

PRECISION MDSD DIGITAL PROCESSOR DC-1000



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Accuphase marks its 50th anniversary with the DP/DC-1000, that is 5th generation separate SACD/CD playback system.

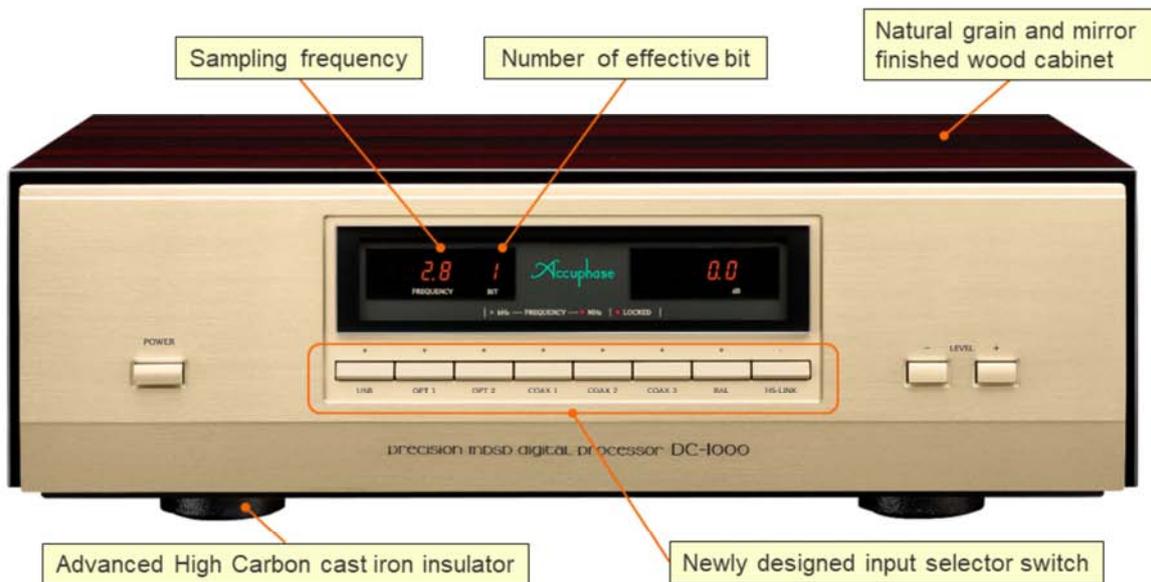
In 2000, Accuphase launched the DP/DC-100 as the 1st SACD separate system, it's gone down in history with its overwhelming sound quality and electrical performance.

The new DP/DC-1000 is the superior SACD/CD player that will bear the next generation with an array of the latest technologies renewed from the DP/DC-950 in 2016.

With the significant revision of circuit configurations and PCB arrangement, the DC-1000 achieved immense stride in advance for both electrical performance and sound quality.

The DC-1000 provides the provocative experience derived from the spectacular music playback.

Front view



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DC-1000 cab show the sampling frequency and the number of effective bits of input signals on front panel display.

Sampling frequency and the number of effective bits are actually measured internally, not simply showing the data which is attached with the signals.

While the former DC-950 shows the sampling frequency of DSD signals in “kHz”, the DC-1000 displays in “MHz” with a smaller number of digits.

Internal view



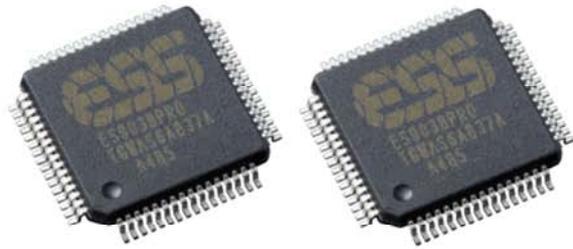
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The DC-1000 has symmetrical layout same as the former DC-950, but the number of components are greatly increased, it also contributes to the DC-1000's advanced evolution.

