PRODUCT DATA

Hydrophone Types 8103, 8104, 8105 and 8106

Brüel & Kjær hydrophones are transducers for measuring waterborne sound. The four hydrophones are:

- *Miniature Hydrophone Type 8103*
- *Calibration Standard Hydrophone Type 8104*
- *Spherical Hydrophone Type 8105*
- *Low-noise Hydrophone Type 8106*

Each hydrophone:

- *Is individually calibrated*
- *Has a flat frequency response*
- *Is omnidirectional over a wide frequency range*
- *Is absolutely waterproof*
- *Has a high resistance to corrosion*
- *Is manufactured using lead-free nitrile butadiene rubber*
- *Has shielded-element construction*



Hydrophone Overview

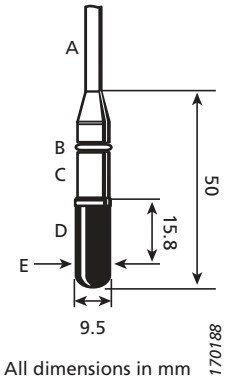
Fig. 1
***A**: Integral low-noise, double-shielded cable*

***B**: Mounting seal*

***C**: Supporting body: CuNi*

***D**: Lead free, nitrile butadiene rubber*

***E**: Acoustic centre*



Miniature Hydrophone Type 8103

A small-size transducer with a high sensitivity relative to its size and good all-round characteristics; applicable to laboratory, industrial and educational use. Its high-frequency response is valuable when measuring pressure-distribution patterns in ultrasonic-cleaning baths, for example.

Uses

- Cavitation measurements
- Ultrasonic measurements in liquids
- Acoustic investigation of marine animals
- Laboratory and industrial measurements in liquids and gases
- Noise measurements in humid and polluted atmospheres

Features

- Frequency range: 0.1 Hz to 180 kHz
- Receiving sensitivity: −211 dB re 1 V/µPa
- Very small size (50 × 9.5 mm)
- −3 dB limit in air at 15 kHz
- Integral (built-in) cable

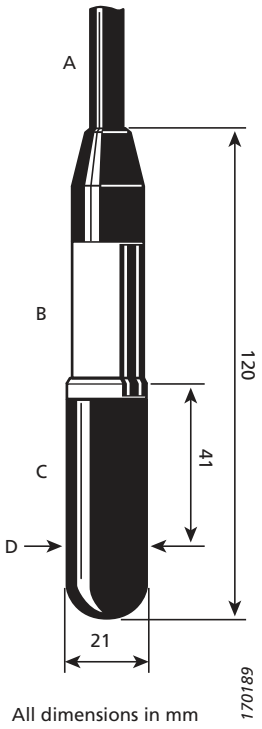
Brüel & Kjær

Fig. 2
***A**: Integral low-noise cable*

***B:** CuNi supporting body*

***C**: Lead free, nitrile butadine rubber*

***D**: Acoustic centre*



All dimensions in mm

Calibration Standard Hydrophone Type 8104

A wide-range standard measuring transducer that can also be used as a sound transmitter (projector), which makes it ideal for calibration purposes by reciprocity, calibrated-projector and comparison methods.

Uses

- Calibration reference standard
- Underwater projector
- Ultrasonic measurements in liquids
- Laboratory and industrial measurements in liquids and gases
- Noise measurements in humid and polluted atmospheres

Features

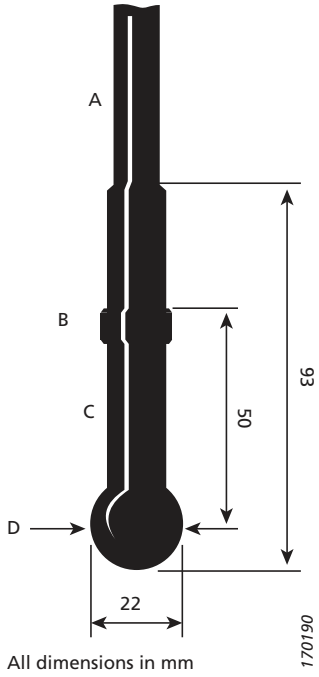
- Frequency range: 0.1 Hz to 120 kHz
- Receiving sensitivity: −205 dB re 1 V/µPa
- Integral cable

Fig. 3
***A**: Integral low-noise cable*

***B:** Positioning belt*

***C**: Lead free, nitrile butadiene rubber*

***D**: Acoustic centre*



All dimensions in mm

Spherical Hydrophone Type 8105

A small, spherical transducer with rugged construction, capable of withstanding pressures of up to 9.8 MPa (100 atm; 1000 m (3250 ft) ocean depth). This hydrophone has excellent directional characteristics: at 100 kHz, it is omnidirectional over 360° in the *xy* (radial) plane and 270° in the *xz* (axial) plane.

