

PRODUCT DATA

Brüel & Kjær® Microphone Type 4966 Family

Microphone Cartridge Type 4966 combined with different preamplifiers

This is a family of microphone cartridge and preamplifier combinations based on Type 4966, a ½" prepolarized, free-field microphone cartridge.

The family is designed to be accurate, reliable and robust.



220105

Uses and Features

Uses

- Automotive noise measurements (interior and exterior noise)
- Industrial noise measurements (sound power)
- Environmental noise measurements
- Electroacoustic testing
- Acoustic measurements requiring a robust and reliable ½" free-field microphone operating at temperatures from –50 to +125 °C (–58 to +257 °F)

Features

- IEC 61094-4/WS2F
- Operating temperature range: –50 to +125 °C (–58 to +257 °F) (Type 4966-H-041)
- Dynamic range: 15.2 to 144 dB (Type 4966-L-001)
- Sensitivity: 48.4 mV/Pa, –26.3 dB re 1 V/Pa
- Frequency range: 6.3 Hz to 20 kHz, or A-weighted
- No measurable influence of humidity in the absence of condensation

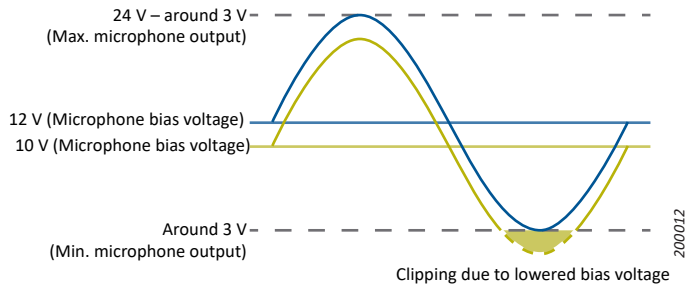
The Combinations

Type number	4966-H-041	4966-A-031	4966-A-041	4966-L-001
Temperature range	–50 to +125 °C (–58 to +257 °F)	–20 to +65 °C (–4 to +149 °F)	–20 to +60 °C (–4 to +140 °F)	–20 to +60 °C (–4 to +140 °F)
Dynamic range (Full temp. range*)	16.5 dB(A) to 134 dB	18 dB(Lin) to 131 dB	16.5 dB(A) to 134 dB	15.2 dB(A) to 144 dB
Frequency range (±2 dB)	6.3 Hz to 20 kHz	A-weighted	12.5 Hz to 20 kHz	6.3 Hz to 20 kHz
Preamplifier	Type 1706	Type 2699	Type 2695	Type 2669-L
Connector	BNC	BNC	10–32 UNF	LEMO® 1B, 7-pin
Application	For all-round acoustic measurements in temperatures from –50 to +125 °C (–58 to +257 °F). Typical applications include interior and exterior vehicle acoustic measurements and sound power	For eliminating low-frequency disturbance, such as body boom or road noise	For measurements in confined spaces, or when building an array with a low noise floor	For high sound pressure level (SPL) measurements, or if the integrity of the microphone measurement channel needs to be checked (charge injection calibration (CIC))

* Our online [transducer catalogue](#) contains more information about the effects of temperature.

Bias Voltage

Fig. 1 Change in the bias voltage reduces the dynamic range of a microphone



CCLD* microphones operate on a constant current power supply and give output signals in the form of voltage modulation on the power supply line. For HBK microphone preamplifiers, the power supply line is designed as 12 V DC to give maximal voltage swing and is normally called bias voltage.

Changes in bias voltage lower the possible voltage swing. The consequence is that the microphone preamplifier will overload at a lower SPL, as illustrated in Fig. 1, thereby reducing the dynamic range. For this reason, the bias voltage of a CCLD microphone is a key factor of microphone dynamic range.

