System Documentation

PSU 218-40

Power supply unit / 2x18V 1A0

$265V_{AC}$ 50VA

PSU 218-40 A

Power supply unit / 2x18V 1A0 / enhanced main filter /

$265V_{AC}$ 50VA

The new power supply unit **PSU 218-xx** delivers excellent noise and hum rejection in combination with an adequate output power to supply a preamplifier, active crossover network, phono preamplifier and / or a line driver simultaneously. The power supply unit may not to much be seen as a voltage stabilizer circuit, it may rather be seen as a voltage conditioner, delivering a flat, noise and hum free DC output. The main focus has been set on the topics of noise rejection, AC hum suppression and thermal stability of the DC output voltage.

1. Modular Concept:

- **Main filter** – To suppress inrush currents and AC transients (optional with the **PSU 218-40/50 (A)**).
- **Main transformer** – Encapsulated Toroidal Transformer, screened for minimum magnetic emissions.
- **Voltage conditioner** and pre stabilizer circuit – Triple LC filter stage with complementary compound emitter follower (CCEF) as pre stabilizer.

2. AC characteristics - Performance of the Tripple LC filter stage – full load P_{out} = 40W:

In order to achieve optimum noise and AC hum rejection the unit has been build around multiple LC filter stages. The performance of the filter stages has been tested under maximum load condition (**40W**). The efficiency of the three LC stages to suppress AC hum can be verified by observing fig. 1.

Fig. 1 (*left side*) illustrates the AC share of the intermediate voltage directly measured at the first smoothing capacitor. With roughly about 730mV_{eff}, the AC share is rather large but in favor of limited inrush current and premature failure of the rectifier elements the smoothing capacity has been kept small. Fig. 1 (*right side*) illustrates the effect of the first **LC filter stage**, reducing the AC share by about 12dB.

One of the main points of interest in designing LC filter stages for power supply filters is to keep the series resistance of the filter inductor low. Each of the three filter stages exhibits very low ohmic losses (series resistance is far less than 100mΩ). In favor of a good high frequency attenuation the filter capacitors have been kept small to guarantee a low ESR – so whenever necessary multiple capacitors are used in parallel. Every electrolytic capacitor has been bypassed by a ceramic capacitor to improve high frequency characteristics.

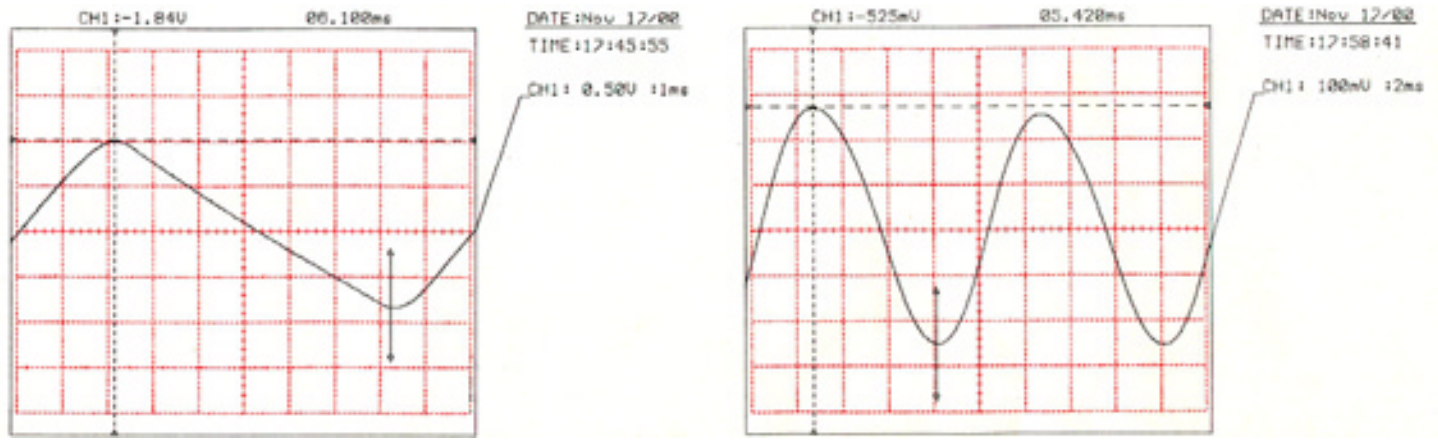

Fig.1 Input AC hum at full load conditions (Pout = 40W). *left:* rectifier output – smoothing capacitor, *right:* 1st LC filter stage output

The first filter stage is followed by a similar LC filter stage. The pre-stabilizer, setup by a complementary compound emitter follower (**CCEF**), stabilizes the output to a voltage level of about **19V$_{DC}$**. The CCEF is followed by another LC filter stage to reduce residual AC hum and noise. The output voltage is shown by fig. 2.