Uses

- Ultrasonic measurements in liquids
- Laboratory and industrial measurements in liquids and gases
- Underwater projector
- Noise measurements in humid and polluted atmospheres

Features

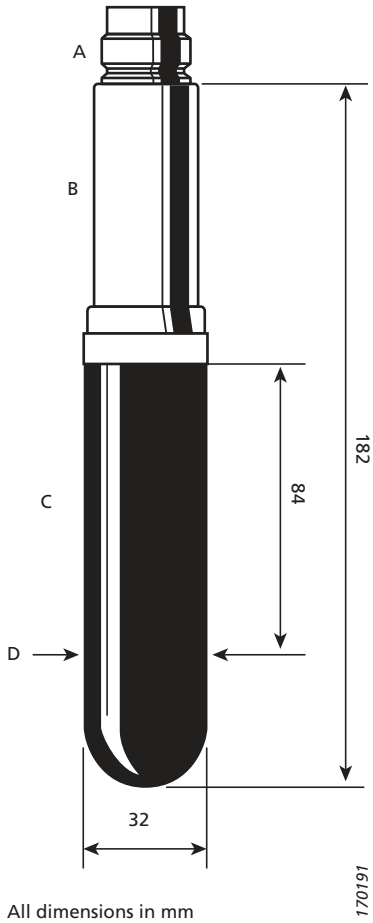
- Frequency range: 0.1 Hz to 160 kHz
- Receiving sensitivity: −205 dB re 1 V/µPa
- Spherical
- Omnidirectional over full frequency range
- Completely encased in rubber
- −3 dB limit in air at 7 kHz
- Can sustain a hydrostatic pressure of 9.8 MPa (approximately corresponds to a 1000 m column of water)
- Integral cable

Fig. 4
***A**: Waterproof connector*

***B:** Aluminium-bronze ($CuAl_{10}Ni_5Fe_4$) supporting body*

***C**: Lead free, nitrile butadiene rubber*

***D**: Acoustic centre*



All dimensions in mm

Low-noise Hydrophone Type 8106

A wide-range, general-purpose transducer capable of withstanding high static pressure, the operational upper limit being 9.8 MPa (100 atm; 1000 m (3250 ft) ocean depth). An integrated watertight connector enables disconnection of the cable, making replacement and storage very easy.

Built-in Preamplifier

A high-quality, thick-film, low-noise, 10 dB built-in preamplifier provides signal conditioning for transmission over long underwater cables. The preamplifier features a 7 Hz high-pass filter and an insert-voltage calibration facility, but does not allow the hydrophone to be used as a projector.

Uses

- Measurement of weak, underwater signals

Features

- Frequency range: 3 Hz to 80 kHz
- Receiving sensitivity: −173 dB re 1 V/µPa
- Durable construction
- Equivalent noise level well below sea-state zero
- Can sustain a hydrostatic pressure of 9.8 MPa (corresponding to approximately 1000 m water column)

Construction

Brüel & Kjær hydrophones are piezoelectric transducers. The ceramic piezoelectric sensing element and its internal supporting structure are permanently bonded into sound-transparent, lead-free, nitrile butadiene rubber.

Internal Support

Support structures are made from metal alloys that are extremely resistant to corrosion in virtually all hostile environments, and have very good anti-fouling properties when immersed in seawater. Note that Type 8105 is completely covered in nitrile butadiene rubber, leaving no metal components exposed.

The internal support is mechanically and electrically isolated from the metal housing, being coupled only by synthetic rubber. This provides vibration isolation of the sensing element. Except for Type 8106, the hydrophones are equipped with an integral cable, the shield of which is connected to the internal support/housing, thus providing electrical shielding for the sensing element.

High Electromagnetic Interference

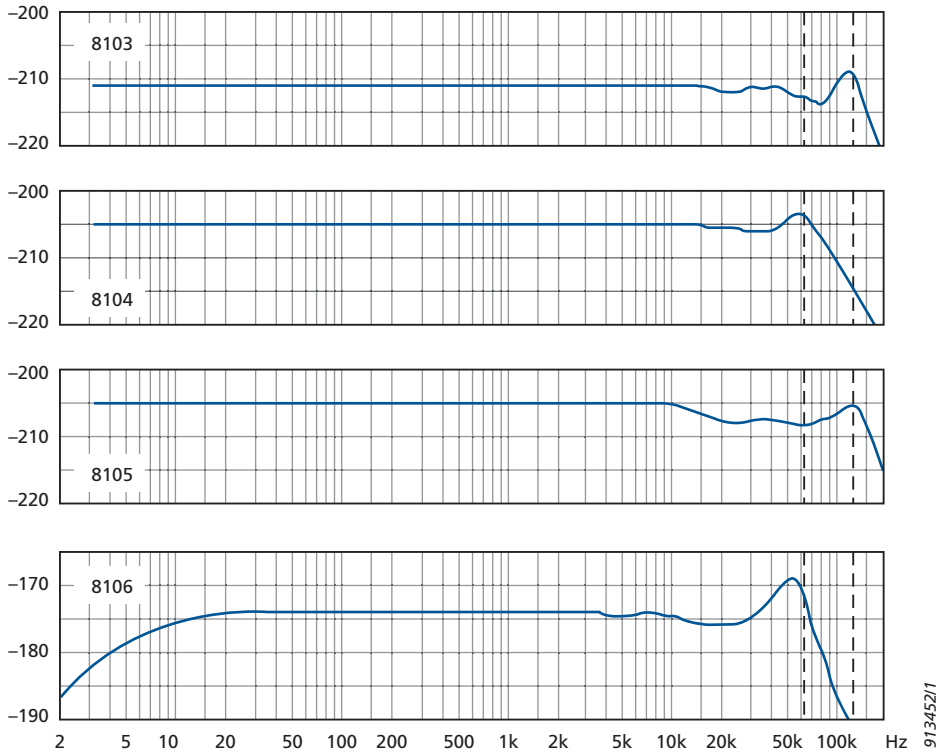
The support body of Type 8103 is connected internally to the outer shield of the integral cable which is connected to the inner shield of the terminating plug end of the cable. For instances of high electromagnetic interference, a metal screen can be clamped onto the metal support body.

