Mouth Simulator Types 4227 and 4227-A

Mouth Simulator Types 4227 and 4227-A are high-performance artificial mouths conforming to ITU-T Rec. P.51 and designed for accurate and repeatable electroacoustic measurements.

The mouth simulators produce a guaranteed minimum continuous output of 110 dB SPL (200 Hz to 2 kHz) at a distance of 25 mm from the lip ring. A sound pressure level of more than 120 dB is possible with pulsed operation. A built-in overload-protection circuit minimizes the risk of accidental damage to the loudspeaker.

A microphone can be fitted at the mouth opening for use in a compressor loop to give constant sound pressure output. Accurate calibration is facilitated by a calibration jig provided with the simulator.

Type 4227-A contains a built-in Class-D amplifier.

Uses and Features

**Uses**
- Quality control testing of frequency response and distortion of telephone transmitters and close-talking microphones
- Sound source for acoustic measurements

**Features**
- Accurate and very consistent simulation of human voice field
- Built-in Class-D amplifier (Type 4227-A only)
- Continuous SPL of 110 dB at 25 mm from lip ring
- Low distortion
- Built-in overload protection circuit
- Optional regulating microphone for very accurate frequency response control
- Calibration Jig included
- Conforms to standards: IEEE-269, IEEE 661 and ITU-T Rec. P.51
- Low sensitivity to temperature and humidity changes

Description

The mouth simulators are high-performance, low-distortion sound sources used for testing acoustic transducers. They consist of a high-quality loudspeaker mounted in a specially shaped housing. A lip ring is mounted on the upper surface of the unit, providing a convenient reference plane for measurements. Type 4227-A also has a built-in Class-D amplifier. This simplifies setup, and the use of a Class-D design minimizes thermal output, allowing use of the mouth simulator in small test chamber installations while avoiding heating of tested components.
When testing telephone transmitters and close talking microphones it is required that the sound field closely replicates the sound field generated by the human mouth, as specified in IEEE 269 and fulfilled by Types 4227 and 4227-A. Calibration of the mouth simulator can be made with the aid of the Calibration Jig UA-0901 provided. The jig is designed to hold a ½” measuring microphone at a distance of 25 mm from the lip ring (see Fig. 2). It consists of two interlocking plates which can be fitted together in two ways enabling the microphone to be held with its axis at either 0° (free-field microphone, Fig. 2) or 90° (pressure-field microphone Fig. 3) to the mouth axis.

The mouth simulators consist of a high-quality loudspeaker mounted in a specially shaped housing. A lip ring is mounted on the upper surface of the unit, providing a convenient reference plane for measurements. A Brüel & Kjær ¼” microphone with ¼” preamplifier can be fitted in the mouth opening to monitor the acoustic output level (Fig. 5). The use of such a microphone is strongly recommended whenever an extremely stable system with a flat frequency response is required without sacrificing ease of operation. The simulator is fitted with a removable plastic dummy ¼” microphone in the mouth opening. This ensures that the mouth simulator has the same acoustic characteristics whether a monitoring microphone is installed or not.

**Frequency Response**

A typical frequency response without equalization is shown in Fig. 4. A frequency response with less than ±1 dB deviation over the frequency range (100 Hz to 10 kHz) at 25 mm distance from the lip ring can easily be obtained with the aid of an equalizing arrangement comprising a ¼” microphone, inserted in the mouth opening of the simulator, measuring the reference sound pressure (Fig. 5). The mouth simulators are delivered with a calibration chart giving the frequency response measured at a distance of 25 mm from the lip ring.
Output SPL

**Type 4227** can produce a minimum SPL of 110 dB in the frequency range 200 Hz to 2 kHz and 100 dB in the range 100 Hz to 8 kHz, at a distance of 25 mm from the lip ring. This is achieved with the maximum continuous power consumption of 10 W. The Mouth Simulator can be operated at higher power levels for short periods. Power levels of up to 50 W can be safely used for periods of less than 2 s (with 20 s pulse intervals), producing a corresponding SPL of 120 dB, 25 mm from the lip ring.

**Type 4227-A** can produce a minimum SPL of 110 dB in the frequency range 200 Hz to 2 kHz and 100 dB in the range 100 Hz to 10 kHz, at a distance of 25 mm from the lip ring. This is achieved with the maximum continuous input voltage of 0.8 Vrms. The Mouth Simulator can be operated at higher input levels for short periods. Input levels of up to 1.5 Vrms can be safely used for periods of less than 2 s. If voltage is exceeding this time frame, the amplifying module will go into protection mode (muting the loudspeaker) for 2 s.