D/A converter

- 8 parallel D/A converters per channel
 - ES9038PRO 32bit HyperStream DAC, 1 chip per channel
 - Multiple Delta-Sigma++ for PCM signal
 - Multiple Double Speed DSD for DSD signal



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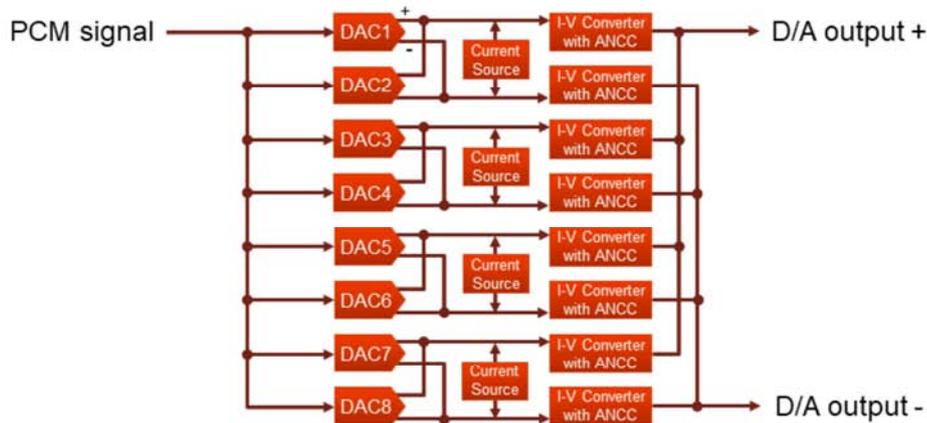
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For D/A Converter section, Accuphase adopts the ESS Technology's 32bit Hyperstream DAC ES9038PRO. Each channel uses 1 DAC chip which incorporates 8 converters, and has them drive in parallel.

These DACs are essential for our original circuits, MSD++ (Multiple Delta-Sigma) converter for PCM signals and MDSD (Multiple Double Speed DSD) principle for DSD signals.

Multiple Delta-Sigma++

- Technique to make DAC parallel
- Performances improved by a factor of 2.8



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Multiple Delta Sigma++(MDS++) is a technique to make DACs parallel. The same digital signal is supplied to each converter. The output of each DAC is combined.

The Audio signal values are added up but the conversion error and noise are canceled. The ratio between the signal and conversion errors increases. So the converter performance is improved.

The improvement degree works by a square root of the number of DACs.

In DC-1000, all performances are improved by a factor of 2.8.

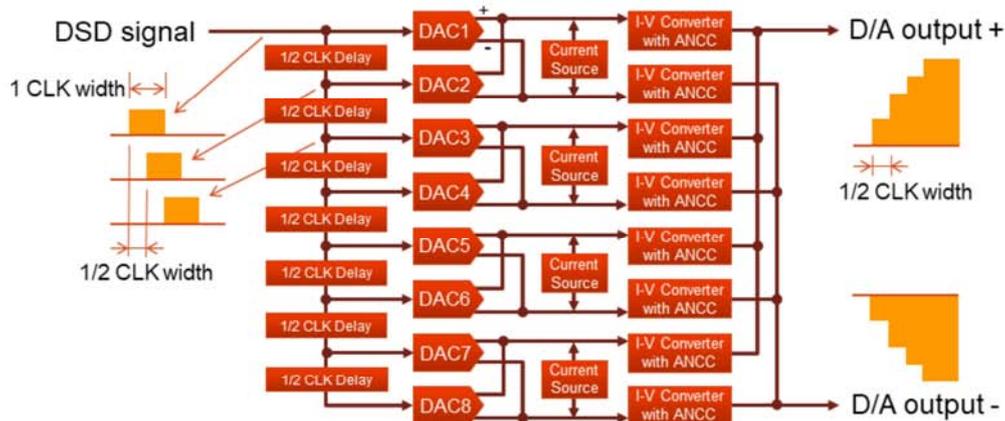
As the output current of D/A Converters is very large, the number of I-V converters are increased to 4 circuits each at \pm output from 1 circuit each in DC-1000.

Furthermore, in I-V converters, the ANCC which is an Accuphase original technology for reducing noise and distortion is installed.

**Refer to the Appendix for the details of ANCC

Multiple Double Speed DSD

- In the high frequency works as a low pass filter, in the low frequency works as MDS++ principle



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MDSD stands for Multiple Double Speed DSD.

The DSD signals have a large amount of noise at the high frequency. It must be removed.

MDSD works as a low pass filter to remove the noise in the high frequency and also works as the MDS++ principle to improve the characteristics in the low frequency.

The point of MDSD is the delay elements.