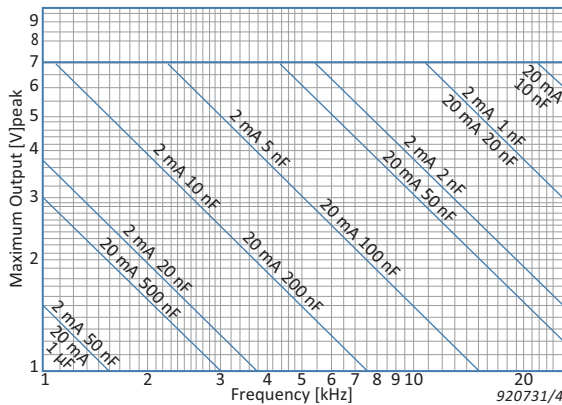
HBK microphone preamplifiers are so well-designed and manufactured that the bias voltage stays stable through changes in humidity and temperature, ensuring that there is minimal change to the dynamic range of the instrument over the course of a measurement.

Temperature and Humidity

As with every HBK microphone, the Type 4966 family has been carefully designed by knowledgeable engineers and assembled in a clean room to ensure precision and reliability. As long as there is no condensation, humidity does not affect the performance of the microphones, so therefore, there is no need for water-proofing.

Cable Length

Fig. 2 Typical curves for maximum output level of CCLD microphones, showing maximum capacitive load over the recommended current supply range



Cable length is limited by the available output current of the preamplifier, especially in situations where high-frequency signals must be measured at high levels. Typical cable capacitance is 100 pF/m.

Combinations with CCLD Preamplifiers

When using Type 4966-H-041, 4966-A-031 or 4966-A-041, the typical maximum output level of the microphone is limited by cable capacitance or current supply range. Typical limitations are shown in Fig. 2.

Combinations with Classical Preamplifiers

When using Type 4966-L-001, the maximum sound pressure level ($L_{p,peak}$) that can be measured with the combination of available current, cable load, frequency content of the signal and microphone sensitivity can be calculated with the following equation:

$$L_{p,peak} = 94 + 20 \log \left(\frac{i_{peak}}{2\pi \cdot f_{max} \cdot C_L \cdot 1 Pa \cdot S_c} \right) [dB]$$

where:

i_{peak} = maximum available peak current, either the preamplifier's maximum output current or the supply current minus the preamplifier's current consumption, whichever is the smallest

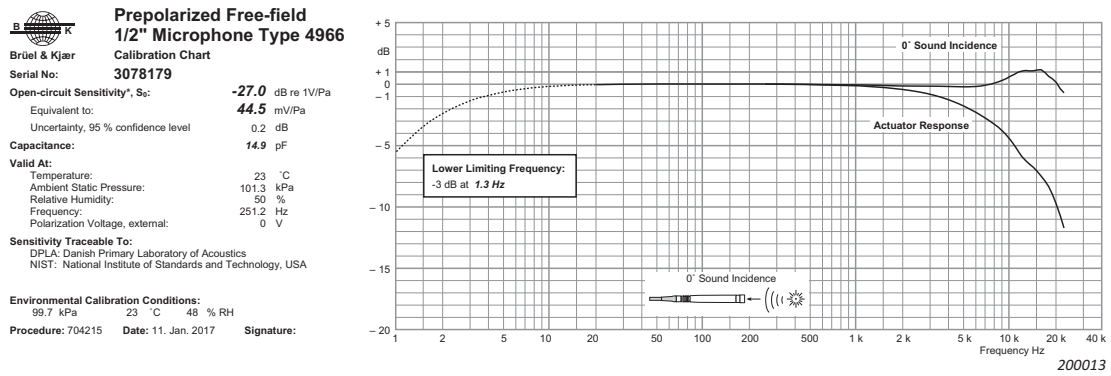
f_{max} = maximum frequency of the signal

C_L = total capacitive load presented by the connection cable in farad (F). The load is calculated by multiplying the cable length in metres with the cable capacitance in F per metre

S_c = loaded sensitivity of the microphone in V/Pa (nominal sensitivity)

* Constant current line drive, also known as DeltaTron® (ICP and IEPE compatible)

Fig. 3 Example of a calibration chart. TEDS includes information given in the chart



The preamplifiers combined with Type 4966 are equipped with TEDS (transducer electronic data sheet).

