

BRAINGASM

MP1

USER MANUAL



TECHNICAL DOCUMENTATION

BRAINGASM – MP1

Small Diaphragm Condenser Microphone

1. OPERATING INSTRUCTIONS

1.1 Introduction & Acoustic Operating Principle

The **Braingasm MP1** is a small diaphragm condenser microphone engineered for **acoustic instruments, drums, percussion, and orchestral recordings**.

At its core, the microphone utilizes a unique small-diaphragm, hand-skinned 22mm capsule operating on the pressure gradient transducer principle. This transducer is paired with a JFET impedance converter and a balanced, transformerless Class A Push-Pull output stage. This active architecture is specifically engineered to provide extreme **transparency, transient speed, and a clinical flat response**.

To optimize polar response and maintain physical protection, the MP1 features a highly rigid, CNC-machined solid brass housing protected by a durable Cerakote finish, minimizing resonance and internal acoustic interference.

1.2 Application Hints & Directional Characteristics

The directional characteristic of the MP1 is a specially tailored cardioid pattern.

Cardioid Pattern (*see appendix 1):

- **Acoustic Resonator Engineering (Slots vs. Circular Holes):** While traditional microphone designs utilize wide open slots that act as simple acoustic resistances the MP1 features a specialized, high-precision pattern of circular holes that create small air cavities functioning as miniature resonators.
- **High-Mid Spectrum Optimization:** In standard small-diaphragm microphones, the true cardioid pattern naturally begins to degrade into an unwanted hypercardioid or lobing

pattern in the upper-mid and high frequencies (2 kHz to 8 kHz) due to acoustic shadowing and diffraction caused by the physical body of the microphone. By tuning the circular hole pattern to act as a resonator specifically targeting these critical wavelengths, this natural physical limitation is minimized.

- **Primary Applications:** Close-miking on high-energy acoustic sources, precision instrument tracking (e.g., acoustic guitars, grand pianos, string ensembles, woodwinds), and drum overhead arrays. Its high SPL tolerance removes the typical restriction of close-up placement on intense percussive transients. Furthermore, because the acoustic resonator targets the specific zone where the human ear is most sensitive to phase issues (1 kHz – 5 kHz), off-axis bleeding—such as hi-hat bleed into a snare microphone or adjacent acoustic instruments in an ensemble—remains incredibly clean, natural, and highly attenuated.

Matched pair version

The MP1 is distributed either as an individual microphone or in a **Matched Pair** configuration.

While individual units conform to standard production tolerances relative to the nominal specifications, the matched pairs undergo a comparative measurement protocol to minimize magnitude and frequency response deviations.

Selection Criteria and Tolerance Tolerances

The pair calibration protocol evaluates 2 parameters measured under identical conditions:

- **Nominal Sensitivity:** The open-circuit sensitivity of the two units is matched within a maximum tolerance of $\leq 0.5 \text{ dB}$ (measured at 1 kHz, 1 Pa / 94 dB SPL). This limits input gain asymmetries in the stereo capture system.
- **Magnitude Response Coherence:** The frequency response curves are overlaid across the entire spectrum from 10 Hz to 20,000 Hz. The pairing is validated only if the deviation does not exceed $\pm 1 \text{ dB}$ at any given frequency within the audible audio band.
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1.3 Connection and Powering

The MP1 features a high-grade genuine Neutrik 3-pin XLR output connector.

