

## BRÜEL & KJÆR® Electroacoustic Solutions

### 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 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.



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### Uses and Features

#### Uses

- Quality control testing of frequency response and distortion of telephone transmitters and close-talk 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 has a built-in class D amplifier which simplifies setup and minimizes thermal output, allowing use of the mouth simulator in small test chamber installations while avoiding heating of tested components.

Types 4227 and 4227-A fulfill the requirement of IEEE 269 and ITU-T Rec P.51, that the sound field closely replicates the sound field generated by the human mouth when testing telephone transmitters and close-talk microphones. See Specifications for more details.

Fig. 1

**Left:** Types 4227 and 4227-A include two lip rings and a calibration jig;  
**Centre:** Mouth simulator shown with Free-field Microphone Type 4191 in jig for calibration according to IEEE 269 (0° incidence);  
**Right:** Mouth simulator shown with Pressure-field Microphone Type 4192 in jig for calibration according to ITU-T Rec. P.51 (90° incidence)



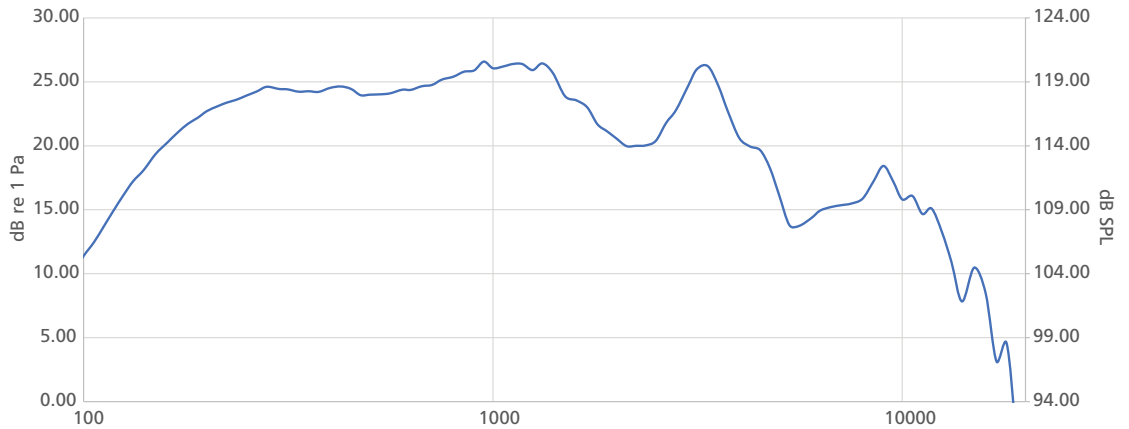
Calibration of the mouth simulator can be performed using the provided Calibration Jig UA-0901, that is designed to hold a ½” measuring microphone at a distance of 25 mm from the lip ring (see Fig. 1). The jig consists of two interlocking plates that can be fitted together in two ways enabling the microphone to be held with its axis at either 0° (free-field microphone, Fig. 1, centre) or 90° (pressure-field microphone Fig. 1, right) to the mouth axis.

A Brüel & Kjær ¼” microphone with ¼” preamplifier can be fitted in the mouth opening to monitor the acoustic output level (Fig. 3). 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. 2. 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. 3). The mouth simulators are delivered with a calibration chart giving the frequency response measured at a distance of 25 mm from the lip ring.

Fig. 2  
 Typical frequency response for Types 4227 and 4227-A at lip ring without equalization



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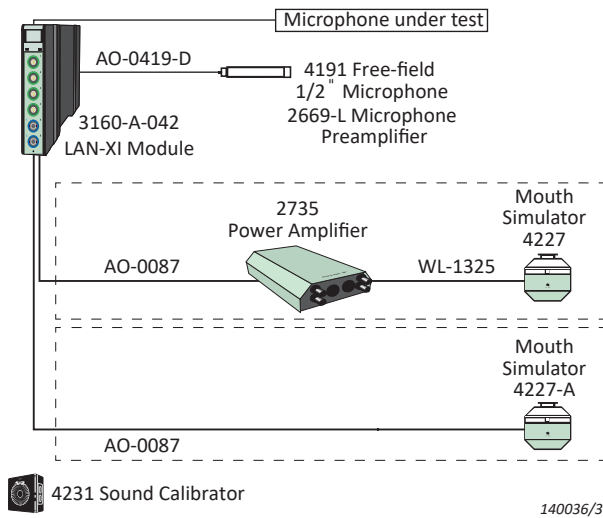
Fig. 3  
 View of connectors and reference microphone (shown fitted)  
**Left:** Type 4227 has dual banana input connectors  
**Centre:** Type 4227-A has a BNC input and a power supply connector  
**Right:** Mouth simulator with a ¼” reference microphone, Type 4938, positioned in the mouth opening




## Applications

Testing of telephone handsets is performed 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. 4 for an overview of two different microphone test systems, one with Type 4227, and one with Type 4227-A.