Each TEDS is programmed with the microphone's identity, including its type and serial number and its sensitivity. Thereby, microphone information is readily available when using TEDS-compatible data acquisition and analysis systems.

Fig. 4 TEDS compliance and template version for each Type 4966 combination

Type number	4966-H-041	4966-A-031	4966-A-041	4966-L-001
Standard	IEEE 1451.4			IEEE P1451.4
Template version	Version 1.0			Version 0.9*

* A mapping to template version 1.0 is available free of charge for new items, see Ordering Information on page 8

Microphone Data

Together with the microphone, frequency correction curves for different conditions and other useful information, such as the influence of different accessories on the frequency response, are supplied on a mini CD and are also available online.

Cable Length and TEDS

TEDS will normally work with cables up to 100 m (328 ft).

The Microphone Viewer, an application installed on your PC from our [website](#) or from the included mini CD, shows frequency response and correction data under different conditions. The correction data can be uploaded to PULSE™ LabShop or BK Connect®, where it can be used to correct the frequency response in real time according the actual conditions during use, or exported as a Microsoft® Excel® file for use in applications such as MATLAB®.

Fig. 5 The Microphone Viewer: View graphs of the frequency response of Type 4966 under different conditions

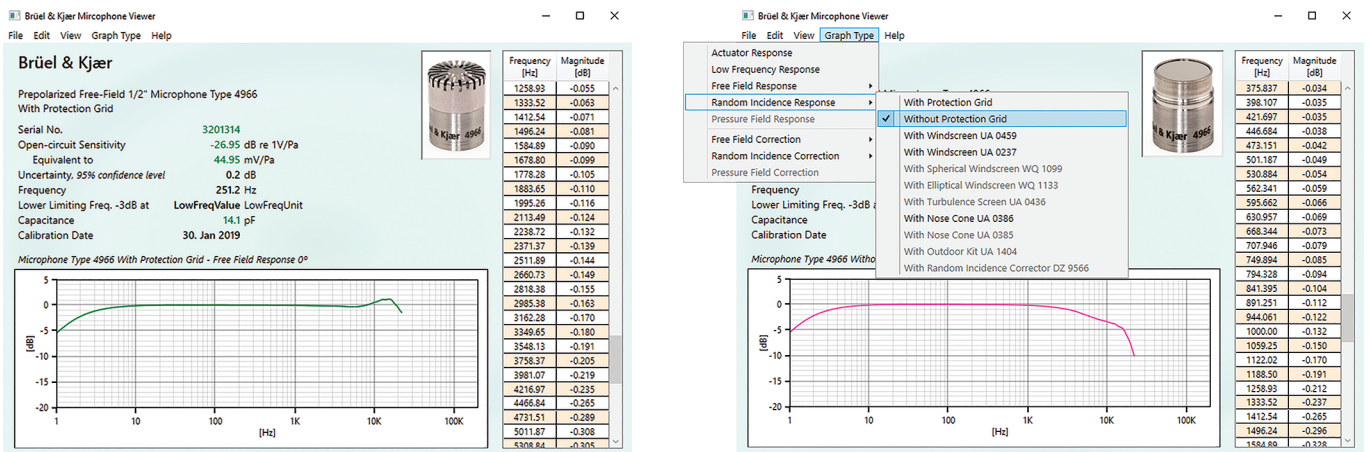
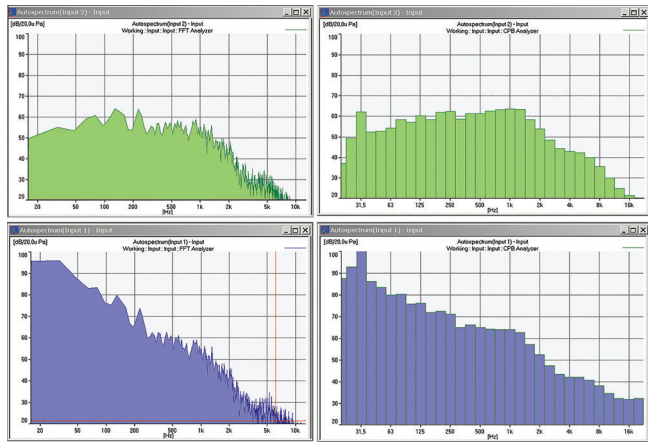