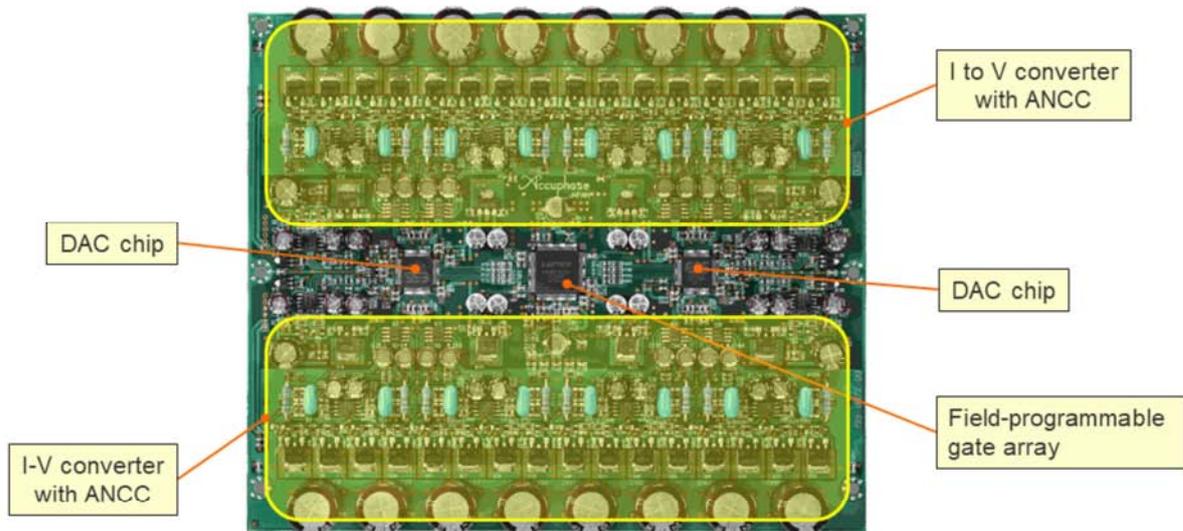
DSD signal in DC-1000 is D/A converted with half-delayed clocks and is combined when it comes to the output.

As the analog output becomes half-clock time resolution, it allows double speed operation.

This configuration is a moving-average filter.

It works as a complete linear phase low pass filter and removes high frequency noise of DSD signals.

D/A converter assembly



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To demonstrate the superior performance of MDS++, MDSD, the DAC chips and I-V converters need to be placed as close as possible.

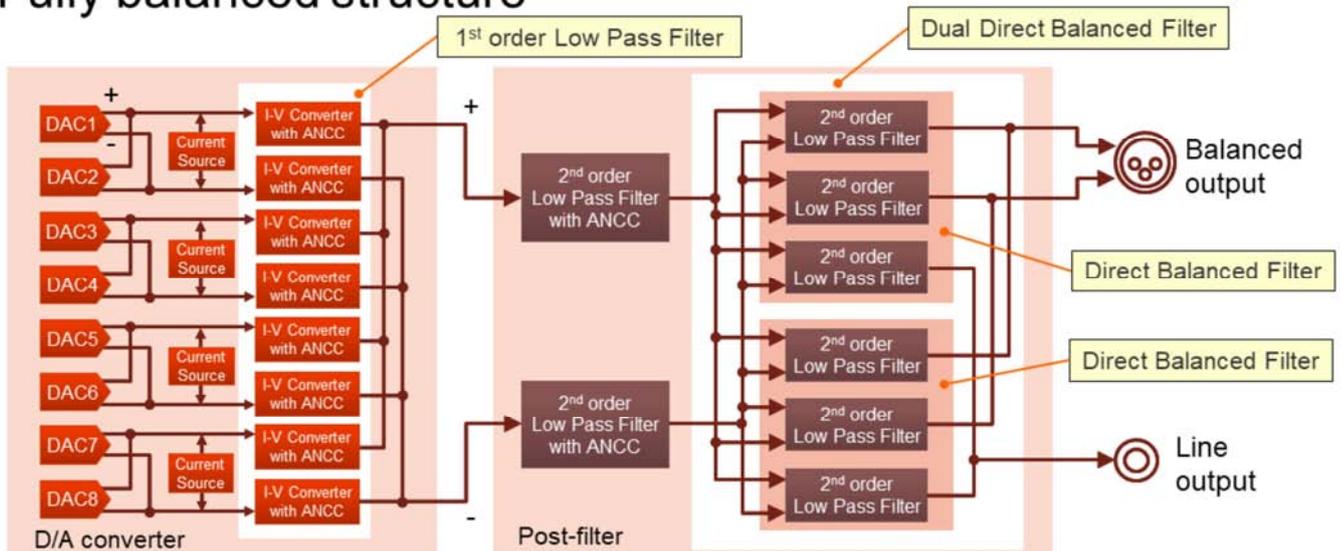
In the DC-1000, DAC chip and I-V converters are mounted on the one PCB so the electrical performance is drastically improved.

