Technical Documentation

Power Amplifier

CL1600 DYNACORD
CP2200 EV
CPS2.8 EV

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1. General Specifications

1.1 Type & Model

The following devices are “class H” technology audio power amps. The power supply unit follows conventional design: 2 sections with toroidal transformer, multi-country suitable. The unit comes in a 2HU enclosure.

Type	Order No.	Mains Voltage	Mains Frequency
CL1600	112 911	100V	50 - 60 Hz
CL1600	112 914	120V	50 - 60 Hz
CL1600	112 917	220V	50 - 60 Hz
CL1600	112 920	230V	50 - 60 Hz
CL1600	112 923	240V	50 - 60 Hz
CP2200	170 252	100V	50 – 60 Hz
CP2200	170 258	120V	50 – 60 Hz
CP2200	170 264	220V	50 – 60 Hz
CP2200	170 270	230V	50 – 60 Hz
CP2200	170 276	240V	50 – 60 Hz
CPS2.8	170 255	100V	50 – 60 Hz
CPS2.8	170 261	120V	50 – 60 Hz
CPS2.8	170 267	220V	50 – 60 Hz
CPS2.8	170 273	230V	50 – 60 Hz
CPS2.8	170 279	240V	50 – 60 Hz

1.2 PCB-Name & EDP Order No.

Part / PCB	CL1600 / CP2200				CPS2.8			
	100V	120V	220/230V	240V	100V	120V	220/230V	240V
PCB-Amplifier	84216		84212		84221		842148	
Mains Transformer	362 027	359 426			362 027	359 426		

1.3 Testing Conditions, unless stated otherwise

Measuring Tolerance	$\Delta X = \pm 1.5dB$
Test Frequency	f = 1kHz
All Levels relate to	U = 775mV (0dBu)
XLR-type Connector Pin-Assignment	PIN 1 = GND/SHIELD PIN 2 = + INPUT PIN 3 = - INPUT
Source Impedance for Signal Feeds via XLR-type Connector	R(Q) = 50Ω

- AC-Voltages are stated as effective value

1.4 Service Plug Pin-Assignment CNS1, CNS2, CNS3 (A) / 4 (B)

	CNS1 (Supply)	CNS 2	CNS 3 (Ch.A) / CNS 4 (Ch.B)
PIN	Assigned	Assigned	Assigned
1	+ High	+ U1	Limiter Test
2	+ Low	+16V	-15V
3	GND	GND	Limiter Off
4	GND	-16V	Speaker Output
5	- Low	-U1	+15V
6	- High	Relay-Drive	Temperature
7	x	x	Bias +
8	x	x	Bias -

2. Measuring Data

2.1 Operating Voltage

U(B) = 100V 50Hz ... 60Hz / U(B) = 120V 50Hz ... 60Hz
U(B) = 220/230V 50Hz ... 60Hz / U(B) = 240V 50Hz ... 60Hz

Operating Voltage Deviation: -20% .... +10%

2.2 Power Consumption

- Both channels driven, Max. Output @ 1% THD

CL1600 / CP2200 / CPS2.8	U_{mains} [V]	I_{mains} [A]	P_{mains} [W]	P_{out} [W]	Pd (5) [W]	BTU/hr(1)
idle	230V	0.5	65	-	65	220
Max. Output Power @ 8Ω(1)	230V	8.0	1440	2 x 500	440	1500
Max. Output Power @ 4Ω(1)	230V	13.2	2520	2 x 800	920	3140
1/3 Max. Output Power @ 4Ω(1)	230V	7.5	1360	2 x 266	828	2825
1/8 Max. Output Power @ 4Ω(1)	230V	3.0	520	2 x 100	320	1090
1/8 Max. Output Power @ 4Ω(2)	230V	3.3	570	2 x 100	370	1260
1/8 Max. Output Power @ 4Ω(2),(4)	254V	3.6	660	2 x 120	420	1435
Normal Mode (-10dB) @ 4Ω(1)	230V	2.8	470	2 x 80	310	1060
Rated Output Power (0dB) @ 4Ω(1)	230V	12.5	2360	2 x 700	960	3275
Alert (Alarm) Mode (-3dB) @ 4Ω(1)	230V	8.8	1610	2 x 350	910	3105
Max. Output Power @ 2Ω(1)	230V	20.0	4000	2 x 1100	1800	6140
1/8 Max. Output Power @ 2Ω(1)	230V	4.5	815	2 x 138	540	1840
1/8 Max. Output Power @ 2Ω(2)	230V	4.5	815	2 x 138	540	1840

