Product Data

Power Amplifier — Type 2713

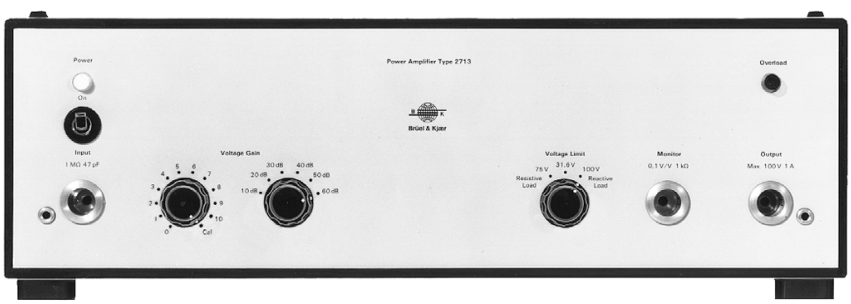
USES

- ❍ Driving Brüel & Kjær Hydrophones Types 8103, 8104 and 8105 as projectors
- ❍ Driving electrostatic actuators at high voltage levels
- ❍ As general purpose power amplifier for capacitive piezoelectric transducers

FEATURES:

- ❍ 100 V (RMS), 1 A into capacitive load
- ❍ Frequency range 10 Hz to 200 kHz
- ❍ 0 to 60 dB voltage gain in six 10 dB ranges
- ❍ Switchable maximum output voltage limits
- ❍ Circuit protection against overload

The Power Amplifier Type 2713 is designed specifically to drive highly capacitive transducers to high voltage levels, such as when the Brüel & Kjær Hydrophones Types 8103, 8104 or 8105 are employed as projectors in underwater calibration arrangements.



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When a piezoelectric transducer like the standard hydrophone is used as a transmitter, the driving voltage should be high so that the best possible signal-to-noise ratio can be obtained at low frequencies where the transmitting sensitivity is low. This in turn leads to a heavy current at high frequencies where the transmitting sensitivity of the hydrophone is higher. Furthermore, the driving amplifier must deliver this constant voltage without being influenced by the highly capacitive loading presented by the hydrophone and cable.

These special requirements place severe demands on the output section of the power amplifier because the voltage and current are out of phase with each other with capacitive loading, so that transistors will not be satisfactory, due to secondary breakdown limitations. Therefore, the unusual step was taken of employing electron tubes in the output section of the 2713. This arrangement can handle capacitive loads up to 30 nF, while maintaining a good signal-to-noise ratio.

The power amplifier has a frequency range from 10 Hz to 200 kHz with a maximum gain of 60 dB in 10 dB steps with continuously variable gain in each range. Switchable voltage limits of 100 V (RMS), (141 V (peak)) for reactive loads, 75 V (RMS), (105 V (peak)) for resistive loads, or 31,6 V (44,7 V (peak)) for both reactive and resistive loads can be selected to protect the particular transducer being employed. The maximum output current is 1,41 A (peak). The maximum RMS current available (I) can be found from the following relationship:

$$I = \frac{100 + W}{200}(A(RMS))$$

Where the output power (W) depends upon the loading and the duty cycle of the amplifier. In any case the maximum continuous output power available is 100 W.

With the “pure” capacitive loading obtained from the hydrophone, the output power will be 0 W, so the maximum continuous current

= 0.5 A (RMS)

When the amplifier is operating with a gated signal, the maximum available RMS current limits the duty cycle to 50% when a current level of 1,41 A (peak) is required.

The output voltage can be monitored at the “Monitor” socket on the front panel which gives a calibrated level of 0.1V for each 1.0V at the “Output”. The “Monitor” socket, like the other front panel sockets is paralleled by a BNC socket on the rear panel.

Extensive precautions have been taken to prevent damage to either the transducer, or to the amplifier due to overload or overheating. The “Overload” lamp on the front panel lights, and the signal is prevented from reaching the output section (and sockets) if the output voltage exceeds the preset “Voltage Limit”, or if the output current exceeds the peak value of 1,41 A. The lamp also lights and the output is removed during the “warm-up” period of the instrument (about 40 s). To ensure adequate cooling of the tubes, an extractor fan is built in. Nevertheless, should the output section temperature rise above 120 °C (250 °F), the “Overload” lamp will light and the output be inhibited.

Fig.1 shows a typical arrangement that can be used for calibrating the frequency response and sensitivity of hydrophones and projectors. This particular arrangement is suitable for use in small water tanks because the use of the gating system allows accurate calibration even where reflections are present. Calibration is achieved by emitting an impulse from the gating system, and then measuring the received signal for only a short period during the time when the direct signal is being received. This blocks out the reflections completely and gives measurements corresponding to those obtained under free-field conditions.

