

# Product Data

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

Hydrophone Calibrator Type 4229 is a precision, high sound pressure source. It provides a quick and easy method to calibrate sound measuring systems employing Brüel & Kjær Hydrophones, in air. If required, sound pressure levels produced in the couplers can be monitored by a  $1/2$ " microphone, giving a calibration accuracy of within 0.3 dB. Using a dummy hydrophone, the microphone itself can be calibrated.

All Brüel & Kjær Hydrophone Calibrators undergo individual factory calibration making them traceable to NIST. The hydrophone calibrator is compact and battery operated, suitable for both field and laboratory use.

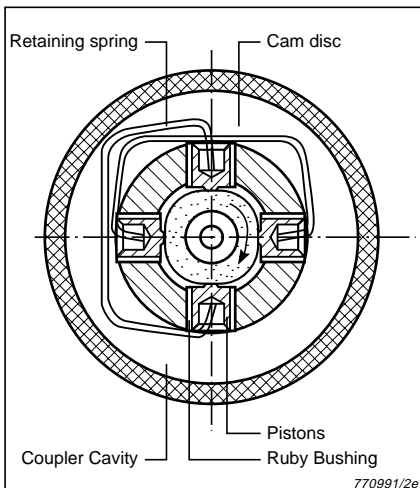


Fig. 1 Cross sectional view showing how the hydrophone calibrator works



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 electroni-

cally controlled to within  $\pm 0.1\%$ . 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  $1 \mu\text{Pa}$  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 0658, 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 dum-

my 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  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  ( $14^{\circ}\text{F}$  to  $122^{\circ}\text{F}$ ) without significant loss of accuracy. Providing there is no condensation, humidity does not affect its operation.

## Specifications 4229

### FREQUENCY:

**Nominal:** 250 Hz

**Actual:**  $251.2\text{ Hz} \pm 0.1\%$  (ISO 266)

### SPECIFIED HYDROPHONES:

Brüel & Kjær Types 8100, 8101, 8103, 8104, 8105 and 8106

### SPECIFIED MONITOR MICROPHONES:

Brüel & Kjær Types 4133, 4134, 4189 or 4190

### SOUND PRESSURE LEVELS IN COUPLERS

(at reference conditions):

Coupler No.	Hydrophone Type	Sound Pressure Level dB re $1\ \mu\text{Pa}$
UA 0547	8100/04	$162.0 \pm 0.7$
UA 0546	8101	$156.5 \pm 0.7$
UA 0548	8103	$166.0 \pm 0.7$
UA 0546 <sup>†</sup>	8105	$151.5 \pm 0.7$
WA 658	8106	$152.0 \pm 0.7$
UA 0548	Dummy DO 0077 and Mic. 4133/34/89/90	$166.0 \pm 0.7$

<sup>†</sup>With Adaptor UA 0903

### Ambient Reference Conditions

**PRESSURE:** 1013 hPa

**TEMPERATURE:**  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ )

**HUMIDITY:** 65% RH

**NOMINAL HYDROPHONE VOLUME\*:**

Hydrophone Type 8100/04:  $15800\text{ mm}^3$

Hydrophone Type 8101:  $49900\text{ mm}^3$

Hydrophone Type 8103:  $1440\text{ mm}^3$

Hydrophone Type 8105 (with Adaptor UA 0903):  $36000\text{ mm}^3$

Hydrophone Type 8106:  $41000\text{ mm}^3$

### Obtainable Calibration Accuracy

**At Reference Conditions:**  $\pm 0.15\text{ dB}$

**With Variation of one Ambient Condition from Reference Conditions:**  $\pm 0.30\text{ dB}$

**At Ambient Reference Conditions with Nominal Hydrophone Volume Varied from Reference Condition:**

**8100/04:**  $\pm 0.4\text{ dB}$

**8101:**  $\pm 0.5\text{ dB}$

**8103:**  $\pm 0.3\text{ dB}$

**8105 (incl. UA 0903):**  $\pm 0.4\text{ dB}$

**8106:**  $\pm 0.5\text{ dB}$

One Ambient Parameter varied from Reference Conditions and Nominal Hydrophone Volume varied from Reference Condition:

**8100/04:**  $\pm 0.5\text{ dB}$

**8101:**  $\pm 0.6\text{ dB}$

**8103:**  $\pm 0.4\text{ dB}$

**8105 (incl. UA 0903):**  $\pm 0.5\text{ dB}$

**8106:**  $\pm 0.6\text{ dB}$

### SPECIFIED RANGES FOR AMBIENT CONDITIONS:

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

\* See instruction manual for further information

### AMBIENT TEMPERATURE:

$-10$  to  $+50^{\circ}\text{C}$  ( $+14$  to  $+122^{\circ}\text{F}$ )