(1) Sine Signal Modulation (1kHz) (2) VDE-Noise (3) 1BTU = 1055.06J = 1055.06Ws
(4) 10% Mains Over Voltage (5) Pd = Power Dissipation

Power consumption is direct proportional for other mains voltages. The following conversion factors are meant for easy conversion:

100V = 2.3; 120V = 1.9; 240V = 0.96

2.3 Voltage Amplification

- no load connected at the output, sine signal with f = 1kHz, Bridged Mode switch engaged.

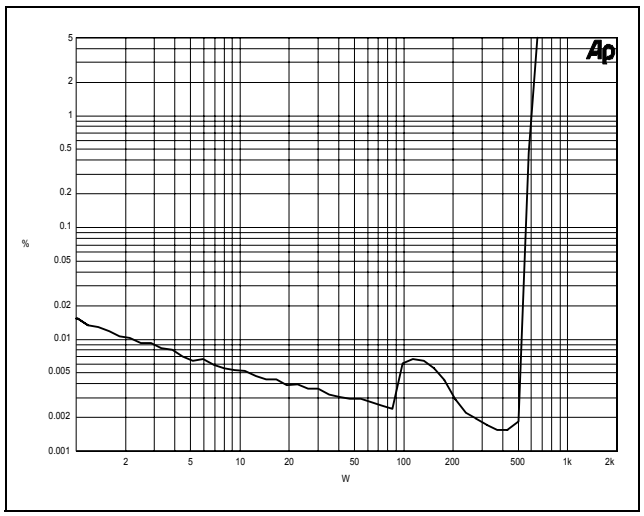
Gain	Input	U_E (dBu)	Measuring Point	U_A (dBu)	U_A (V)	P_{OUT} (W)
38.0dB	Ch. A	+4.7dBu	BRIDGED OUT	+42.7dBu	105.8 V	1400/8ohms
32.0dB	CH. A/B	+4.7dBu	SPEAKER A/B	+36.7dBu	52.9 V	700/4ohms

2.4 Maximum Input Level
The maximum input level is: U_{Emax} = +22dBu

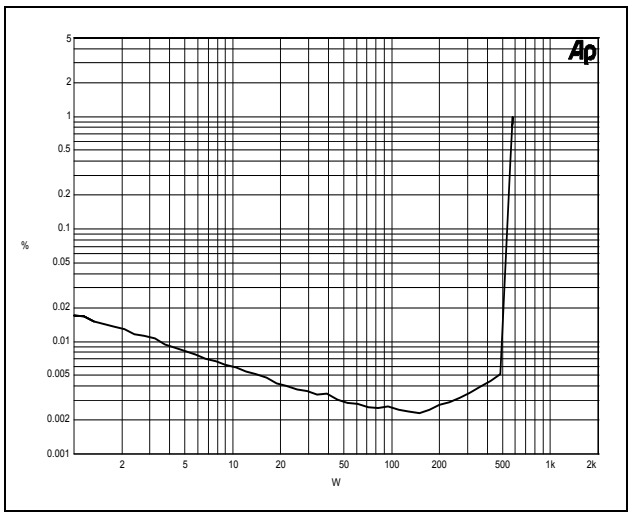
2.5 Amplitude – Non-Linearity
- Measurements with load resistor 8Ω
- Driven up to nominal output
- MBW = 80kHz

Measurement		Remarks
THD+N	<0.05 %	1 kHz
IMD-SMPTE	<0.02 %	60 Hz, 7 kHz
DIM 30	<0.01 %	3,15 kHz, 15 kHz

