The 60LK consists of four phase-matched ¼" intensity microphones equally distributed on a sphere. This well described tetrahedral arrangement enables 3D vector sound intensity measurements.
Introduction

The 60LK is a 3D Vector Probe Head with four 1/4” phase-matched measurement microphones arranged in a Ø30mm spherical shell. The microphones are placed at the vertices of a tetrahedron. Since the microphones span a three-dimensional space, appropriate mathematical operations allow the determination of the full sound intensity vector. Due to its small form factor, it is possible to make measurements in confined spaces that cannot be accessed with traditional intensity probes.

With four microphones in a traditional vector probe, reflections and diffraction effects from microphones, preamplifiers and mounting hardware tend to distort measurements. In the GRAS four microphone spherical intensity probe, the effects of diffractions and reflections are well defined and controllable. By incorporating the microphones in a hard sphere, it is possible to calculate the diffraction effects and thereby compensate for them.

The microphones are part of the sphere’s surface and thereby create minimal disturbance to the sound field.

The microphones are specially designed pressure microphones. They have the same stability against environmental stress factors such as temperature, vibration and mechanical shock as the standard GRAS1/4” microphones. In multi-transducer measurements the stability of the microphones is essential as even small changes to sensitivity and frequency response will affect the phase response, and thereby affect the combined response of the probe.

GRAS microphones are specifically designed to withstand impact from handling and environmental factors. This is described in detail at gras.dk/halt.

Typical Applications and Use

60LK is an acoustic troubleshooting tool that can be used for a quick localization of noise sources, their interaction and propagation. It can be used for sound power measurements, sound source localization and vector sound field mapping. Therefore, it is a powerful tool for acoustic testing and analysis of source localization, leak detection, sound propagation and the sound flow around a device under test. Its small form factor makes it possible to perform 3D measurements of acoustic problems around complex surfaces and in confined spaces.

Compatibility

60LK’s microphones are prepolarized microphones with CCP preamplifiers. The intensity analyzer must support this technology with BNC sockets, 0 V polarization voltage and 2 to 20 mV supply current.

System Verification

When the need for calibration arises, the 60LK must be sent to GRAS

Calibration

Before leaving the factory, all GRAS products are calibrated in a controlled laboratory environment using traceable calibration equipment. An individual test certificate is included.

Performance and Warranty

GRAS microphones are made of components from our proven standard portfolio and are all manufactured of high-quality material and branded parts that were chosen and processed to ensure life-long stability and robustness. All parts are manufactured and assembled at the factory in Denmark by skilled and dedicated operators in a verified clean-room environment. The microphone diaphragm, body and unique protection grid are
made of high-grade stainless steel and make the microphone set resistant to physical damage as well as corrosion caused by aggressive air or gasses. This, together with the reinforced gold-plated microphone terminal which guarantees a highly reliable connection, enables us to offer 5 years warranty against defective materials and workmanship. The warranty does not cover products that are damaged due to negligent use, an incorrect power supply, or an incorrect connection to the equipment.

Service and Repairs

All repairs are made at GRAS International Support Center located in Denmark. Our Support Center is equipped with the newest test equipment and staffed with dedicated and highly skilled engineers. Upon request, we make cost estimates based on fixed repair categories. If a product covered by warranty is sent for service, it is repaired free of charge, unless the damage is the result of negligent use or other violations of the warranty. All repairs are delivered with a service report, as well as an updated calibration chart.
## Specifications

### 60LK 3D Vector Probe Head Development Kit

<table>
<thead>
<tr>
<th>Specification</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range (±1 dB)</td>
<td>Hz</td>
<td>50 to 5 k</td>
</tr>
<tr>
<td>Dynamic range lower limit (microphone thermal noise)</td>
<td>dB(A)</td>
<td>33</td>
</tr>
<tr>
<td>Dynamic range upper limit</td>
<td>dB</td>
<td>150</td>
</tr>
<tr>
<td>Set sensitivity @ 250 Hz (±3 dB)</td>
<td>mV/Pa</td>
<td>6.5</td>
</tr>
<tr>
<td>Power supply (Constant Current Power)</td>
<td>mA</td>
<td>2 to 20</td>
</tr>
<tr>
<td>Temperature range, operation</td>
<td>°C / °F</td>
<td>0 to 95</td>
</tr>
<tr>
<td>Temperature range, storage</td>
<td>°C / °F</td>
<td>0 to 95</td>
</tr>
<tr>
<td>Temperature range with GRAS preamplifier, operation</td>
<td>°C / °F</td>
<td>-30 to 70 / -22 to 158</td>
</tr>
<tr>
<td>Influence of axial vibration @1 m/s²</td>
<td>dB re 20 µPa</td>
<td>63</td>
</tr>
</tbody>
</table>

**Typical phase match according to IEC 1043-1993-12**

**Typical frequency response, measured with a 114 dB input signal at 250 Hz.**

GRAS Sound & Vibration reserves the right to change specifications and accessories without notice.

Date 27-05-2019.
About GRAS Sound & Vibration

GRAS is a worldwide leader in the sound and vibration industry. We develop and manufacture state-of-the-art measurement microphones to industries where acoustic measuring accuracy and repeatability is of utmost importance in R&D, QA and production. This includes applications and solutions for customers within the fields of aerospace, automotive, audiology, and consumer electronics. GRAS microphones are designed to live up to the high quality, durability and accuracy that our customers have come to expect and trust.