Fig. 6 Measurements using an A-weighted preamplifier (upper) and a linear-weighted preamplifier (lower)



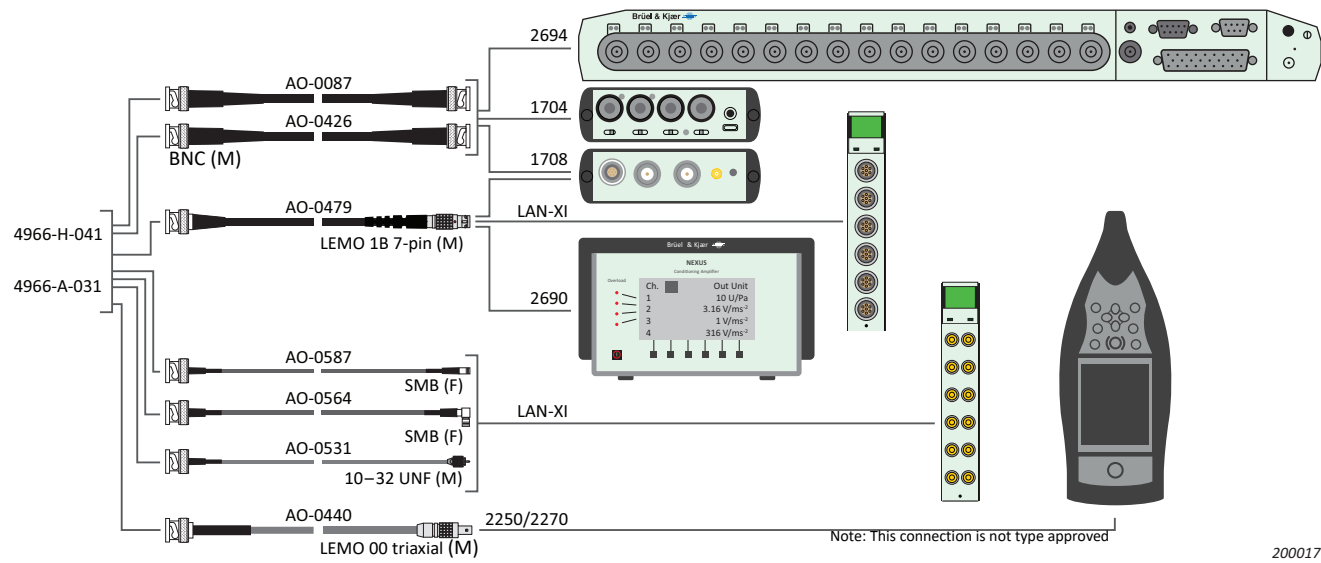
Type 4966-A-031 is A-weighted in the preamplifier. Frequency weighting A is defined in the international sound level meter standard IEC 61672 and the US standard ANSI S1.4. Type 4966-A-031 uses a carefully selected set of filter tolerances, such that the complete measurement chain complies with the class 1 frequency-weighting, A-weighting specifications. This applies when Type 4966-A-031 is followed by a measuring chain with a frequency response of ± 0.1 dB from 10 Hz to 20 kHz.