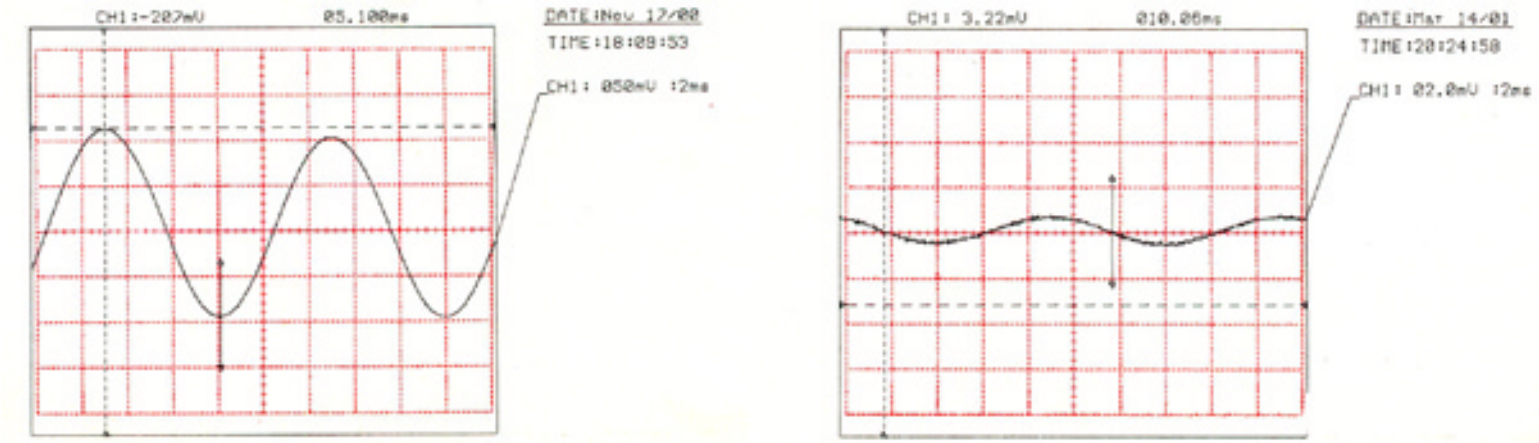

Fig.2 Output AC hum at full load conditions (Pout = 40W). *left:* 2nd LC filter stage CCEF input, *right:* 3rd LC filter stage - output

The 2nd LC filter stage provides an AC hum attenuation of about 8dB. The final CCEF and 3rd LC filter stage provides another AC hum attenuation of about 48dB.

3. *AC characteristics - Performance of the Tripple LC filter stage – light load P_{out} = 5W, Load pulse:*

The **noise floor** of the output voltage has been evaluated under typical load conditions of **P_{out} = 2x5W**. Fig. 3 shows a noise floor of about **–118dBu**. The behavior of the PSU 218-40 under varying load conditions has been tested with a **20ms load pulse** (load increase from 2W to 40W).

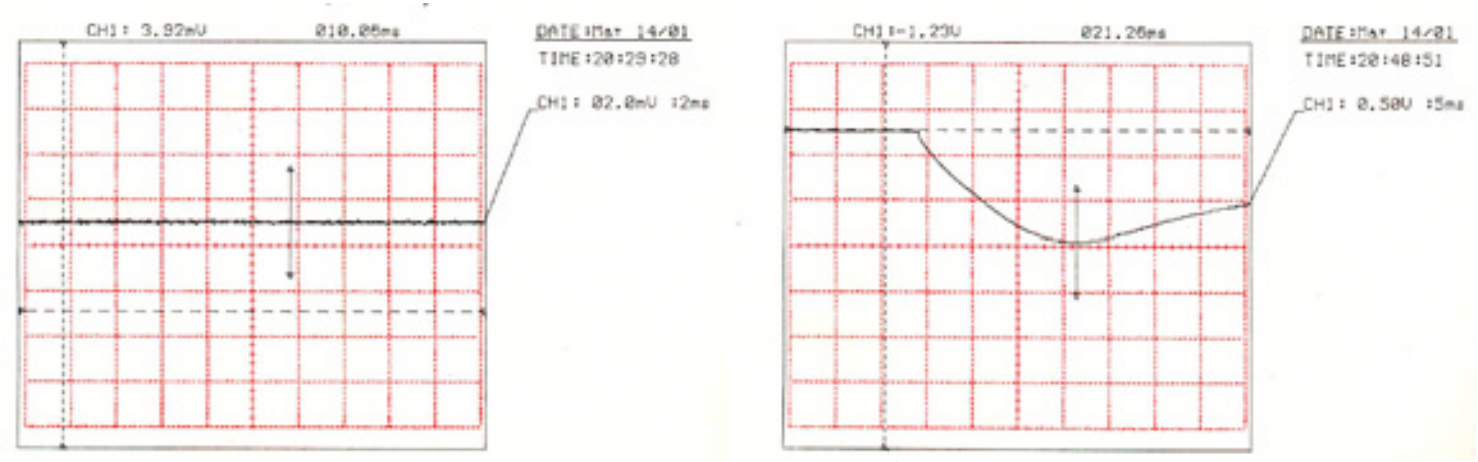

Fig.3 Noise floor at light load conditions (Pout = 2x5W). *left:* 3nd LC filter stage / CCEF output, *right:* output behavior under load pulse of 40W

4. *Summary:*

The following tables summaries the **DC** and **AC characteristics** of the PSU 218-40 audio power supply unit.

P_{out} = 40W (U_P = 240V_{AC}, T_A = 25°C)	U_{out} [V]	I_{LOAD} [A]	AC_{HUM} + N [µV]
	17,340	**1,156**	**873,5**

The relevant noise bandwidth is 500kHz.

P_{out} = 2W (U_P = 240V_{AC}, T_A = 25°C)	U_{out} [V]	I_{LOAD} [A]	AC_{HUM} + N [µV]
	19,235	**0,052**	**1,2**

The relevant noise bandwidth has been limited to 5**00kHz**. This results in a spectral noise density of $1{,}69nV/\sqrt{Hz}$ and a noise floor of **–118dBu**.

All measurements had been performed with one of the following instruments: Gould DSO 1604, HP oscilloscope HP54602B, HP multimeter HP34401A or a Fluke graphical multimeter 867B.