- **Phantom Power Requirements:** The microphone requires standard P48 Phantom Power ($48\text{ V} \pm 4\text{ V}$) conforming to IEC 61938.
- Ensure that the monitoring system volume/gain is fully attenuated before routing phantom power to the unit.
- After turning on P48 power, allow 5–10 seconds for the circuit to completely stabilize before commencing operation.
- **Pin Allocation:**
 - Pin 1: 0 V / Chassis Ground
 - Pin 2: Audio Signal + (Positive Phase / Hot)
 - Pin 3: Audio Signal - (Negative Phase / Cold)

1.4 Care and Maintenance

- **Capsule Protection:** The capsule is highly sensitive to moisture deposition. Always employ an external studio pop shield if you are using MP1 for vocal recordings.
 - **Storage:** When not in use for extended periods, place the microphone into its protective enclosure to minimize dust buildup.
 - **Cleaning:** Dust the chassis using exclusively a dry, lint-free fabric. Never let liquid cleaning solvents contact the internal capsule housing.
 - **Suppression of Stray RF and RF Interference:** Following strict high-frequency shielding principles:
 - Keep all microphone cabling paths as short as practically possible.
 - Do not route audio lines parallel to AC main supply lines; always cross them at strict 90-degree angles if unavoidable.
 - Avoid placing the high-sensitivity J-FET circuit in immediate proximity to prominent electromagnetic fields (e.g., computers, wireless routers, power transformers, switching power supplies).
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2. TECHNICAL SPECIFICATIONS

- Acoustic Principle: Pressure gradient transducer
 - Active Electronics: Low-noise JFET input stage, Class-A Push-Pull BJT output stage
 - Directional Pattern: Cardioid
 - Frequency Range: 20 Hz – 20,000 Hz
 - Capsule Sensitivity at 1 kHz: -36 dB/Pa (16 mV)
 - Self Noise: 13 dB (A-weighted)
 - Signal-to-Noise Ratio: 81 dB (A-weighted)
 - Dynamic Range: 120 dB
 - Maximum SPL: 133 dB (for 0.5% THD)
 - Maximum Input Level (electrical): 870 mV
 - Maximum Output Level: 1.3 V
 - Rated Output Impedance: 50 Ω
 - Physical Dimensions: Diameter: 22 mm
 - Housing Finish: Cerakote finish, solid brass body
 - Made in Italy
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3. ELECTRICAL SAFETY & OPERATING PRECAUTIONS

3.1 Phantom Powering Safety (IEC 61938 Compliance)

The MP1 is an active solid-state microphone requiring a stabilized **P48 Phantom Power supply ($48\text{ V} \pm 4\text{ V}$)** via a balanced XLR connection, adhering strictly to the IEC 61938 standard.

- **Power Source Quality:** Never attempt to power this microphone using non-standard or unregulated voltage sources (e.g., T-power, unbalanced DC lines). Doing so may cause permanent thermal damage to the internal circuitry.
- **Hot-Plugging Prevention:** Always turn off the P48 phantom power source before connecting or disconnecting the microphone cable. Sudden voltage spikes caused by

"hot-plugging" can induce severe inductive transients capable of damaging both the microphone's circuitry and the input stage of your console or audio interface.

3.2 Grounding, Cable Integrity, and Shielding

- **Pin 1 Connection (Chassis Ground):** The XLR connector utilizes Pin 1 for chassis grounding and shielding. Never lift, disconnect, or alter the ground connection on Pin 1. Proper chassis grounding is legally and functionally essential to shield the microphone from external Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI).
- **Symmetrical Cable Requirements:** Use exclusively fully shielded, balanced microphone cables with a low capacitance rating. Defective shielding or asymmetrical wiring will lead to severe stray RF leakage, audible hum, and potential phantom power distribution imbalances.
- **Routing Layout:** Avoid routing the microphone cables parallel to high-voltage AC mains lines, digital data cables, or proximity to switching power supplies and wireless transmitters. If crossing is mandatory, always orient the cables at a strict 90-degree angle.

3.3 Environmental and Electrostatic (ESD) Precautions

- **Electrostatic Discharge (ESD) Hazards:** Avoid touching the capsule or inserting metallic objects through microphone chassis. Electrostatic discharges transferred via external conductors can puncture or permanently damage the diaphragm.
 - **Moisture and Condensation:** High humidity levels or breath moisture condensation can cause temporary electrical leakage pathways across the high-impedance capsule resistors, leading to audible sputtering, crackling noises, or a temporary loss of sensitivity. Always employ an external studio pop shield during vocal tracking sessions to isolate the capsule from moisture.
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4. REGULATORY COMPLIANCE & EUROPEAN DIRECTIVES

4.1 CE Marking and Declaration of Conformity

This product bears the CE Mark, which legally certifies that the Braingasm MP1 microphone strictly complies with the essential health, safety, and environmental protection standards established by European Union legislation.