Fig. 6 shows in-car measurements using an A-weighted preamplifier as compared to a linear-weighted preamplifier. The filter tolerances attenuate low-frequency components, thus allowing a gain increase of up to 35 dB without overload, which means an improvement in the signal-to-noise ratio.

Compliance with Standards

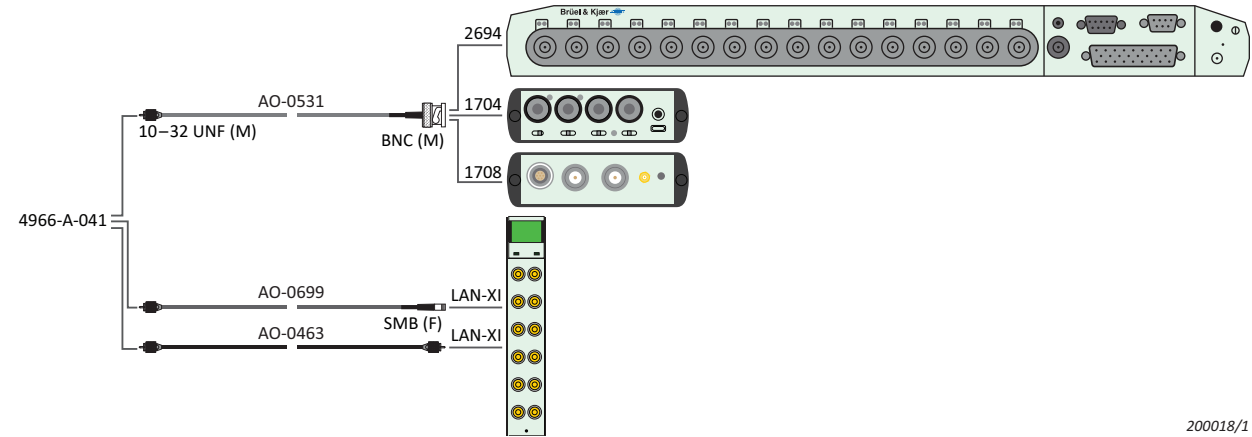
   	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME. China RoHS mark indicates compliance with 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. WEEE mark indicates compliance with the EU WEEE Directive.
Safety	EN/IEC 61010 – 1: Safety requirements for electrical equipment for measurement, control and laboratory use. ANSI/UL 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. EN/IEC 61000 – 6 – 4: Generic emission standard for industrial environments. CISPR 32: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device. This ISM device complies with Canadian ICES – 001 (standard for interference-causing equipment).
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 document.
Temperature	IEC 60068 – 2 – 1 & IEC 60068 – 2 – 2: Environmental Testing. Cold and Dry Heat. Operating Temperature: Type 4966-H-041: – 20 to +125 °C (– 4 to +257 °F) Type 4966-A-031: – 20 to + 65 °C (– 4 to +149 °F) Type 4966-A-041, Type 4966-L-001: – 20 to + 60 °C (– 4 to +140 °F) Storage Temperature (all types): – 20 to +70 °C (– 13 to +150 °F)
Humidity	IEC 60068 – 2 – 78: Damp Heat: 0 to 93% RH (non-condensing) storage. Type 4966-H-041: 93% RH (non-condensing at 40 °C (104 °F)) Type 4966-L-001: 95% RH (non-condensing at 40 °C (104 °F)) Type 4966-A-031, Type 4966-A-041: 90% 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 250 m/s ²

Fig. 6 Cables for connecting Types 4966-H-041 and 4966-A-031 to conditioning and data acquisition hardware