** DC-950 incorporated DAC chips and I-V converters on 2 separate PCBs.

Furthermore, the output voltage at I-V converters is set at higher than the former DC-950, so the noise performance is improved that the noise generated in the latter filter amp is relatively decreased.

Post-filter configuration

- Fully balanced structure



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The fully balanced post-filter eliminates the image noise in high frequency of D/A converter output.

The I-V converter in the D/A converter circuit works as the 1st order low pass filter as well, and it passes through two 2nd order filters inside the post-filter, so it is composed of 5th order low pass filter in total.

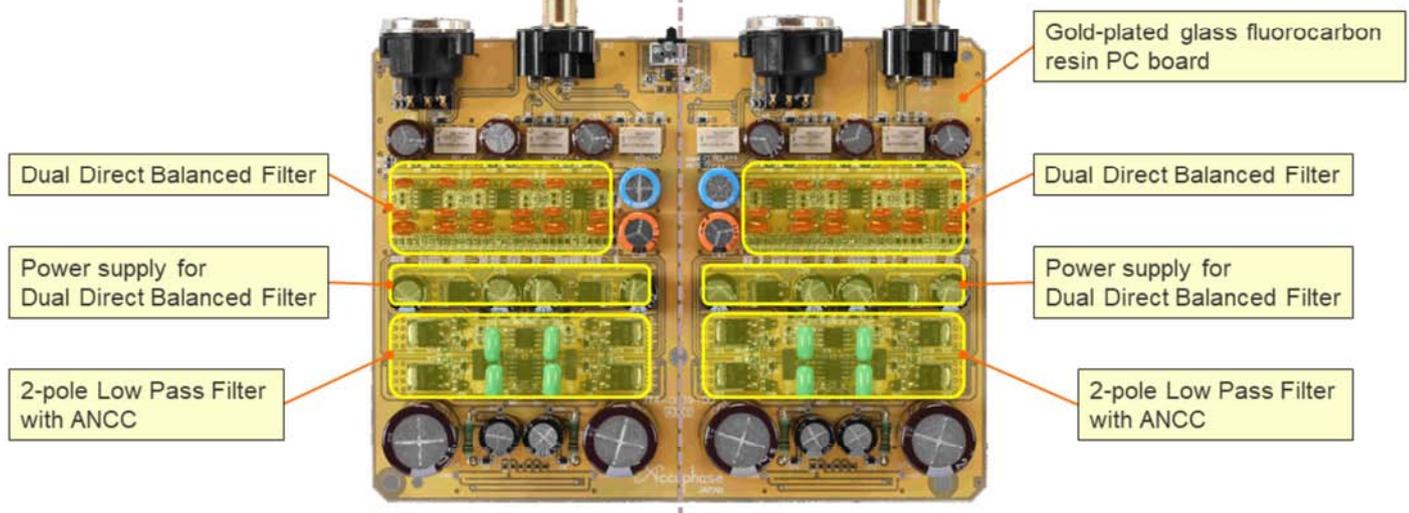
Newly-developed Dual Direct Balanced Filter that drives two circuits of Direct Balanced Filter in parallel is installed at the final stage of the post-filter, it contributes to the further improvement for noise and distortion characteristics.

The DC-1000 is the first model that features this cutting-edge technology.

**Direct Balanced Filter is the circuit configuration that has each independent output circuit not to mutually interference the line output and balance output by the loading effect.

Filter amp assembly

Left channel ← → Right channel



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The Filter amp assembly contains the post-filter subsequent to the D/A converter.