Fig. 4  
Overview of microphone  
test systems



## Compliance with Standards

|  |   |
|--|---|
|  | <p>The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME<br/>China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China<br/>WEEE mark indicates compliance with the EU WEEE Directive</p> |
| <b>Safety</b>  | EN/IEC 61010-1, ANSI/UL 61010-1 and CSAC22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use  |
| <b>EMC Emission</b>  | EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments<br>EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements  |
| <b>EMC Immunity</b>  | EN/IEC 61000-6-2: Generic standards – Immunity for industrial environments<br>EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements<br><b>Note:</b> The above is only guaranteed using accessories listed in this Product Data sheet  |
| <b>Temperature</b>   | IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat<br>Operating Temperature: -5 to +40 °C (23 to 104 °F)<br>Storage Temperature: -25 to +70 °C (-13 to 158 °F)   |
| <b>Humidity</b>  | IEC 60068-2-78: Damp Heat: 90% RH (non-condensing at 40 °C (104 °F))  |
| <b>Mechanical</b>  | Non-operating:<br>IEC 60068-2-6: Vibration: 0.3 mm, 20 m/s <sup>2</sup> , 10 – 500 Hz<br>IEC 60068-2-27: Shock: 1000 m/s <sup>2</sup><br>IEC 60068-2-29: Bump: 1000 bumps at 250 m/s <sup>2</sup>   |