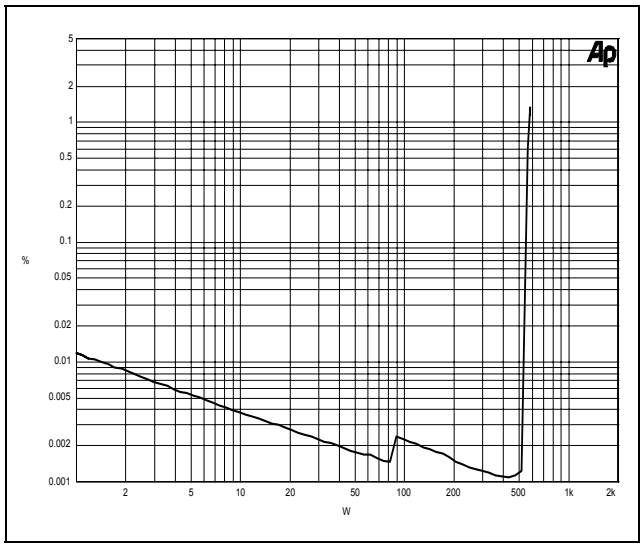
2.6.1 Amplitude – Non-Linearity, typical values
- 8 ohms load, regulated to nominal output if necessary



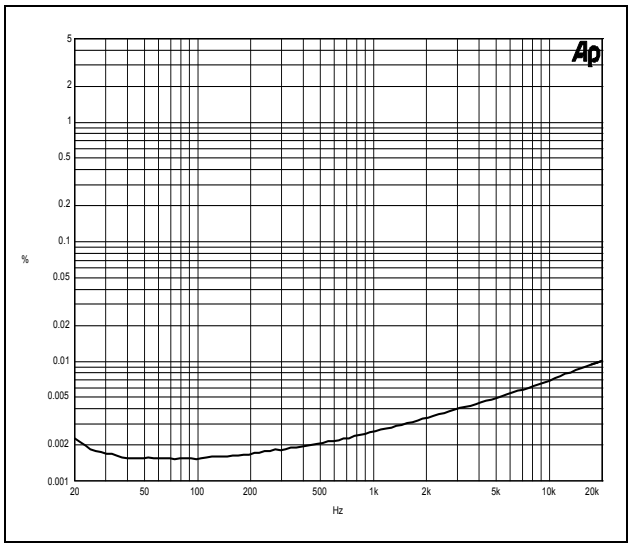
a) SMPTE 60Hz / 7kHz



b) DIM30



c) THD+N vs Level



d) THD+N vs Frequency

2.6 Border Frequencies

- Power amplifier without load connected

	Lower Border Frequency	Upper Border Frequency
-3dB	fu < 10 Hz	fo = 70 kHz
-1dB	fu = 13 Hz	fo = 40 kHz

2.7 Static Noise / Interference

- U(F) = extraneous voltage non-weighted with B = 22Hz ... 22 kHz, effective value (IEC 268-1)
- U(G) = noise voltage, frequency weighting filter according to CCIR-468-3, quasi peak-weighted (IEC 268-1)
- U(A) = interference voltage A-weighted, dB(A), effective value (IEC 268-1)
- S/N ratio referenced to maximum output voltage at 4Ω and interference voltage with A-weighting
- Inputs terminated with R(Q) = 50Ω

Power Amplifier	Output	U(F)	U(A)	U(G)	GAIN	EIN(A)	S/N-R.(A)	Remarks
CL / CP CPS	SPEAKER OUT A&B	-67dBu	-70dBu	-56dBu	32.0dB	-102dBu	107dB	Level Control max.
CL / CP CPS	SPEAKER OUT A&B	-69dBu	-72dBu	-59dBu	-	-	-	Level Control min.

2.8 Heat-Sink Feeler Gauge

Heat-Sink Temperature	25°C	40°C	60°C	70°C	80°C	90°C	100°C*
Voltage CNS3/4 Pin6	5.8 V	7.8 V	10.3 V	11.3 V	12.2 V	12.8 V	13.5 V

* The switch-off point is 95°C - 100°C, the power amplifier enters Protect-Mode.