The device conforms to the requirements of the following European Directives:

- **EMC Directive (2014/30/EU):** Electromagnetic Compatibility Directive.
- **RoHS Directive (2011/65/EU):** Restriction of Hazardous Substances Directive.

4.2 RoHS Compliance Statement

Braingasm certifies that the MP1 hardware and its internal electronic component assembly are fully compliant with Directive 2011/65/EU (RoHS 2) and its subsequent amendments. This product does not contain lead, mercury, cadmium, hexavalent chromium, or restricted polybrominated flame retardants above the maximum tolerated threshold limits defined by EU regulations.

4.3 WEEE Disposal Instructions (Waste Electrical and Electronic Equipment)

In accordance with European Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), this electronic device must not be disposed of with regular, unsorted municipal household waste.

The user is legally obligated to dispose of this hardware by delivering it to a designated municipal collection facility, local recycling center, or returning it to the retailer upon purchasing an equivalent new product. Correct disposal ensures that critical raw materials are safely recycled, mitigating potential adverse effects on public health and the environment caused by inappropriate waste handling.

5. MANUFACTURING

Braingasm Lab

Via Zenodossio 11, 00176 Rome, Italy

Handmade in Italy

Official Communications: www.braingasmlab.com

This product conforms to the standards listed in the Declaration of Conformity.

Please contact us if you want to order a free copy of the Declaration of Conformity.

Technical data subject to change without notice.



TECHNICAL GLOSSARY:

CONDENSER MICROPHONE SPECIFICATIONS

1. Capsule Sensitivity

Definition: The efficiency with which a microphone capsule converts acoustic sound pressure into an electrical voltage. It is measured at a reference frequency of 1 kHz and expressed either in millivolts per Pascal (mV/Pa) or in decibels relative to 1 Volt per Pascal (dBV/Pa).

Formula: Sensitivity (dBV/Pa) = $20 * \log_{10} (\text{Sensitivity in mV/Pa} / 1000)$

*Example: 18 mV/Pa converts to $20 * \log_{10}(0.018) \approx -35 \text{ dBV/Pa}$.*

2. Self Noise (Equivalent Noise Level)

Definition: The residual electrical noise voltage generated solely by the microphone's internal circuitry and thermal air agitation on the diaphragm, expressed as an equivalent acoustic sound pressure level. It is measured in decibels using an A-weighting filter (dB(A)) to mimic human hearing sensitivity.

Formula: Self Noise (dB(A)) = 94 dB SPL - SNR (dB)

Example: Acts as the absolute floor of both the Signal-to-Noise Ratio and the Dynamic Range.

3. Signal-to-Noise Ratio (SNR)

Definition: The ratio between a standard reference speech level and the inherent self-noise floor of the microphone. By industry convention, the standard reference signal is 1 Pascal of air pressure, which equals 94 dB SPL at 1 kHz.

Formula: SNR (dB) = 94 dB SPL - Self Noise (dB(A))

Example: $94 \text{ dB} - 12 \text{ dB(A)} = 82 \text{ dB}$.

4. Maximum SPL (Sound Pressure Level)

Definition: The highest acoustic sound pressure level that the microphone can handle before its internal electronics or capsule clip, typically measured at the point where Total Harmonic Distortion (THD) reaches 0.5% or 1%.

Formula: Max SPL (PAD) = Max SPL (Standard) + PAD Value (dB)

Example: Engaging an input PAD (x dB) increases this limit by reducing the signal level before it overloads the impedance converter circuit.

5. Dynamic Range

Definition: The entire usable operational window of the microphone, stretching from the quietest audible sound it can capture above its own noise floor up to the loudest sound it can handle before distorting.