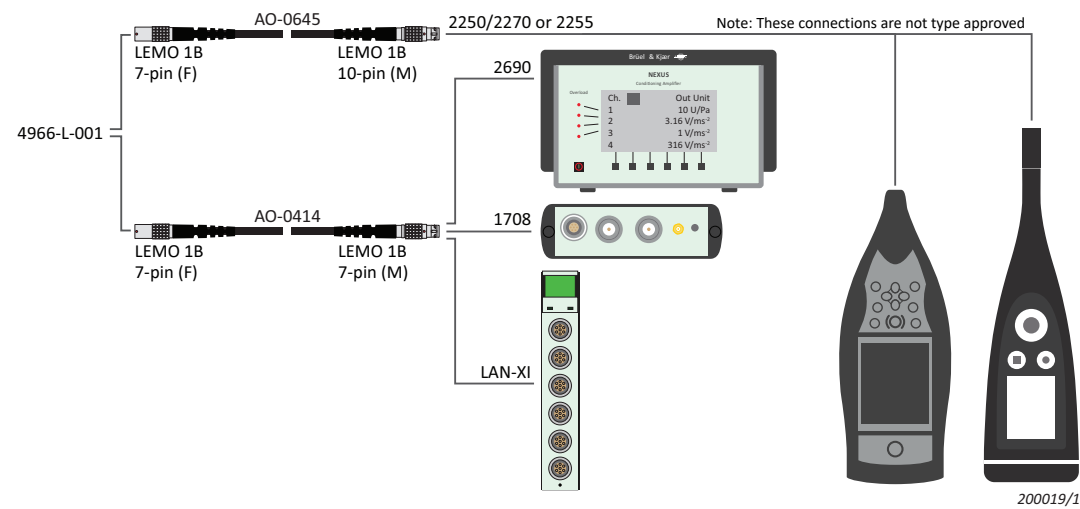
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Fig. 7 Cables for connecting Type 4966-A-041 to conditioning and data acquisition hardware



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Fig. 8 Cables for connecting Type 4966-L-001 to conditioning and data acquisition hardware



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Specifications – Type 4966 + Preamplifier Combinations