2.9 GROUND LIFT Switch

The resistance is measured between Circuit Ground (at the input or output connector) and Chassis Ground (at the grounding screw on the rear panel or at the mains plug's ground wire contact).

Switch set to	Resistance
GROUNDED	R = 0Ω
UNGROUNDED	R = 5Ω

2.10 Dimensions and Weight

Power Amplifier	Weight	Dimensions in mm
CP2200 / CL1600 / CPS2.8	16kg	483 x 88.1 x 386.8

3. Settings

3.1 Idling Current

- Connect a DC voltmeter at the BIAS measuring points (CNS3 7/8 respectively CNS4 7/8)
- Adjust the idling current via trimmer VR103/VR303 (on the PCB-Amplifier). Trim both power amplifier channels A&B to U(DC) = 7.5mV
- Idling current adjustment has to be performed at normal room temperature. If the power amplifier had previously been operated, it has to be given several hours to regain normal temperature.

3.2 VCA–Offset

- Rhythmically open and short-circuit CNS3(A) respectively 4(B) Pin 1 and Pin 2
- Use VR102 respectively VR302 (on the PCB-Amplifier) to adjust the power amplifier output to minimum offset (with oscilloscope to minimal peak value or to the audible minimum volume of the interference impulse).

4. Function Test

4.1 Output–Offset Voltage

- DC voltage measurement at loudspeaker outputs SPEAKER A/B.
- **$U_{DC} \leq \pm 10mV$**.

4.2 Limiter

4.2.1 Attenuation

- Drive both channels separately with a 1 kHz signal up to U_A = 56.5V (without load)
- Increase the input voltage by 10dB
- The LIMITER LED lights, while the output voltage rises by approx. 2dB to approx. 71V. Slight clipping occurs.
- The distortion rate of the limited signal is at THD = 1.0 ... 1.5%
- Further increasing the input signal up to +20dBu should not result in remarkably higher clipping of the output signal.

4.2.2 Attack and Release Times

- Test the power amplifier channels separately
- Test without load resistors connected
- Drive the power amplifier with a burst signal (f = 1kHz, 10 cycles, rate : ≈ 0.5 sec.) and U_E = +14dBu applied to the input. The level is lowered to +4 dBu (by –10dB) during OFF-time.
- Monitor the output signal via oscilloscope. The limiter has controlled the major distortion down to a minor residual distortion (THD = 1% .... 1.5%) after 3 - 4 signal periods.

Attack Time: 3-4 ms **Release Time: 30-40 ms**

4.3 Power-On Delay

- Apply the signal to the power amplifier's input
- Switch the power amplifier's power on using its Power-On switch
- During power-on operation the Protect LED lights and the fans run at max. speed
- The power amplifier leaves Protect Mode approximately 2 seconds after pressing the power switch and the signal will be present at the output

4.4 Fan Control

- The fans run for approx. 2 seconds upon power-on (Ufan=29.7Vdc). If the power amplifier has not been operated before (cold), the fans stop running
- In idle condition (Power-On, no modulation) the fans switch between SLOW (Ufan=15.6Vdc) and OFF state, depending on the operational temperature of the heat sinks.
- Bridging Pin 6 (CNS3/4) and Pin 5 (CNS3/4) using according resistors provides forced fan operation: SLOW via 8k2, FAST via 3k, PROTECT via 1k.