Formula: Dynamic Range (dB) = Maximum SPL (dB SPL) - Self Noise (dB(A))

Example: 130 dB SPL - 12 dB(A) = 118 dB.

6. Maximum Output Level

Definition: The maximum electrical voltage (expressed in Volts, V, or dBu) that the microphone's output stage can cleanly deliver to a preamplifier before clipping.

Formula: $\Delta\text{dB} = \text{Max SPL} - 94 \text{ dB}$

Voltage Gain Factor = $10^{(\Delta\text{dB} / 20)}$

Max Output Level (V) = Sensitivity (V/Pa) * Voltage Gain Factor

*Example: $0.018 \text{ V/Pa} * 10^{((130 - 94) / 20)} = 0.018 * 63.1 \approx 1.136 \text{ V} \rightarrow 1.1 \text{ V}$ (rounded).*

7. Rated Output Impedance

Definition: The internal electrical resistance of the microphone's output circuit looking back from the XLR connector, measured in Ohms (Ω).

Formula: $Z_{\text{in}} (\text{Preamplifier}) \geq 10 * Z_{\text{out}} (\text{Microphone})$

Example: For a 50Ω microphone, the preamplifier input impedance should be at least 500Ω (standard studio preamps are typically $1000 \Omega - 2400 \Omega$).

APPENDIX 1:

THE "SPECIAL" CARDIOID PATTERN

1. Tuned Acoustic Impedance vs. Generic Acoustic Resistance

In a standard SDC condenser microphone, the rear entries of the capsule typically consist of wide and open structural slots. This configuration acts as a simple acoustic resistance, providing a path for the sound to enter the phase delay network of the backplate of the capsule to generate the cardioid pattern. However, a purely resistive barrier offers limited control over narrow, frequency-specific anomalies.

The MP1 replaces generic slots with a high-precision grid pattern of circular holes. Mechanically, each hole and its underlying boundary layer functions as an array of miniature acoustic resonators (Helmholtz cavities). By calculating and varying the specific depth of the metal housing, the hole diameter, and the volume of the internal air compliance, the acoustic impedance (the balance of acoustic mass, compliance, and resistance) can be tuned to specific target frequencies. This allows the designer to shape the frequency spectrum of the sound wave reaching the rear side of the diaphragm with greater precision than broad-bandwidth slots allow.

2. Compensation for High-Frequency Directivity Degradation (Lobing)

A textbook cardioid polar pattern relies on a perfect phase cancellation network. In real-world applications, as the acoustic wavelength approaches the physical dimensions of the microphone housing (typically between 2 kHz and 8 kHz), the microphone body acts as a physical obstacle. This induces acoustic shadowing and diffraction.

Consequently, standard SDC's suffer from polar pattern degradation at high frequencies, where the pattern tends to narrow into a hypercardioid shape or develop unwanted rear pickup lobes (lobing). Because the MP1's circular hole pattern is tuned to act as a reactive acoustic network specifically matching these high-mid wavelengths, it introduces a calibrated mechanical phase shift that counteracts the diffraction effects of the housing.

This architectural compensation stabilizes the cardioid pattern, attenuating rear lobing within the critical 2 kHz to 8 kHz spectrum.

3. Linearization of Off-Axis Phase Coherence

When a microphone's directivity pattern alters at high frequencies, any off-axis acoustic energy (spill or bleed from adjacent instruments) undergoes phase-smearing and frequency coloration. This makes isolation and subsequent mixing problematic due to comb-filtering effects.

The human auditory system is exceptionally sensitive to phase variance and transient arrival times in the mid-to-high frequency spectrum (1 kHz to 5 kHz). Because the MP1's tuned rear network maintains a stable, uniform cardioid rejection curve across this specific frequency band, off-axis spill is attenuated evenly across its harmonic spectrum rather than selectively filtered. This linearity ensures that off-axis bleed remains phase-coherent and clean.