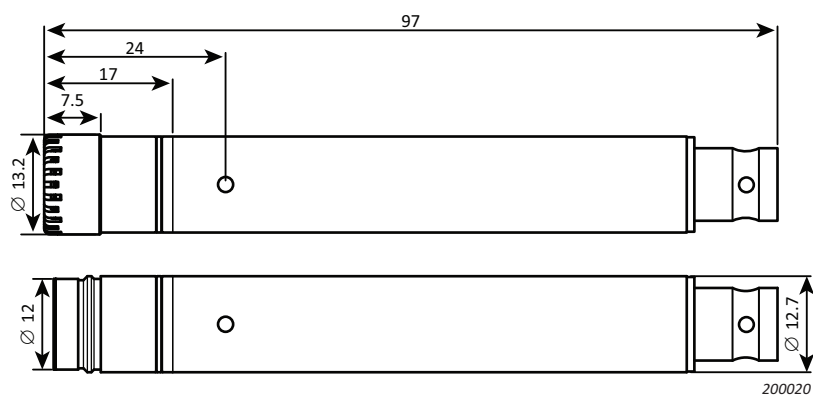
	4966-H-041	4966-A-031	4966-A-041	4966-L-001
Preamplifier Type Number	1706	2699	2695	2669-L
General Specifications				
Operating Temperature	–50 to +125 °C (–58 to +257 °F)	–20 to +65 °C (–4 to +149 °F)	–20 to +60 °C (–4 to +140 °F)	–20 to +60 °C (–4 to +140 °F)
Free-field Frequency Range	±1 dB (–20 to +60 °C)			3 Hz to 20 kHz
	±1 dB (–20 to +125 °C)	10 Hz to 8 kHz		
	±1 dB (–50 to +125 °C)	20 Hz to 8 kHz		
	±2 dB	6.3 Hz to 20 kHz	A-weighted	12.5 Hz to 20 kHz
	±3 dB	3 Hz to 20 kHz		3 Hz to 20 kHz
Cartridge 0° Incidence Free-field Response (±2 dB)	5 Hz to 20 kHz			
Cartridge Lower Limiting Frequency (–3 dB)	1 to 3 Hz			
Dynamic Range Inherent noise to 3% distortion in operating temp.	16.5 dB(A) to 134 dB	18 dB(Lin) to 131 dB	16.5 dB(A) to 134 dB	15.2 dB(A) to 144 dB
Cartridge Thermal Noise	14.9 dB(A), 15.4 dB(Lin)			
Cartridge Capacitance	14 pF at 250 Hz			
Cartridge Max. Sound Pressure Level (Peak)	158 dB			
Sensitivity	Type 4966	50 mV/Pa, –26 ± 1.5 dB re 1 V/Pa at 250 Hz		
	Type 4966 + Preamplifier	48.4 mV/Pa, –26.3 ± 1.5 dB re 1 V/Pa at		
	250 Hz	1 kHz	250 Hz	250 Hz
Polarization Voltage	0 V			
Pressure Equalization Vent	Both microphone cartridge and preamplifier are vented			
Pistonphone Correction	0.00 dB for Type 4228 with DP-0776			
Electronic Specifications				
Supply Voltage	CCLD supply: 24 to 28 V	CCLD supply: 24 to 28 V	CCLD supply: 24 to 28 V	Dual: ±14 to ±60 V Single: 28 to 120 V
Supply Current	4 to 20 mA	4 to 20 mA	4 to 20 mA	–
Output Bias Voltage In operating temperature range	12 ± 2 V	14.75 V ± 2 V	12 ± 2 V	–
Output Voltage (Peak)	7 V	5 V	7 V	$\frac{\text{Total supply voltage}}{2} - 5 \text{ V}$
Maximum Output Current (Peak)	3 mA at 4 mA supply 19 mA at 20 mA supply	2 mA at 4 mA supply 18 mA at 20 mA supply	2 mA at 4 mA supply 18 mA at 20 mA supply	20 mA
Start-up Time for Signal within 0.1 dB	<60 s	<10 s	<60 s	<10 s
IEC 61094-4 Compliance	WS2F			
TEDS Template	Version Number	1.0 (IEEE 1451.4)		0.9 (IEEE P1451.4)
	ID	UDID = 127-0-0-0U		UTID = 769
Charge Injection Calibration	No	No	No	Yes
Environmental Specifications				
Storage Temperature	In Microphone Box	–25 to +70 °C (–13 to +150 °F)		
	With Mini-CD	5 to 50 °C (41 to 122 °F)		
Temperature Coefficient (250 Hz)	+0.003 dB/K			
Pressure Coefficient (–10 to +50 °C (+14 to +122 °F))	–0.012 dB/kPa			
Operating Humidity Range Without condensation at 40 °C (104 °F)	0 to 93% RH			
Influence of Humidity	Not measurable in the absense of condensation			
Vibration Sensitivity (< 1000 Hz)	62.5 dB equivalent SPL for 1 m/s ² axial vibration			
Magnetic Field Sensitivity	15.6 dB SPL for 80 A/m, 50 Hz field			
Cartridge Magnetic Field Sensitivity	6 dB SPL for 80 A/m, 50 Hz field			
CE including RoHS2 compliant	Yes			
Dimensions				
Diameter with Grid	13.2 mm	13.2 mm	13.2 mm	13.2 mm
Length including connector and protection grid	97 mm	101.5 mm	47 mm	87.2 mm
Shape	Cylindrical	Cylindrical	Cylindrical	Conical*
Socket	BNC	BNC	10–32 UNF	LEMO 1B, 7-pin

* Optimized with respect to acoustic properties
All values are typical at 23 °C (73.4 °F), 101.3 kPa and 50% RH unless otherwise specified