**AMBIENT HUMIDITY:** 5% RH to 95% RH

**REQUIRED MEASUREMENT ACCURACY:**

**PRESSURE:**  $\pm 2.0\%$  of actual pressure. Achievable with Barometer UZ 0004

**TEMPERATURE AND HUMIDITY:**

Measurement not necessary

**DISTORTION:**  $< 3\%$

**NOMINAL EFFECTIVE COUPLER VOLUME†:**

UA 0547:  $9900\text{ mm}^3$  with Type 8100/04

UA 0546:  $18700\text{ mm}^3$  with Type 8101

UA 0548:  $6250\text{ mm}^3$  with Type 8103

UA 0546:  $33200\text{ mm}^3$  with Type 8105

WA 0658:  $31350\text{ mm}^3$  with Type 8106

### Power Supply

**BATTERIES:** 6 Alkaline Batteries IEC LR 6

**BATTERY LIFE:** 30 hours continuous use

### Environmental

**OPERATING TEMPERATURE:**

$-10$  to  $+50^{\circ}\text{C}$  ( $+14$  to  $+122^{\circ}\text{F}$ )

**STORAGE TEMPERATURE:**

$-25$  to  $+70^{\circ}\text{C}$  ( $-13$  to  $+158^{\circ}\text{F}$ ) without batteries

**AMBIENT TEMPERATURE:**

$-0.0005\text{ dB}/^{\circ}\text{C}$  (est.)

† Including monitor microphone and calibrator load volume:  $250\text{ mm}^3$

### AMBIENT PRESSURE:

The sound pressure is proportional to the ambient pressure

**AMBIENT HUMIDITY:**

$-0.0001\text{ dB}/\%$  RH, at ambient reference conditions

### Dimensions and Weight

	Length mm (in)	Diameter mm (in)
<b>4229</b> (without coupler):	205 (8.07)	36 (1.4)
<b>Coupler UA 0546:</b>	137 (5.4)	36 (1.4)
<b>Coupler UA 0547:</b>	61 (2.4)	36 (1.4)
<b>Coupler UA 0548:</b>	31 (1.2)	36 (1.4)
<b>Coupler WA 0658:</b>	127 (5.0)	46 (1.8)

### WEIGHT:

**Pistonphone** (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 WA 0658:** 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  $25^{\circ}\text{C}$  ( $77^{\circ}\text{F}$ ), unless measurement uncertainty is specified. All uncertainty values are specified at  $2\sigma$  (i.e. expanded uncertainty using a coverage factor of 2)

### COMPLIANCE WITH STANDARDS:

	CE-mark indicates compliance with: EMC Directive.
Safety	EN 61010-1 (1993) and IEC 1010-1 (1990): Safety requirements for electrical equipment for measurement, control and laboratory use.
EMC Emission	EN 50081-1 (1992): Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081-2 (1993): Generic emission standard. Part 2: Industrial environment. CISPR 22 (1993): Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Class B limits.
EMC Immunity	EN 50082-1 (1992): Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082-2 (1995): Generic immunity standard. Part 2: Industrial environment. <b>Note:</b> The above is guaranteed using accessories listed in this Product Data sheet only.
Temperature	IEC 68-2-1 & IEC 68-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: $-10$ to $+50^{\circ}\text{C}$ ( $+14$ to $+122^{\circ}\text{F}$ ) Storage Temperature: $-25$ to $+70^{\circ}\text{C}$ ( $-13$ to $+158^{\circ}\text{F}$ )
Humidity	IEC 68-2-3: Damp Heat: 95% RH (non-condensing at $40^{\circ}\text{C}$ ( $104^{\circ}\text{F}$ ))
Enclosure	IEC 529 (1989): Protection Provided by Enclosures: IP 40

# Ordering Information

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



**WORLD HEADQUARTERS:**

DK-2850 Naerum · Denmark · Telephone: +45 45 80 05 00 · Fax: +45 45 80 14 05 · Internet: <http://www.bk.dk> · e-mail: [info@bk.dk](mailto:info@bk.dk)  
Australia (02 ) 9450-2066 · Austria 00 43-1-865 74 00 · Belgium 016/44 92 25 · Brazil (011) 246-8166 · Canada: (514) 695-8225 · China 10 6841 9625 / 10 6843 7426  
Czech Republic 02-67 021100 · Finland 90-229 3021 · France (01) 69 90 69 00 · Germany 0610 3/908-5 · Holland (0)30 6039994 · Hong Kong 254 8 7486  
Hungary (1) 215 83 05 · Italy (02) 57 60 4141 · Japan 03-3779-8671 · Republic of Korea (02) 3473-0605 · Norway 66 90 4410 · Poland (0-22) 40 93 92 · Portugal (1) 47114 53  
Singapore (65) 275-8816 · Slovak Republic 07-37 6181 · Spain (91) 36810 00 · Sweden (08) 71127 30 · Switzerland 01/94 0 09 09 · Taiwan (02) 713 9303  
United Kingdom and Ireland (0181) 954-236 6 · USA 1 - 800 - 332 - 2040  
Local representatives and service organisations worldwide  
BP 1024-13.