuner reproduction.

Amplification is through a high performance Class-D (switch mode) design capable of delivering 75 watts into an 8 ohm load. To ensure the purest sound quality, all audio signals are balanced to remove noise before the amplification stage.

Inputs and outputs

The CDI 10 has three sets of RCA inputs as well as recording and preamplifier outputs. In addition to these, a 3.5mm combined headphone output and line input mini jack socket are found at the front of the CDI 10. Using the front inputs, an iPod®, MP3 or minidisk player can be connected and volume control is moved to the CDI 10.

Furthermore, the CD I10 incorporates an A/D-converter, which ensures that a digital SPDIF-output will be available regardless of the selected input source, making high quality digital recordings possible on for example a minidisk recorder.

The user interface

To satisfy Primare's signature desire for operational simplicity, full remote operation is supported by the major function controls, conveniently mounted on the top panel, together with an interactive graphical display.

The top cover overlaps the back panel allowing for placement near a wall with all cabling covered by the unit.

Compact high performance

CD

The CD-transport is the high performance DSL710 from DVS, a drive mechanism Primare has used with excellent results in many more costly units.

The electrical circuit consists of a PCM1738 D/A-converter which performs conversion from both the CD-player and the DAB/FM receiver module. The current to voltage conversion stage consists of Burr-Brown OPA2134 high performance operational amplifiers and is finished in a single-ended output stage.

Here you'll find a single MOSFET transistor together with an active current source instead of the use of passive resistors.

more...

Volume control is performed by a carefully isolated PGA2311 from Burr-Brown together with a DC-servo circuit instead of the use of capacitors in the signal path.

Before reaching the class-D amplifier, the signal is converted to balanced. This is done to cancel out noise and distortion that have arisen during transmission, leaving only the pure audio signal to reach the power stage.

Independent test report – CD

The integrated CD player is not directly affected by any interference and looks 'cleaner' from 20kHz-100kHz than the competing CD/DAB/amp solutions currently on the market. CD distortion may not be as low as the very best standalone solutions but at just ~0.001% this is perfectly low enough. The >100dB A-wtd S/N ratio is also more than wide enough for 16bit CD while the player's low-level linearity is evidently good to 105-110dB. Jitter, too, is impressively low at ~125psec. All-in-all, this is a very solid result for CD.

Tuner

40 FM presets and 10 DAB presets. 24bit/196kHz conversion is available for DAB reproduction.

Independent test report – DAB tuner

DAB offers very low <0.002% distortion, a wide 87dB S/N ratio and flat frequency response.

Class D Analogue amplification module- background

The “D” in class-D is sometimes said to stand for “digital.” This is not correct because the operation of the class-D amplifier is based on analogue principles. There is no digital coding of the signal. Before the advent of the class-D amplifier, the standard classes were class-A, class-AB, class-B, and class-C. The “D” is simply the next letter in the alphabet after “C.” Indeed, the earliest work on class-D amplifiers involved vacuum tubes and can be traced to the early 1950s.

There are basically two different types of class-D amplifier: externally clocked and self modulated. Examples of externally clocked amplifiers are triwave modulated and digitally modulated amplifiers. Two major disadvantages with externally clocked class-D amplifiers are that there are two signal paths and that there is no feedback in the modulation. The two signal paths are from the power supply to the output and from the signal input to the output. The absence of feedback in the modulation makes it necessary to switch extremely fast which gives rise to large amounts of EMI. There is great need of global feedback in externally clocked class-D amplifiers because of the previously mentioned problems. Global feedback complicates things and gives poor phase margin because of the output filter. Self modulated amplifiers have great possibility to correct non ideal effects such as rising/falling edges and power supply variations. The switching frequency of self modulated amplifiers generally drops as the output signal increases. This is positive when it comes to efficiency but makes global feedback inefficient when it comes to lowering distortion. All together the designer of a class-D amplifier has to decide which philosophy to go for. All parameters can not be optimized at the same time.

Some people prefer the sound from class-D amplifiers because it is more dynamic and detailed. There are as many explanations for this as there are class-D designers but one of the major reasons is actually the efficiency. A traditional amplifier produces about 45 % efficiency while good class-D amplifiers produce about 92 % efficiency. This means that, pound for pound, a similar power supply would provide twice the available energy in a class-D amplifier than in a class AB design, and better bass and dynamics are the result. Class-D also offers superior operational stability as the idle point of a class-D amplifier does not need the

thermal feedback required by a traditional class-AB amplifier. Class-D provides easier recovery after dynamic periods and also gives better detail during dynamic periods.

For the class-D modules inside CDI10, the input (audio) signal from the transport is balanced analogue. It is received by a differential stage built around a high precision op amp from Analog Devices, which eliminates potential ground loops and improves crosstalk between channels. This op amp passes a single ended input (audio) signal to a second (modulating) op amp by Analog Devices which inverts the input (audio) signal and sums and integrates it with the PWM pulses (in the form of a square wave) from the output stage in a modulating loop. The resulting modulating (control) signal running at 550kHz is sent to a comparator/driver developed by International Rectifier for the switching power electronics industry. The comparator/driver has two inputs. One is the modulating (control) signal and the other is a DC voltage. The comparator/driver operates an output stage comprising two N-channel MOSFETs optimized for switching applications. It tells the switches to turn on/off at 550,000 times per second to produce a square wave of pulses having variable width in accordance with the input (audio) signal between a threshold of +42V and -42V. The average voltage of each square wave cycle represents the voltage of the input (audio) signal at that point (one of 550,000 each second).