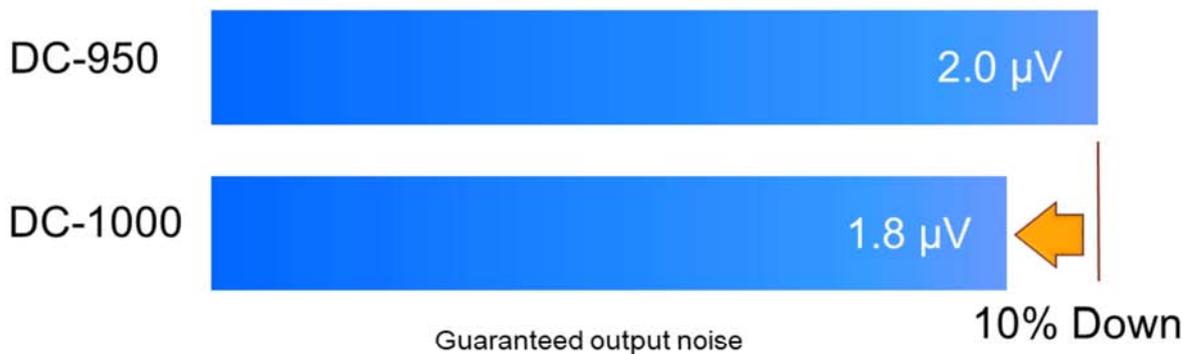
The monophonic construction with appropriate clearance between left channel and right channel circuits is adopted for the good channel separation.

Moreover, the power supply circuit or GND patterns also feature the independent configurations for each channel, and it just prevents the mutual interference.

The glass cloth fluorocarbon resin with gold-plate processing is used for the PCB, which has excellent high-frequency and heat-resistant characteristics.

Ultra low noise

- 10% lower than the former model
 - Guaranteed output noise: 1.8 μ V (S/N ratio: 123dB)



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Ultra Low Noise is one of the main technical features of DC-1000.

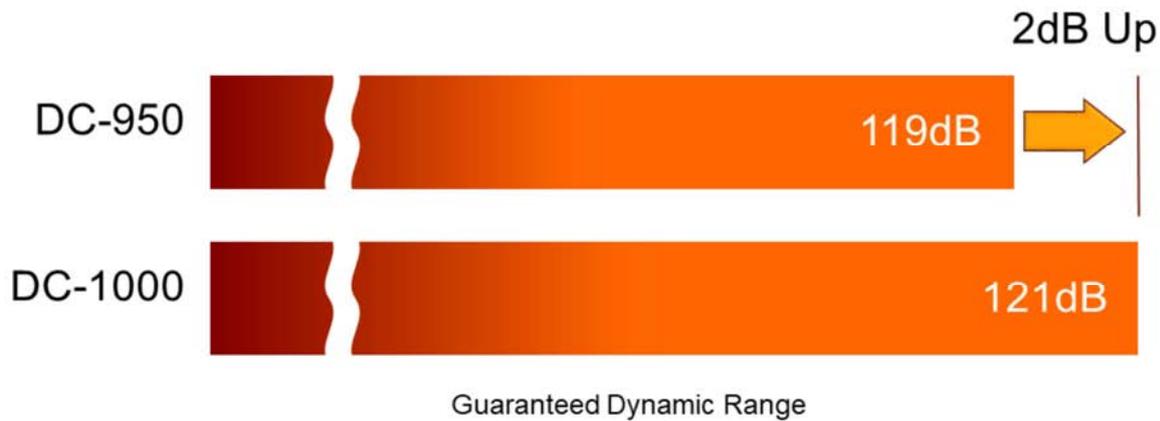
DC-1000 guarantees 123dB** Signal to Noise ratio which means 1.8 μ V of output noise voltage.

** 0dB: 2.5V

The former model, DC-950 still shows the excellent noise performance, however, DC-1000 achieves 10% lower output noise voltage than DC-950.

Super high Dynamic Range

- 2dB higher than the former model



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The Dynamic Range is the value that indicates the ratio of maximum playable signal to minimum.

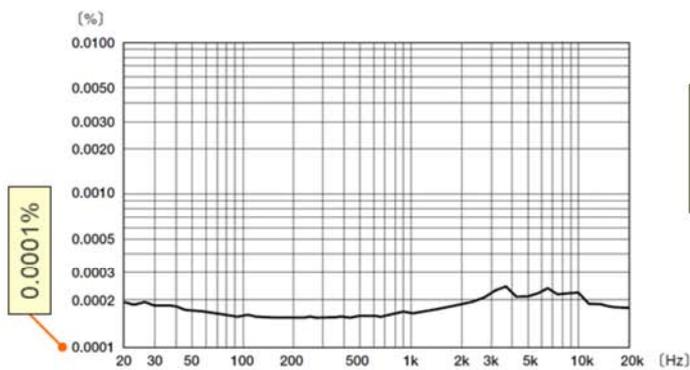
The higher Dynamic Range is, the higher the reproducibility of the small signal is.