4.5 SOA-Protection

- Separately drive the channels with a sine signal up to 56.5V (Ue=+5dBu) into 4Ω. Set the generator for burst 1kHz, 10 cycles On, Rate = 100ms.
- Parallel connect a 1Ω resistor
- The protection circuitry reacts and continuously tries to restart! The Protect-LED lights
- Caution: During this test, the mains voltage has to be kept as constant as possible at nominal mains voltage (e.g. 230V).
- Repeat the test using a 2Ω resistor
- The power amplifier should not switch off

4.6 Short-Circuit Limiting

- Operate the power amplifier without load connected
- Individually perform the test for each power amplifier channel
- Drive one channel with a burst signal (f = 1kHz, 1-3 cycles, rate ≈ 1 s, with U_E = +14dBu
- Connect a 1Ω load resistor
- The short-circuit current-limiter limits the output voltage at the load resistor symmetrically (monitor via oscilloscope) to a peak voltage value of **52-54V (ca. 52-54Apk).**

4.7 DC-Protection

- Operate the power amplifier without load connected
- Individually perform the test for each power amplifier channel
- Drive the power amplifier with a test signal f = 7 Hz
- Starting with an input voltage of approx. 12dBu the protection circuitry reacts and continuously tries to restart. The Protect LED blinks rhythmically
- Repeat the test with f = 14Hz. The power amplifier should not switch off

4.8 HF-Protection

- CAUTION: Operating the power amplifier without load connected is mandatory. Set the limiter to OFF by bridging pins 2 and 3 of CNS3/4
- Drive the power amplifier with a f = 60kHz sine burst signal 100ms ON, 900ms OFF applied to a single channel with +20dBu (7.7V).
- The protection circuit has to respond The power amplifier continuously tries to restart
- The PROTECT LED blinks rhythmically
- Repeat the test with f = 30kHz and the limiter set to ON. The power amplifier should not switch off.

4.9 Level Meters

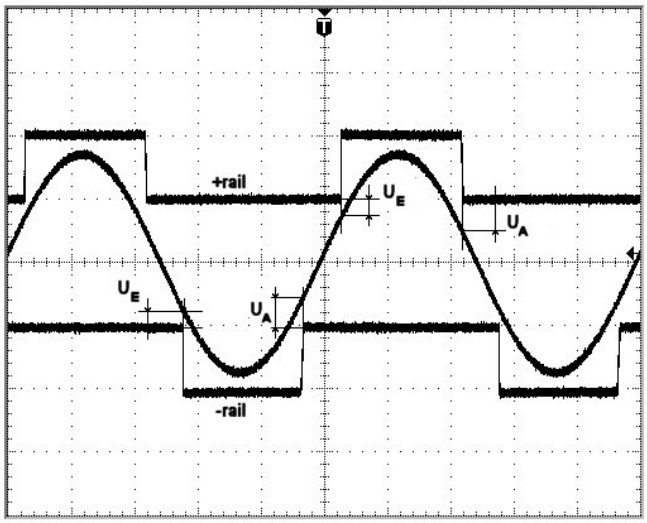
- Apply a sine signal f = 1kHz with –40dBu and slowly increase the signal
- The **SIGNAL** LEDs light at approx. -22dBu
- The **0dB** LEDs light at approx. +7.5dBu
- The **LIMIT** LEDs start lighting (dimmed) at +8.5dBu
- The **LIMIT** LEDs light bright at +11dBu

4.10 Shipping State

- GND-Lift = GROUNDED
- Dual/Parallel Routing = Dual
- Normal/Bridged Mode = Normal

4.11 Function Test „Class H“

- Monitor the corresponding operating voltage (Rail+ or Rail-, e.g. measured at the according heat-sink) and the power amp output via milli-voltmeter and oscilloscope.
  Input voltage 230V, U - Low = approx. 52V, U - High = approx. 104V
- Apply a sine signal f = 1kHz to channel A or B and slowly increase it.
  Once the U_A at the power amp output reaches approx. 26V-27Veff, Rail+ and Rail- have to switch to the next higher operating voltage.
- Switching operating voltages should not have any influence on audio signal quality.
- The edges of the control signal rise with a speed of 20-30V/µs (see diagram).
- With an output signal of 61Veff, the control margin ΔU_{Ein} between Rail and U_A is between 12,5V and 14,5V while ΔU_{AUS} is between 23V and 28V.



5. CPS2.8 Appendix

5.1 INPUTS A / B

- Other than the OUTPUT connectors A / B the inputs A and B are carried out via 3-pole terminal strips.