Individual Calibration

Each Brüel & Kjær hydrophone is submitted to an extensive ageing and temperature stabilizing procedure before being individually calibrated. Individual calibration data and frequency response curves are supplied with each hydrophone. The receiving sensitivity calibration of the hydrophones is traceable to international standards.

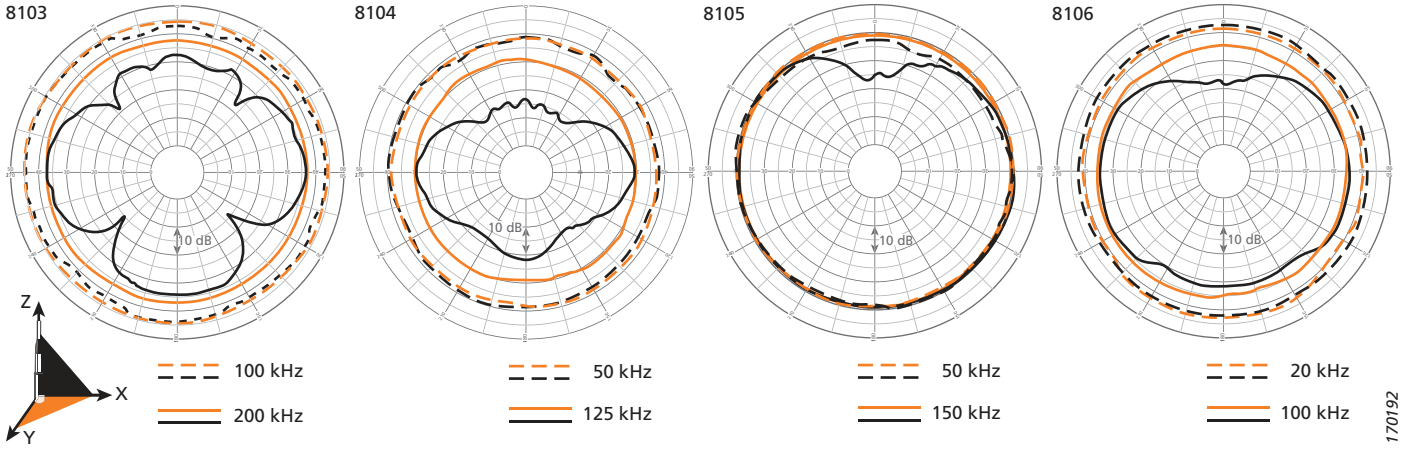
Typical frequency responses of the hydrophones are shown in Fig. 5. These are measured in a water tank in free-field conditions achieved by means of pulse techniques using a Brüel & Kjær PULSE™-based calibration system (see Fig. 8).

Fig. 5 *Typical receiving frequency characteristics (dB re 1 V/µPa)*



The hydrophones have very good omnidirectional characteristics. Typical directivity patterns of the hydrophones in water are shown in Fig. 6. These polar directivity patterns were measured in free-field conditions achieved by means of gating techniques in a water tank. This method requires a standard hydrophone as a projector and the unknown hydrophone as the receiver whose polar directivity pattern is to be determined.

Fig. 6 *Typical directivity patterns*



Hydrophone Calibrator Type 4229

At low frequencies, the sensitivity of a hydrophone is the same in air as in water, and the calibration can be checked using Hydrophone Calibrator Type 4229 (Product Data: BP 1024). The calibrator includes couplers for Types 8103, 8104 and 8105 and a barometer giving the atmospheric pressure correction in dB. A coupler for Type 8106 is available separately.

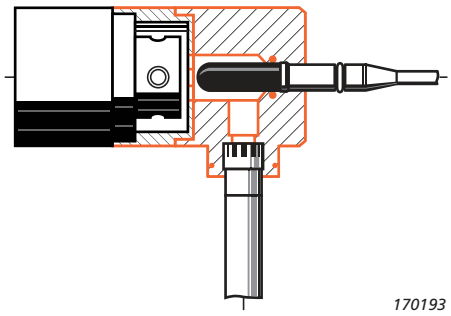


Fig. 7 *Illustration of Type 8103 mounted in its coupler (UA-0548). A ½″ microphone monitors the sound pressure level produced in the coupler*

Traceable Calibration

The sound pressure level in the coupler volume can be monitored with a ½″ microphone (see Fig. 7), enabling the calibration to be traceable to international standards.