The former model, DC-950 still has the high Dynamic range performance, however, DC-1000 achieves 2dB higher than DC-950.

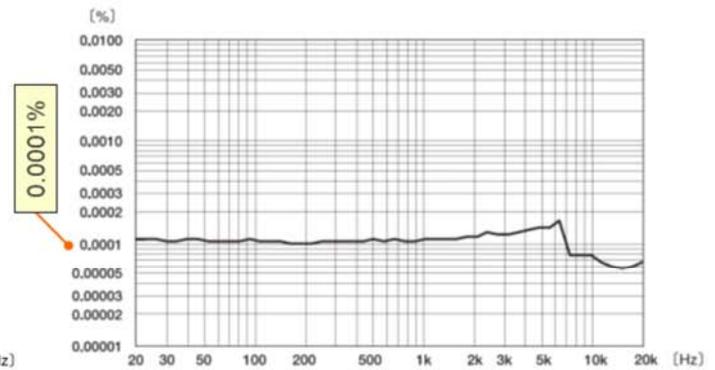
** "2dB higher" means 25% up.

Ultra low THD+Noise

- Total Harmonic Distortion + Noise vs Frequency



DC-950



DC-1000

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DC-1000 proves itself the great Total Harmonic Distortion (THD) + Noise characteristics which are quite important for music playback.

DC-1000 has a major improvement for this, that shows less than 0.0001% in most frequency band.

Digital inputs

- HS-LINK
 - Version1: 192kHz/24bit, 2.8224MHz/1bit
 - Version2: 384kHz/32bit, 5.6448MHz/1bit
- Balanced, Coaxial: 192kHz/24bit
- Optical: 96kHz/24bit
- USB2.0: 384kHz/32bit, 11.2896MHz/1bit



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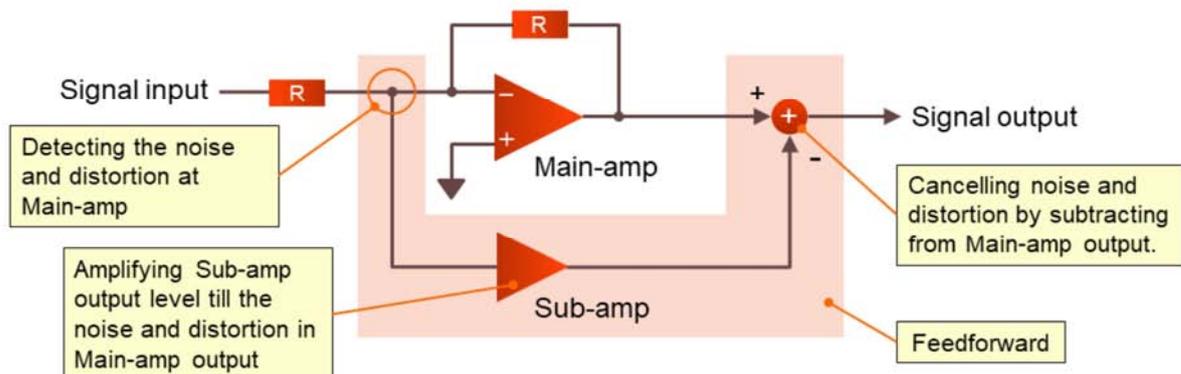
DC-1000 is equipped with 5 types of 8 digital inputs.

USB Input accepts 384kHz/32bit-PCM or 11.2896MHz-DSD. DSD data can be received both DoP (DSD over PCM, up to 5.6448MHz) and ASIO2.1(up to 11.2896MHz).

HS-LINK function supports both Ver.1 and Ver.2, the DC-1000 automatically recognizes which version is transmitted.

Appendix “ANCC”

- ANCC: Accuphase Noise and distortion Canceling Circuit
 - Detecting the noise and distortion with Sub-amp, and cancelling them by Main-amp output.



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ANCC: “Accuphase Noise and distortion Canceling Circuit” is Accuphase unique technology to cancel the noise and distortion generated in the amplifiers with feedforward technique.

Output noise and distortion reduced to $1/\text{gain}$ come up at the input terminal which is applied with negative feedback.

ANCC detects the noise and distortion at the main-amp input terminal with sub-amp, and cancels them by subtracting from main-amp output.