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

| SPECIFICATION  | TYPE 4227   | TYPE 4227-A   |
|--|---|---|
| <b>GENERAL</b>   |   |   |
| Compliance with Standards  | ITU-T Rec. P.51, IEEE 269 and 661   | ITU-T Rec. P.51, IEEE 269 and 661   |
| Input Connector  | Banana (female)   | BNC (female)  |
| Continuous Max. Input at 20 °C (86 °F)                                 | 10 W  | 0.7 V <sub>rms</sub>  |
| Pulsed Max. Input at 20 °C (86 °F), 2 s on, 20 s off                   | 50 W  | 1.5 V <sub>rms</sub>  |
| Input Impedance  | 4 Ω   | Greater than 30 kΩ  |
| Typical Input Amplifier Gain   | N/A   | 19 dB ±0.3 dB   |
| Input Protection Circuit   | <ul style="list-style-type: none"> <li>• Threshold Voltage: 6.4 V</li> <li>• Detection Time: 1 s</li> <li>• Recovery Time: 2 s (loudspeaker disconnected)</li> </ul>  | <ul style="list-style-type: none"> <li>• Threshold Voltage: 1 V</li> <li>• Detection Time: 12 s</li> <li>• Recovery Time: 2 s (loudspeaker muted)</li> </ul>  |
| Sound Pressure Distribution  | See ITU-T Rec. P.51 Table 5   | See ITU-T Rec. P.51 Table 5   |
| Continuous Output Level at mouth reference point (MRP) with Sine Tones | <ul style="list-style-type: none"> <li>• Min. 110 dB SPL, 200 Hz to 4 kHz</li> <li>• Min. 100 dB SPL, 100 Hz to 10 kHz</li> <li>• Min. 80 dB SPL, 100 Hz to 17.0 kHz</li> </ul>   | <ul style="list-style-type: none"> <li>• Min. 110 dB SPL, 200 Hz to 4 kHz</li> <li>• Min. 100 dB SPL, 100 Hz to 10 kHz</li> <li>• Min. 80 dB SPL, 100 Hz to 17.0 kHz</li> </ul>   |
| Continuous Output Level at MRP with 1/3-octave Pink Noise              | <ul style="list-style-type: none"> <li>• Min. 106 dB SPL, 50 Hz to 16 kHz</li> <li>• Min. 100 dB SPL, 20 Hz to 20 kHz</li> </ul>  | <ul style="list-style-type: none"> <li>• Min. 106 dB SPL, 50 Hz to 16 kHz</li> <li>• Min. 100 dB SPL, 20 Hz to 20 kHz</li> </ul>  |
| Typical Sensitivity at 1 kHz at MRP                                    | <ul style="list-style-type: none"> <li>• 94 dB SPL @ 0.4 V<sub>rms</sub></li> <li>• 110 dB SPL @ 2.4 V<sub>rms</sub></li> <li>• 118 dB SPL @ 6 V<sub>rms</sub></li> </ul>   | <ul style="list-style-type: none"> <li>• 94 dB SPL @ 35 mV<sub>rms</sub></li> <li>• 110 dB SPL @ 0.2 V<sub>rms</sub></li> <li>• 120 dB SPL @ 0.7 V<sub>rms</sub></li> </ul>   |
| Harmonic Distortion at 100 dB SPL                                      | <ul style="list-style-type: none"> <li>• Less than 10% from 100 Hz to 125 Hz</li> <li>• Less than 3% above 125 Hz to 200 Hz</li> <li>• Less than 1% above 200 Hz to 315 Hz</li> <li>• Less than 0.8% above 315 Hz; considering components up to 10 kHz</li> </ul> | <ul style="list-style-type: none"> <li>• Less than 10% from 100 Hz to 125 Hz</li> <li>• Less than 3% above 125 Hz to 200 Hz</li> <li>• Less than 1% above 200 Hz to 315 Hz</li> <li>• Less than 0.8% above 315 Hz; considering components up to 10 kHz</li> </ul> |
| <b>MECHANICAL</b>  |   |   |
| Mouth Opening Diameter   | 20 mm (0.8")  | 20 mm (0.8")  |
| Loudspeaker Diameter   | 88 mm (3.5")  | 88 mm (3.5")  |
| Equivalent Lip Plane Position, CL                                      | 6 mm (0.24")  | 6 mm (0.24")  |
| Mouth Reference Point  | 25 mm (0.98")   | 25 mm (0.98")   |
| Weight   | 2.2 kg (4.85 lb)  | 2.2 kg (4.85 lb)  |
| Dimensions   | <ul style="list-style-type: none"> <li>• Height: 104 mm (4.1")</li> <li>• Diameter: 104 mm (4.1")</li> </ul>  | <ul style="list-style-type: none"> <li>• Height: 104 mm (4.1")</li> <li>• Diameter: 104 mm (4.1")</li> </ul>  |
| <b>ENVIRONMENTAL</b>   |   |   |
| Operating Temperature Range  | - 5 to 40 °C (23 to 104 °F)   | - 5 to 40 °C (23 to 104 °F)   |

## Ordering Information

### Type 4227 Mouth Simulator

includes the following accessories:

- UA-0901: Calibration Jig
- 2 × SO-0005: Lip Rings
- DA-0150: 1/4" Plastic Microphone Dummy

### Type 4227-A Mouth Simulator

includes the following accessories:

- UA-0901: Calibration Jig
- 2 × SO-0005: Lip Rings
- DA-0150: 1/4" Plastic Microphone Dummy
- ZG-0426: Power Supply 100 – 240 V AC

### OPTIONAL ACCESSORIES

|           |                                       |
|-----------|---------------------------------------|
| Type 2669 | 1/2" Microphone Preamplifier          |
| Type 2670 | 1/4" Microphone Preamplifier          |
| Type 4191 | Free-field Microphone for calibration |

### Type 4192

Type 4938

### Type 4939

UA-0899

UA-0801

DB-2164

WL-1325-D-050

AO-0087-D-012

### CALIBRATION

4227-CAF

4227-CFF

Pressure-field Microphone for calibration

1/4" Pressure-field Condenser Microphone (for monitoring acoustic output level)

1/4" Free-field Condenser Microphone (for monitoring acoustic output level)

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

Tripod, with ball head, lightweight set

Adapter screw, for Tripod UA-0801

Cable, speakON®, 4-pin (F) to 2-way banana (M), 5 m (16.7 ft), max. +70 °C (158 °F)

Cable, coax single screen, BNC (M) to BNC (M), 1.2 m (4 ft), max. +85 °C (185 °F)

Accredited Calibration

Factory Standard Calibration (included with delivery)