5.2 POWER OUTPUTS A / B

- The POWER OUTPUTS A / B are carried out via a single 4-pole terminal strip and not via Speakon-type connectors. The BRIDGED OUT-connector is missing.

5.3 LEVEL CONTROLS A / B

- CPS-Series amplifiers' Level Controls A / B are located at the rear panel.

5.4 POWER REMOTE

- Switch the device's power off using the POWER ON switch. Apply a control voltage of +24V to the Power Remote Input. The power amplifier has to switch on and after removing the control voltage switch off again.

5.5 POWER ON DELAY

- The 6 Dip-switches (t_1 – t_6) allow setting different delay times.

t_1 = 0,25 s	switch 1 to ON
t_2 = 0,50 s	switch 2 to ON
t_3 = 1,00 s	switch 3 to ON
t_4 = 1,50 s	switch 4 to ON
t_5 = 2,00 s	switch 5 to ON
t_6 = 2,50 s	switch 6 to ON
t_0 = 5,00 s	no switch to ON

5.6 Shipping State CPS2.8

- t_1 = 0,25 s switch 1 to ON

6. Technical Specifications

- Amplifier at rated conditions, both channels driven, 8Ω loads, unless otherwise specified.

	CL1600 / CP2200 / CPS2.8		
Load Impedance	**2Ω**	**4Ω**	**8Ω**
Maximum Mid band Output Power THD = 1%, 1kHz, Dual Channel	1100 W	800 W	500 W
Rated Output Power THD < 0.1%, 20Hz ... 20kHz	----	700 W	350 W
Maximum Single Channel Output Power Dynamic-Headroom, IHF-A	2200 W	1200 W	625 W
Maximum Single Channel Output Power Continuous, 1kHz	1500 W	950 W	550 W
Maximum Bridged Output Power THD = 1%, 1kHz	------	2200 W	1600 W
Maximum RMS Voltage Swing THD = 1%, 1kHz		72 V	
Power Bandwidth THD = 1%, ref. 1kHz, half power @ 4Ω		10 Hz ... 60kHz	
Voltage Gain, ref.1kHz		32.0 dB	
Input Sensitivity rated power @ 8Ω, 1kHz		+ 4.7 dBu (1.33 Vrms)	
THD at rated output power, MBW = 80kHz, 1kHz		< 0.05%	
IMD-SMPTE 60Hz, 7kHz		< 0.02%	
DIM30 3.15kHz, 15kHz		< 0.01%	
Maximum Input Level		+22dBu (9.76 Vrms)	
Crosstalk ref. 1kHz, at rated output power		< -80dB	
Frequency Response ref. 1kHz		15 Hz ... 40 kHz (±1 dB)	
Input Impedance active balanced		20kΩ	
Damping Factor 1kHz		> 300	
Slew Rate		35 V/µs	
Signal to Noise Ratio Amplifier A-weighted		107 dB	
Output Noise A-weighted		< -70 dBu	
Output Stage Topology		Class H	
Power Requirements		240, 230V, 220V, 120V or 100V; 50Hz ... 60Hz (factory configured)	
Power Consumption 1/8 maximum output power @ 4Ω, +10%		660W	
Protection		Audio limiters, High temperature, DC, HF, Back-EMF, Peak current limiters, Inrush current limiters, Turn-on delay	
Cooling		Front-to-rear, 3-stage-fans	
Ambient Temperature Limits		+5°C … +40°C (40°F … 105°F)	
Safety Class		I	
Dimensions (W x H x D), mm		483 x 88.1 x 386.8	
Weight		16 kg (35.2lbs)	
Remote Power On (CPS 2.8 only)		+24Vdc, delay-time selectable	
Optional:			
Rear-rackmount 15,5“		112930 (NRS 90262)	
Rear-rackmount 18“		112933 (NRS 90264)	
2-Way Crossover, internal filter-card, 24dB, LR		330Hz (NRS 90249), 500Hz (NRS 90250), 800Hz (NRS 90251), 1200Hz (NRS 90252)	

Stand: 15.5.2003, JTa