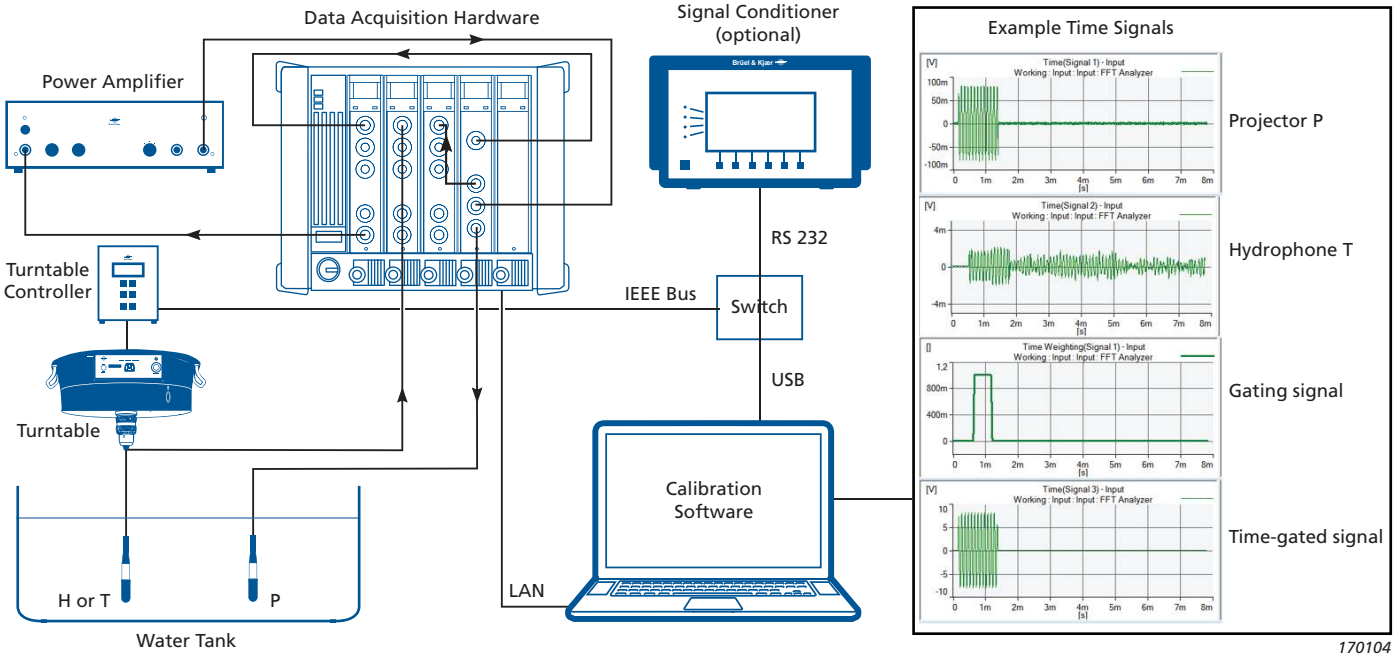
Hydrophone Calibration System Type 9718

Type 9718 uses LAN-XI data acquisition hardware and dedicated hydrophone calibration software based on PULSE. Calibrations performed using Type 9718 are in accordance with IEC 60565 with optional phase response calibration.

Type 9718 is a scalable system that can be configured for:

- Primary calibration of frequency response by the reciprocity method
- Secondary calibration as receiver by the substitution method using a known reference hydrophone
- Calibration of the projecting response, for example pressure in Pa/V versus frequency
- Directivity calibration at multiple customer defined frequencies

Fig. 8 *A typical configuration of Hydrophone Calibration System Type 9718*



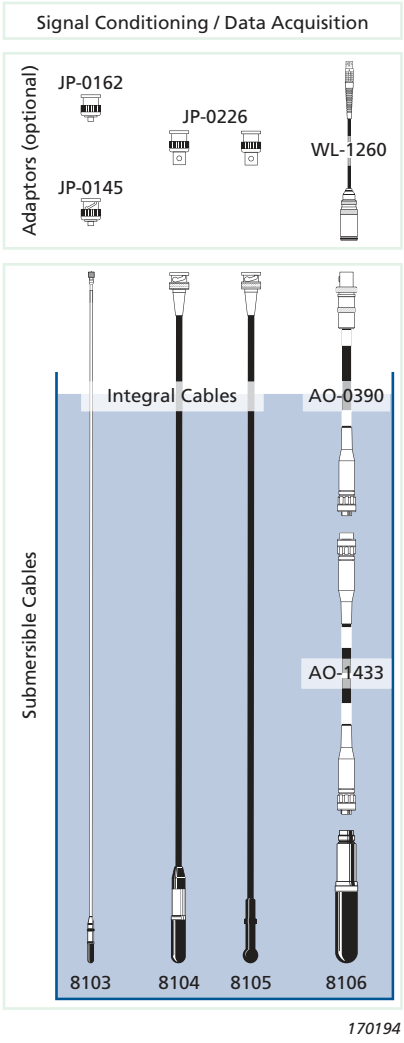


Fig. 9 *Cabling overview*

Brüel & Kjær hydrophone cables have good electrical shielding. This enables the hydrophones to be used in both air and water, where the electrical potential of the water is different from the ground potential, as well as in cases of high electromagnetic interference*.

