Hydrophone Calibrator — Type 4229

USES:

- Calibration of Brüel & Kjær Hydrophones Types 8100, 8101, 8103, 8104, 8105. Calibration of hydrophone Type 8106 requires coupler WA 0658.
- Calibration of sound measuring systems employing Microphones Type 4133, 4134, 4189 or 4190
- Field calibration
- Reference standard

FEATURES:

- Field calibration to within ±0.6 dB
- Laboratory calibration to within ±0.3 dB
- Calibration traceable to NIST
- Well-defined sound source
- Individually calibrated couplers
- Battery operated, compact and portable

The hydrophone calibrator works like a pistonphone (see Fig. 1). A sound pressure is produced in the coupler cavity by oscillating pistons. This arrangement is an original Brüel & Kjær design, and consists of four pistons mounted symmetrically around a cam disc. Rotating the cam disc moves the pistons in and out of the coupler cavity in phase. The design reduces the effect of cam disc eccentricity and harmonic distortion and ensures maximum sound pressure level stability. The resulting tone, of 251.2 Hz, is electronically controlled to within ±0.1%. At this frequency, the sensitivity of Brüel & Kjær Hydrophones in air and in water is almost identical, so they can be calibrated in air without any significant loss of accuracy.

Three couplers are provided for calibrating Brüel & Kjær Hydrophones. The sound pressure levels produced in the coupler volumes are typically 156.5, 166, 162 and 151.5 re 1 μPa for Types 8101, 8103, 8100/04 and 8105 respectively. Accurate values for these levels are given on the calibra-
tion chart supplied with each calibrator. A coupler (WA 0548, typical sound pressure level 152 dB) for calibrating Hydrophone Type 8106 is available as an accessory. Such high levels mean that hydrophones can be calibrated even in very noisy areas.

The hydrophone calibrator can also be used to calibrate measuring systems with Microphone Type 4133, 4134, 4189 or 4190 by using the dummy hydrophone (DO 0077) and coupler UA 0548. When calibrated, this microphone can be used to monitor the actual sound pressure level inside any coupler volume during hydrophone calibrations. By comparing the sound pressure levels measured by the microphone and the hydrophone, a more accurate hydrophone calibration can be made.

Variations in atmospheric pressure in the range 650 hPa to 1080 hPa can be corrected for, in dB, using the barometer supplied. The hydrophone calibrator can operate in the temperature range –10°C to +50°C (14°F to 122°F) without significant loss of accuracy. Providing there is no condensation, humidity does not affect its operation.

### Specifications 4229

| FREQUENCY: | Nominal: 250 Hz |
| Actual: | 251.2 Hz ±0.1% (ISO 266) |
| SPECIFIED HYDROPHONES: | Bruel & Kjaer Types 8100, 8101, 8103, 8104, 8105 and 8106 |
| SPECIFIED MONITOR MICROPHONES: | Bruel & Kjaer Types 4133, 4134, 4189 or 4190 |
| HUMIDITY: | IP 40 |
| CONDITIONS: | 5% RH to 95% RH |
| AMBIENT TEMPERATURE: | –10 to +50°C (14 to +122°F) |
| AMBITENT HUMIDITY: | 5% RH to 95% RH |
| REQUIRED MEASUREMENT ACCURACY: | ±0.2% of actual pressure. Achievable with Barometer UZ 0004 |

#### Dimensions and Weight

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Length</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4229 (without coupler):</td>
<td>205 (8.07)</td>
<td>36 (1.4)</td>
</tr>
<tr>
<td>Coupler UA 0546:</td>
<td>137 (5.4)</td>
<td>36 (1.4)</td>
</tr>
<tr>
<td>Coupler UA 0547:</td>
<td>61 (2.4)</td>
<td>36 (1.4)</td>
</tr>
<tr>
<td>Coupler UA 0548:</td>
<td>31 (1.2)</td>
<td>36 (1.4)</td>
</tr>
<tr>
<td>Coupler UA 0549:</td>
<td>127 (5.0)</td>
<td>46 (1.8)</td>
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</table>

**Weight:**
- Pistophone (with batteries): 0.7 kg (1.54 lb)
- Coupler UA 0546: 0.5 kg (1.10 lb)
- Adaptor UA 0903: 0.06 kg (0.13 lb)
- Coupler UA 0547: 0.3 kg (0.66 lb)
- Coupler UA 0548: 0.25 kg (0.55 lb)
- Coupler UA 0549: 0.6 kg (1.32 lb)
- Total weight (no batteries): 2.7 kg (5.95 lb)
- Total weight (with batteries): 2.85 kg (6.28 lb)

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

### Ambient Reference Conditions

**PRESSURE**

- 1013 hPa

**TEMPERATURE**

- 20°C (68°F)

**HUMIDITY**

- 65% RH

**Nominal Hydrophone Volume**: Hydrophone Type 8100/04: 15,800 mm³
- Hydrophone Type 8101: 49,900 mm³
- Hydrophone Type 8103: 14,400 mm³
- Hydrophone Type 8105 (with Adaptor UA 0903): 36,000 mm³
- Hydrophone Type 8106: 41,000 mm³

#### Obtainable Calibration Accuracy

At Reference Conditions: ±0.15 dB

With Variation of one Ambient Condition from Reference Conditions: ±0.3 dB

#### Specifications for Ambient Conditions

**Ambient Pressure:** 650 hPa to 1080 hPa

#### Power Supply

**Batteries:** 6 Alkaline Batteries IEC LR6
**Battery Life:** 30 hours continuous use

#### Environmental Operating Conditions

- Temperatures: –10 to +50°C (+14 to +122°F)
- Storage Temperatures: –25 to +70°C (+13 to +158°F) without batteries
- Ambient Temperature: –0.0005 dB/°C (est.)

† Including monitor microphone and calibrator load volume: 250 mm³

### Compliance with Standards

**CE-mark** indicates compliance with: EMC Directive.

**Safety**

**EMC Emission**

**EMC Immunity**

**Note:** The above is guaranteed using accessories listed in this Product Data sheet only.

**Temperature**
- Storage Temperature: –25 to +70°C (+13 to +158°F)

**Humidity**
- IEC 68–2–3: Damp Heat: 95% RH (non-condensing at 40°C (104°F))

**Enclosure**
Ordering Information

<table>
<thead>
<tr>
<th>Type 4229 Hydrophone Calibrator</th>
<th>6×OB.0013: Alkaline Battery</th>
<th>WA.0619: Dummy for Type 8101</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes the following accessories:</td>
<td>UZ.0004: Correction Barometer</td>
<td>WA.0620: Dummy for Type 8100/04</td>
</tr>
<tr>
<td>UA.0546: Coupler for Type 8101/8105</td>
<td>UA.0552: Bottle of Glycerol</td>
<td>WA.0621: Dummy for Type 8105</td>
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<tr>
<td>(includes Adaptor UA.0903 for Type 8105)</td>
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<tr>
<td>UA.0548: Coupler for Type 8103 (includes Dummy DO.0077)</td>
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<tr>
<td>UA.0547: Coupler for Type 8100/04</td>
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<tr>
<td>Optional Accessories</td>
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<tr>
<td>WA.0658: Coupler for Type 8106</td>
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<tr>
<td>WA.0657: Dummy for Type 8106</td>
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Brüel & Kjær reserves the right to change specifications and accessories without notice.