**Applications**

Testing of telephone handsets is facilitated with Telephone Test Head Type 4602. This permits the accurate mounting of the handset relative to the mouth simulator and can also hold various types of artificial ear assemblies. Accurate automated quality control checks of audio communication transducers can be made with a PULSE™ Electroacoustics Type 7797 or 7907 test system. See Fig. 6 or Fig. 7 for an example of a microphone test system overview.
### Compliance with Standards

<table>
<thead>
<tr>
<th>Safety</th>
<th>EN/IEC 61010-1, ANSI/JUL 61010-1 and CSAC22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC Emission</td>
<td>EN/IEC 61000—6–3: Generic emission standard for residential, commercial and light industrial environments. EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements.</td>
</tr>
<tr>
<td>Humidity</td>
<td>IEC 60068–2–78: Damp Heat: 90% RH (non-condensing at 40°C (104°F)).</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Non-operating: IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s², 10–500 Hz IEC 60068–2–27: Shock: 1000 m/s² IEC 60068–2–29: Bump: 3000 bumps at 250 m/s²</td>
</tr>
</tbody>
</table>

### Specifications – Mouth Simulator Types 4227, 4227-A

<table>
<thead>
<tr>
<th>CONTINUOUS OUTPUT LEVEL</th>
<th>TYPE 4227-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. 110 dB SPL, 200 Hz to 2 kHz</td>
<td>Max. Average Input Voltage: 0.8 V&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>Min. 100 dB SPL, 100 Hz to 8 kHz</td>
<td>Max. Pulsed Input Voltage: 1.5 V&lt;sub&gt;rms&lt;/sub&gt; for 2 seconds</td>
</tr>
<tr>
<td>Measured 25 mm from lip ring. (see Fig. 4 for SPL range)</td>
<td>MOUTH OPENING</td>
</tr>
<tr>
<td>DISTORTION (harmonic components up to 8 kHz) at 94 dB SPL, 25 mm from lip ring</td>
<td>Diameter: 20 mm (0.8”)*</td>
</tr>
<tr>
<td>&lt;2%, 200 Hz to 250 Hz</td>
<td>LIP RING</td>
</tr>
<tr>
<td>&lt;1% &gt;250 Hz</td>
<td>Position: 10 mm (0.4”) from mouthpiece</td>
</tr>
<tr>
<td>TYPE 4227</td>
<td>Outer Diameter: 48 mm (1.9”)</td>
</tr>
<tr>
<td>Max. Average Power: 10 W at 20°C (68°F)</td>
<td>DIMENSIONS</td>
</tr>
<tr>
<td>Max. Pulsed Power: 50 W for 2 seconds</td>
<td>Height: 104 mm (4.1”) to top of lip ring</td>
</tr>
<tr>
<td>Impedance: 4 Ω</td>
<td>Diameter: 104 mm (4.1”)</td>
</tr>
<tr>
<td>Loudspeaker Diameter: 88 mm (3.5”)</td>
<td>WEIGHT</td>
</tr>
<tr>
<td>Typical Sensitivity at 1 kHz: 80 dB SPL @ 2 V/500 mm</td>
<td>2.2 kg (4.85 lb)</td>
</tr>
</tbody>
</table>

### Ordering Information

**Type 4227 and 4227-A Mouth Simulator**

- UA-0901: Calibration Jig
- SO-0005: 2 x Lip Ring
- DA-0150: ¼” Plastic Microphone Dummy
- ZG-0426: Power Supply 100 – 240 V AC (Type 4227-A only)

**Optional Accessories**

- Type 2669: ½” Microphone Preamplifier
- Type 2870: ¼” Microphone Preamplifier
- Type 4191: Free-field Microphone for calibration
- Type 4192: Pressure-field Microphone for calibration

**Type 4938**

- ¼” Pressure-field Condenser Microphone (for monitoring acoustic output level)

**Type 4939**

- ¼” Free-field Condenser Microphone (for monitoring acoustic output level)

**UA-0899**

- Mouthpiece with Lip Ring (for simulating sound field of earlier Type 4219)

**Accredited Calibration**

- 4227-CAF Accredited Calibration
- 4227-CFF Factory Standard Calibration (included with delivery)

---

Brüel & Kjaer reserves the right to change specifications and accessories without notice. © Brüel & Kjaer. All rights reserved.