All hydrophone connectors are dry-mate connectors, some of which are submersible. Dry-mate connectors cannot be connected/disconnected while under water.

See Table 2 for examples of hardware connections.

Types 8103, 8104 and 8105: Integral Cables

Types 8103, 8104 and 8105 have integral cables that terminate with non-submersible connectors.

Type 8103 Cable

Double-shielded cable that terminates with a coaxial 10–32 UNF plug (male connector). The cable (AC-0043) is waterproof but not water-blocking.

Types 8104 and 8105 Cable

Water-blocking cable that terminates with a BNC plug. The cable (AC-0034) fulfils MIL-C-915. These hydrophones can connect directly to LAN-XI Module Type 3161.

Type 8106: Submersible Connector

Hydrophone Type 8106 has a dry-mate, submersible connector that is an integrated part of the hydrophone's bronze support.

Cables for Type 8106

- AO-1433: underwater cable with two submersible connectors
- AO-0390: wet-to-dry cable with one submersible connector

Adaptors

Depending on your signal conditioning and/or data acquisition hardware, you may need an adaptor. The adaptors described below are non-submersible and are used to convert connectors from one type to another, enabling connection to various hardware. See Table 2 for examples of hardware connections.

Type 8103

- JP-0145: 10–32 UNF coaxial socket (female connector) to BNC plug
- JP-0162: 10–32 UNF coaxial socket to TNC plug

Types 8104 and 8105

- JP-0026: BNC socket to TNC plug

Type 8106

- WL-1260: B&K 7-pin† socket to 7-pin LEMO plug

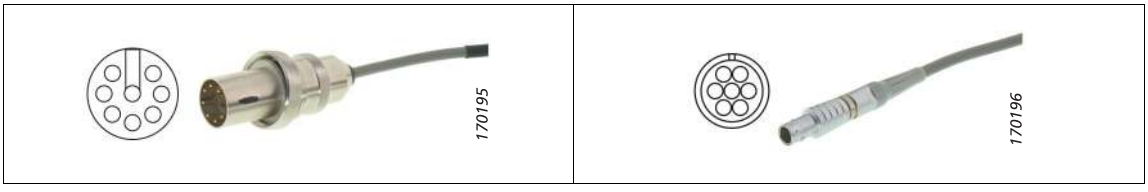


Fig. 10
Left:
B&K 7-pin plug

Right:
7-pin LEMO plug

* In cases of high electromagnetic interference, a metal screen can be clamped onto the metal support body of Type 8103.

Integral Cable Lengths

For Types 8103, 8104 and 8105, the length of the cable is specified when ordering; if unspecified, the minimum length is the default length.

Table 1
Minimum and maximum lengths of the integral cable for Types 8103, 8104 and 8105

Type Number	Cable	Cable Length	
		Minimum	Maximum
8103	AC-0043	0.3 m (1 ft)	400 m (1312 ft)
8104	AC-0034	5 m (33 ft)	200 m (656 ft)
8105			

At Greater Depths

Type 8103

The depth up to which Type 8103 can be used is limited to the maximum length of its integral cable.

Types 8104 and 8105

The maximum length of the integral cable of Types 8104 and 8105 is 200 m (656 ft), but the hydrophones can be used up to depths greater than that: 400 m (1312 ft) and 1000 m (3250 ft) respectively.

To use Types 8104 and 8105 at depths greater than the maximum length of the integral cable, you must replace the BNC connector on the integral cable with a submersible connector. There are two submersible connectors available:

- JP-0415: submersible plug that mates with JJ-0415
- JJ-0415: submersible socket that mates with JP-0415

It is recommended that you attach JP-0415 to the integral cable. Pictorial assembly instructions are provided with JP-0415 and JJ-0415*.

Once the connector on the integral cable has been changed to a submersible connector, you can use the following submersible cables:

- AO-1431: underwater cable with two submersible connectors
- AO-1432: wet-to-dry cable with one submersible connector

Type 8106

Raw Cable AC-0101 is a screened, 4-core cable with reinforcement used in the cables for Type 8106 (AO-1433 and AO-0390). AC-0101 can tolerate high loads: 1300 N in service, with a breaking load of 2600 N. This makes the cable strong enough to be self-supporting for measurements at ocean depths of 1000 m (3250 ft). Despite the strength of the cables, it is always recommended to use some form of cable strain release whenever the cable is exposed to dynamic movements.