In the CDI10, a one point clipping circuit positioned at the differential reciever measures and compares the input (audio) signal with the power supply voltage and corrects in the measuring point to avoid high frequency distortion. As long as the input signal stays away from the clipping threshold the clipping circuit is completely transparent.

The output stage is followed by a second order low pass filter/demodulation filter. This filter removes the high frequency content of the PWM pulses and presents only the audio signal to the loudspeaker.

The power supply inside CDI10 is a story of its own. It is based on a common mode transparent full bridge which emits very low levels of HF noise. In fact this switch mode power supply is more transparent to audio than a traditional power supply. A traditional supply uses only surge current at the top of each half wave of the mains voltage. This type of current is accompanied by a large amount of harmonics. The CDI10's switch mode power supply takes energy during a large portion of the main period thereby lowering the surge currents. The result is a more detailed bass and cleaner male voices through the entire hifi system. The supply voltage to the amplifiers is also regulated by the switch mode supply which makes them perform even better.

Amplification - Designer's notes

Developed by Primare in cooperation with a Swedish partner from the power supply industry, the self modulating class-D amplifiers used by the CDI 10 are of a proprietary design and are not ICE power modules! Their performance can be compared to some of the best of class-AB amplifiers.

The technology used in these modules is extremely simple and still displays world-class audio performance in the entire audio band. This performance is achieved by careful choice of components, design and doing a very thorough PCB layout.

The amplifier is self modulating which means that the switching is controlled by the delay in the loop. The amplifier starts increasing the output voltage as soon as it is a little too low and starts decreasing the output voltage as soon as it is a little too high. The inertia in this process causes the amplifier to oscillate in a controlled manner at about 550 kHz. You could say that the amplifier controls and corrects the output voltage 550000 times per second with close to zero error tolerance during each control cycle. The self oscillating modulator is so linear in itself that it does not need additional feedback paths and this gives a very robust amplifier with low cost and extremely good audio performance. The distortion is not only very low, it is also nearly frequency independent giving a very homogenous sound. The very low noise floor of about 70uVrms allows for every micro-detail to be displayed in the sound stage without deterioration.

The input signal is received by a differential stage built around a high precision op amp from Analog Devices. This eliminates potential ground loops and improves crosstalk between channels. The signal is forwarded to the modulator which is controlled by a second op amp, this one also a precision type from Analog Devices. All self oscillating amplifiers drop their switching frequency as the output signal approaches clipping and this may cause unpleasant high frequency distortion. In order to avoid this, a special “one point clipping circuit” has been developed which is completely transparent as long as it is not active. It measures and clips the signal in the same point thereby eliminating over shoots caused by delay at high frequencies. The result is a more pleasant clipping behaviour.

The output stage is controlled by a driver developed by International Rectifier. This driver is totally dedicated to class-D amplifiers and has patented solutions for pulse by pulse current limiting and dead time settings. A close relationship with International Rectifier has made it possible for the driver’s behaviour to be optimised for the topology that is being used.

The selection of the power devices in the output stage is crucial in order to reach the best audio performance. The devices used in these modules are the best available for building class-D amplifiers.

The modules are fully protected from over current, over temperature and over voltage. This ensures that the loudspeakers are safe from harm during all conditions.

Independent test report - amplifier

The broad specification of the 75W/8ohm CDI10 is very conservative, with each power amp delivering closer to 90W/8ohm, rising to a substantial 175W/4ohm. As is usually the case with Class D/PWM amplifiers, there's no headroom beyond this power output, but the CDI10 still remains capable of driving most 'real world' speakers to high levels. This is aided by an impressively low 0.07ohm output impedance (for the technology) and wide frequency response that's just 3dB down at 80kHz. Distortion, too, is as low as 0.005% at low volume (~1W/8ohm), increasing to ~0.03% from 20Hz-8kHz over 10W/8ohm.

Specifications

FM

Stereo Tuner, 87.5-108Mhz
RDS decoding
Number of Presets: 40
Usable sensitivity: FM Mono 10dBuV, FM Stereo 20dBuV

DAB

Band III (174-240 MHz) and L (1452-1492 MHz).
Usable Sensitivity: 29dBuV band III, 30dBuV band L
Number of Presets: 10

CD Player:

DVLS 710 – Transport
CD / CDR / CDR-W

D>A Conversion (CD / DAB):
PCM1738 - 24-Bit 192 kHz

Amplifier

2x75W (8R load, 1K below 1% THD+N) class D amplifier.
THD+N 20Hz- 20 KHz 10W below 0.1%
Frequency response: 20Hz – 20 KHz, +-0.3dB.

Power Supply

Dual switch mode power supply
Power consumption: Standby: 16W
Operate: 210W

Inputs:

3: Unbalanced Stereo (RCA)
1: Unbalanced Stereo (Front Panel 3.5mm)

IR Inputs:
1: 3.5mm Jack (Emitter or IR Receiver)

RS232:
1: 9 Pin D-Sub

Antenna - F-connector (Combined DAB / FM)

Outputs:

Preamp Output:
1: Unbalanced Preamp Output (RCA)

Record Outputs - All Sources:
1: Unbalanced Record Output (RCA)
1: Coaxial Digital (RCA)
1: Optical Digital (TosLink)

Finishes:

Satin Black or Titanium

Dimensions:
W 430mm x D 385mm x H 100mm (With Feet)

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