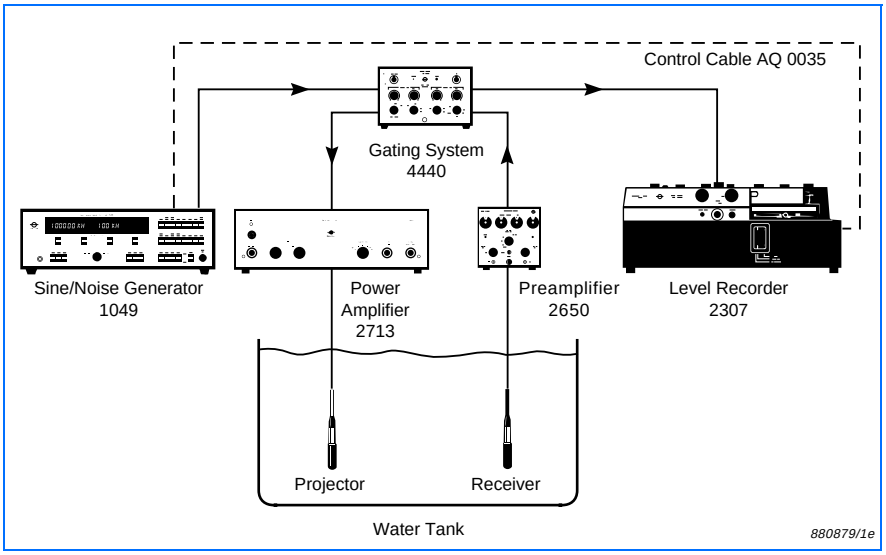

Fig.1 Arrangement for calibrating hydrophones or projectors in small water tanks

Specifications 2713

FREQUENCY RANGE:
10 Hz to 200 kHz <±3 dB
VOLTAGE LIMITS:
100 V (RMS), (141 V (peak)) with reactive load
31.6 V (RMS), (44.7 V (peak)) with reactive and resistive loads
75 V (RMS), (105 V (peak)) with resistive load
INPUT: AC coupled
INPUT IMPEDANCE:
1 MΩ in parallel with 47 pF
OUTPUT IMPEDANCE:
<1 Ω up to 5 kHz
<30 Ω up to 200 kHz
MAXIMUM OUTPUT CURRENT:
1.41 A (peak)
DC STABILITY:
Less than 100 mV offset for ±10% variation of mains supply from nominal, and for 5 to 40 °C (41 to 104 °F) variation in ambient temperature
SIGNAL-TO-NOISE RATIO:
(measured with 300 kHz bandwidth)
80 dB for gain settings 0 to 40 dB
70 dB for gain setting 50 dB
60 dB for gain setting 60 dB
VOLTAGE GAIN:
0 to 60 dB in 10 dB ranges, continuously variable within each range
PROTECTION:
Overload lamp lights and output is blocked under any of the following conditions:

- Output voltage exceeds the preset limit
- Output current exceeds 1.41 A (peak)
- During instrument warm-up time, approximately 40 s
- Temperature in the output section exceeds 120 °C (250 °F)

Forced air cooling of the output section is also supplied by an extractor fan

Power Supply

100 to 240 V, 50 to 60 Hz, approximately 200 VA
Complies with Class 1 of IEC 348

Dimensions and Weight

Height: 132.6 mm (5.2 in)
Width: 430 mm (16.9 in)
Depth: 200 mm (7.9 in)
Weight: 12 kg (26.5 lb)

Note: All values are typical at 25°C (77°F), unless measurement uncertainty or tolerance field is specified. All uncertainty values are specified at 2σ (i.e. expanded uncertainty using a coverage factor of 2)

COMPLIANCE WITH STANDARDS:

CE	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive.
Safety	IEC 348: Safety Requirements for Electronic Measuring Apparatus.
EMC Emission	EN 50081–1: Generic emission standard. Part 1: Residential, commercial and light industry. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
EMC Immunity	EN 50082–1: Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082–2: Generic immunity standard. Part 2: Industrial environment. **Note 1:** The above is guaranteed using accessories listed in this Product Data sheet only. **Note 2:** RF disturbances above 6 MHz may result in demodulation and overload conditions
Temperature	IEC 68–2–1 & IEC 68–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: 5 to 40°C (41 to 104°F) Storage Temperature: –25 to +70°C (–13 to +158°F)
Humidity	IEC 68–2–3: Damp Heat: 90% RH (non-condensing at 40°C (104°F))

Ordering Information

Type 2713 Power Amplifier
Includes the following accessories:
AO 0013: Brüel & Kjær to Brüel & Kjær coaxial cable (1.2 m)
JP 0035: BNC plug
VF 0007: T 1.6 A fuse, (220 – 240 V)
VF 0019: T 3.15 A fuse, (100 – 150 V)

Optional Accessories

KS 0038: Rack mounting flanges
AO 0019: Brüel & Kjær to Brüel & Kjær coaxial cable (3 m)
AO 0020: Brüel & Kjær to Brüel & Kjær coaxial cable (10 m)
AO 0087: BNC to BNC coaxial cable
AQ 0035: Control cable, 7-core DIN cable (1.5 m)

Brüel & Kjær

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