† Proprietary connector used in older Brüel & Kjær hardware: Conditioning Amplifier Type 2635 and Measuring Amplifier Type 2636

* Variations of Types 8104 and 8105 that come pre-assembled with other types of connectors, such as wet mate-able or submersible, are custom orders.

In some cases, it is necessary to route the high-impedance output signals through a signal-conditioning amplifier. Although the international standards call for calibration of the hydrophones' voltage sensitivity (using a voltage amplifier), it is often more practical to use a charge amplifier, which will result in a charge sensitivity independent of the actual cable length.

Recommended Signal Conditioner



170197

Although the entire Brüel & Kjær range of accelerometer preamplifiers is suitable, the NEXUS™ Range of Conditioning Amplifiers (Product Data: BP 1702) are recommended because they feature sensitivity adjustment (for convenient output values: 0.1 or 1 V/Unit), have a wide frequency range and have adjustable low- and high-pass filters.

Type 8106

The built-in preamplifier provides an output signal that does not require further conditioning.

Discontinued Brüel & Kjær Signal Conditioners

The following signal conditioners are no longer manufactured but can be used:

- Conditioning Amplifier Type 2635, requires a cable terminating with a proprietary connector, referred to as a B&K 7-pin connector such as Cable AO-0390
- Measuring Amplifier Type 2525, requires a BNC to TNC adaptor such as Adaptor JP-0226

Charge to CCLD Converter



170198

In case you wish to connect a charge output (for example, output from Types 8103, 8104 and 8105) to CCLD input, you can use Charge to CCLD Converter Type 2647 (Product Data: BP 1874).

Data Acquisition Hardware


170199

The recommended LAN-XI front-end module for hydrophones is Type 3161 (Product Data: BP 2215). The module features one input and one output channel with frequency ranges of DC to 204.8 kHz.

Table 2 gives the cable options for connecting your hydrophone to the recommended signal conditioning and data acquisition hardware.

Please note: Cable options for connection to discontinued signal conditioners are also provided for those that are still in use.

Table 2
Example configurations for connecting hydrophones to signal conditioning and data acquisition hardware

Hydrophone:	Connects to:	Which connects to:	
Type 8103	JP-0145	Type 3161	
	JP-0162	NEXUS Conditioning Amplifier	
		Type 3161	
Type 8104 Type 8105	JP-0026	Type 2525 (discontinued)	
		NEXUS Conditioning Amplifier	
		Type 3161	
	Type 3161		
	AO-1431*	AO-1432*	
	AO-1432*	JP-0026	
		Type 3161	
Type 8106	AO-1433	AO-0390	
	AO-0390	Type 2635	
		Type 2636 (discontinued)	
		WL-1260	NEXUS Conditioning Amplifier
			Type 3161

* This connection requires replacing the original (BNC) connector on the integral cable with JP-0415

Use as Projectors

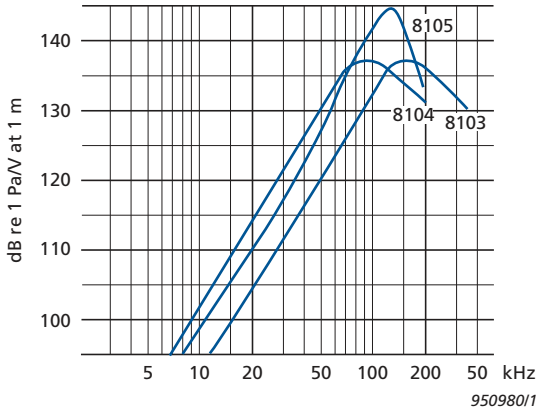


Fig. 11
Typical transmitting response to voltage of Types 8103, 8104 and 8105

Hydrophone Types 8103, 8104 and 8105 can be used as sound transmitters (projectors), for both measurement and reciprocity calibration. Just as the piezoelectric effect produces an electrical output from mechanical excitation, applying alternating voltage to the transducer will produce mechanical excitation in the piezoelectric element.

Transmitting responses to applied voltage in water are shown in Fig. 11. Note the 12 dB/octave slope which is typical for piezoelectric hydrophones driven with constant voltage input.

Amplification of the Projected Signal

When hydrophones are used as projectors as with Hydrophone Calibration System Type 9718, the signal requires power amplification. Power Amplifier Type 2713 (Product Data: BP 0228) is suited for driving signals transmitted from hydrophones, and it can be used to drive other highly reactive loads.

Type 2713 is a low-noise 100 VA power amplifier with a frequency range extending from 10 Hz up to 200 kHz, and a gain continuously adjustable between 0 and 60 dB over six 10 dB ranges. It also features selectable maximum output voltage limits, as well as extensive protective functions to prevent damage to both the amplifier and the transducer.

Measurements in Air

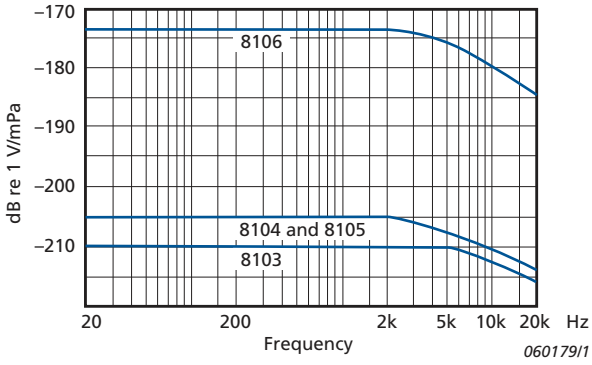


Fig. 12
Typical receiving characteristics in air: Types 8103, 8104, 8105 and 8106 in the xy plane

Hydrophones are particularly useful for measurements under extreme environmental conditions such as very high humidity, very high temperature, or polluted atmospheres – conditions that could damage ordinary microphones or affect their performance.

Hydrophones may also be used for measurement of extremely high sound pressure levels.

Please note that Type 8103 is quite sensitive to acceleration, up to 115 dB/ms^{-2} when vibrated axially and up to 128 dB/ms^{-2} when vibrated perpendicular to the hydrophone axis. As always for hydrophones the dB reference pressure is 1 µPa.

Compliance with Standards

CE	The CE-mark indicates compliance with EMC Directive 2014/30/EU.
Safety	EN/IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments CISPR 32: Radio disturbance characteristics of information technology equipment. Class B. FCC Rules, Part 15: Complies with the limits for a Class B digital device
EMC Immunity	EN/IEC 61000–6–1: Generic standards – Immunity for residential, commercial and light industrial environments EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements **Note:** The above is only guaranteed using accessories listed in this Product Data **Note 2:** Susceptibility when exposed to levels specified in EN 61000–6–1.
Temperature	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat Ambient Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to +158 °F)
Humidity	IEC 60068–2–78: Damp Heat: 93% RH (non-condensing at 40 °C (104 °F))
Mechanical	Non-operating: IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s^2, 10 – 500 Hz IEC 60068–2–27: Shock: 1000 m/s^2 IEC 60068–2–29: Bump: 1000 bumps at 400 m/s^2
Enclosure	IEC 60529: Protection provided by enclosures: IP 68

Specifications – Hydrophones Types 8103, 8104, 8105 and 8106

	Type 8103	Type 8104	Type 8105	Type 8106
Sensitivity*	−211 dB re 1 V/µPa ±2 dB	−205 dB re 1 V/µPa ±3 dB	−205 dB re 1 V/µPa ±2 dB	−173 dB re 1 V/µPa ±3 dB
Nominal Voltage Sensitivity	29 µV/Pa	56 µV/Pa		2.24 mV/Pa
Nominal Charge Sensitivity*	0.1 pC/Pa	0.44 pC/Pa	0.41 pC/Pa	N/A
Capacitance* (incl. standard cable)	3700 pF	7800 pF	7250 pF	N/A
Frequency Response*† (re 250 Hz) Specification is valid with integral cable length up to: • 100 m (382 ft) for Types 8103 and 8104 • 25 m (82 ft) for Type 8105	0.1 Hz to 20 kHz +1/−1.5 dB 0.1 Hz to 100 kHz +1.5/−6.0 dB 0.1 Hz to 180 kHz +3.5/−12.5 dB	0.1 Hz to 10 kHz ±1.5 dB 0.1 Hz to 80 kHz ±4.0 dB 0.1 Hz to 120 kHz +4/−12.0 dB	0.1 Hz to 100 kHz +1/−6.5 dB 0.1 Hz to 160 kHz +3.5/−10.0 dB	10 Hz to 10 kHz +0.5/−3.0 dB 7 Hz to 30 kHz +0.5/−6.0 dB 3 Hz to 80 kHz +6/−10.0 dB
Horizontal Directivity‡ (radial, xy plane)	±2 dB at 100 kHz			±2 dB at 20 kHz
Vertical Directivity (axial, xz plane)	±4 dB at 100 kHz	±2 dB at 50 kHz	±2 dB over 270° at 80 kHz ±2.5 dB at 100 kHz	±3 dB at 20 kHz
Leakage Resistance* (at 20 °C)	>2500 MΩ			
Operating Temperature Range: **Short-term (≤1 hr continuous operation)** **Continuous**	 −30 to +120 °C −30 to +80 °C			 −10 to +60 °C
Sensitivity Change with Temperature: **Charge** **Voltage**	 0 to +0.03 dB/°C 0 to −0.03 dB/°C	 0 to +0.03 dB/°C 0 to −0.04 dB/°C	 0 to +0.03 dB/°C 0 to −0.03 dB/°C	 – 0 to +0.01 dB/°C
Max. Operating Static Pressure	252 dB = 4×10^6 Pa = 40 atm = 400 m ocean depth		260 dB = 9.8×10^6 Pa = 100 atm = 1000 m ocean depth	
Sensitivity Change with Static Pressure	0 to -3×10^{-7} dB/Pa (0 to −0.03 dB/atm)			0 to 1×10^{-7} dB/Pa 0 to 0.01 dB/atm
Allowable Total Radiation Dose	5×10^7 Rad.			
Dimensions: **Length** **Body Diameter**	 50 mm (1.97″) 9.5 mm (0.37″)	 120 mm (4.73″) 21 mm (0.83″)	 93 mm (3.66″) 22 mm (0.87″)	 182 mm (7.17″) 32 mm (1.26″)
Weight (including integral cable)	170 g (0.37 lb)	1.6 kg (3.5 lb)		382 g (0.84 lb)
Integral Cable **Standard Length**	Waterproof low-noise double-shielded 6 m (19.69 ft)	Waterblocked low-noise shielded cable fulfilling MIL–C–915 10 m (32.8 ft)		
Connector	Standard miniature coaxial plug	BNC plug		Proprietary 7-pin

* Each hydrophone is supplied with its own calibration data
† Specification is valid for Types 8103 and 8104 with integral cable length up to 100 m (382 ft)
Specification is valid for Type 8105 with integral cable length up to 25 m (82 ft)
‡ See polar directivity given in Fig. 6

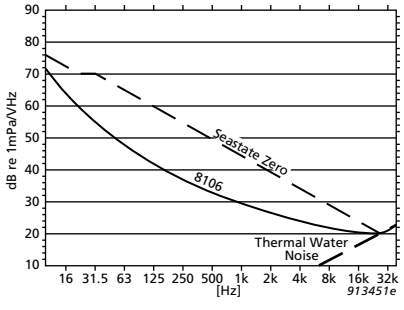
Additional Specifications for Type 8106

Max. output signal:
- 12 V supply: 3.5 V or 28 mA
- 24 V supply: 7.0 V or 28 mA

Max. power output: 50 mW
Output impedance: <30 Ω
High-pass filter: −3 dB at 7 Hz (±2 Hz)
DC ripple rejection (20 Hz to 20 kHz): 70 dB
Overload sound pressure level:
- 12 V supply: 182 dB re 1 µPa
- 24 V supply: 188 dB re 1 µPa

POWER SUPPLY
Supply voltage: 12 to 24 V DC
Power consumption: 6 mA without load

Fig. 13 *Typical equivalent noise pressure level of Type 8106*



Unless otherwise stated, all values are valid at 23 °C (73 °F) and (where applicable) with standard length integral cable.

Ordering Information

Type 8103 Miniature Hydrophone
Type 8104 Calibration Standard Hydrophone
Type 8105 Spherical Hydrophone
Type 8106 Low-noise Hydrophone

Supported Brüel & Kjær Hardware

CABLING

Type 8103		
Raw cable	AC-0043	Low-noise, double-screen; no connectors
Adaptors (Non-submersible)	JP-0145	10–32 UNF Coaxial (F) to BNC (M)
	JP-0162	10–32 UNF Coaxial (F) to TNC (M)
	JJ-2617	10–32 UNF Coaxial (F) to 1/2″ microphone amp
Types 8104 and 8105		
Raw cable	AC-0034	Water-blocked, MIL–C–915; no connectors
Cables	AO-1431	AC-0034 with submersible connectors (JJ-0415 and JP-0415)
	AO-1432	AC-0034 with submersible (JJ-0415) to non-submersible (JP-0108) connectors
Connectors	JP-0415	Submersible, 4-pin (M) for AC-0034
	JJ-0415	Submersible, 4-pin (F) for AC-0034
	JP-0108	Non-submersible, BNC (M) for AC-0034
Adaptor	JP-0226	Non-submersible, BNC (F) to TNC (M)
Type 8106		
Raw cables	AC-0101	Water-blocked, shielded 4-core cable, reinforced
	AC-0038	Water-blocked, MIL-C-915
Cables	AO-1433	AC-0101 with two submersible connectors (JJ-0738 and JP-0735)
	AO-0390	AC-0101 with submersible (JP-0735) to non-submersible (JP-0717) connectors
Connectors	JP-0717	Non-submersible, B&K 7-pin (M) for AC-0101
	JP-0735	Submersible, 7-pin (M) for AC-0101
	JJ-0738	Submersible, 7-pin (F) for AC-0101
	JP-0744	Submersible, 7-pin (M) for AC-0038
Adaptor	WL-1260	B&K 7-pin (F) to 7-pin LEMO (M)
Accessory	WB-0850	Insert-voltage junction unit

CALIBRATION

Type 4229* Hydrophone Calibrator
WA-0658 Type 8106 to Type 4229 Coupler
Type 9718 Hydrophone Calibration System

SIGNAL CONDITIONING AND DATA ACQUISITION

Type 2713 Power Amplifier
Type 2647 Charge to CCLD Converter
Type 2690 NEXUS Conditioning Amplifier
Type 2692 NEXUS Charge Conditioning Amplifier
Type 3161 1-ch. Input + 1-ch. Output Module LAN-XI 204.8 kHz

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SECONDARY CALIBRATION

HYDRO-CFF Factory Standard Calibration
HYDRO-CVN Conformance Test with Measurements Report
HYDRO-TCF Conformance Test with Certificate

* Includes couplers for use with Hydrophone Types 8103, 8104 and 8105

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BP 0317 – 21 2017-09
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