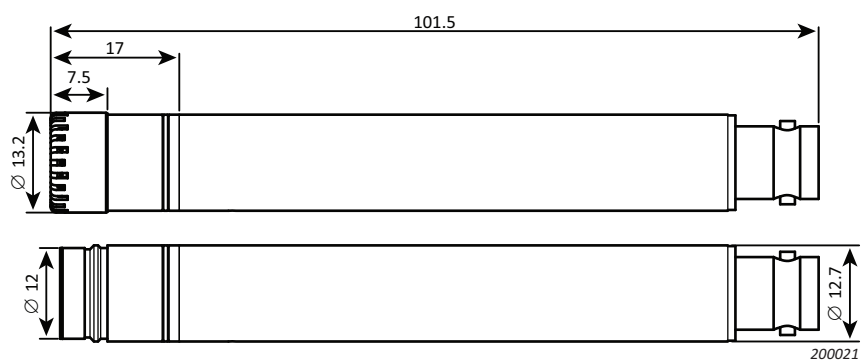
Dimensions

Note: All dimensions in mm

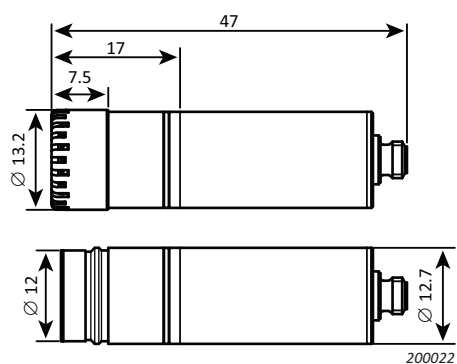
TYPE 4966-H-041



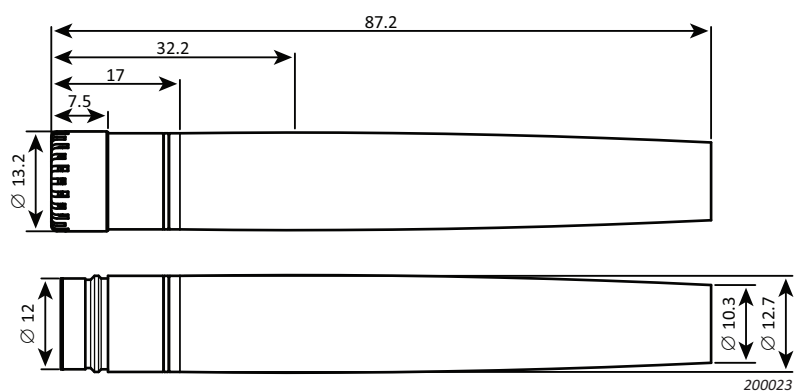
TYPE 4966-A-031



TYPE 4966-A-041



TYPE 4966-L-001



Ordering Information

Type 4966-H-041 Type 4966 + Preamplifier Type 1706

Type 4966-A-031 Type 4966 + Preamplifier Type 2699

Type 4966-A-041 Type 4966 + Preamplifier Type 2695

Include the following:

- Calibration chart
- Microphone mini-CD

NOTE: Calibration and correction data are also available online.

Type 4966-L-001 Type 4966 + Preamplifier Type 2669-L

Includes the following:

- Calibration chart
- Microphone mini-CD
- AO-0419-D-030: Microphone cable, LEMO 1B 7-pin (M) to LEMO 0B 7-pin (F), 3 m (9.8 ft)

Optional Accessories

CABLES

To 80 °C (176 °F)

AO-0463	Coaxial cable, 10–32 UNF (M) to 10–32 UNF (M)
AO-0531	Single-screened coaxial cable, 10–32 UNF (M) to BNC (M)

To 85 °C (185 °F)

AO-0087	Single-screened coaxial cable, BNC (M) to BNC (M)
AO-0426	Double-screened coaxial cable, BNC (M) to BNC (M)
AO-0440	Triaxial cable, LEMO 00 triaxial (M) to BNC (M)
AO-0564	Single-screened coaxial cable, right-angle SMB (F) to BNC (M)

To 90 °C (194 °F)

AO-0414	Microphone cable, LEMO 1B 7-pin (M) to LEMO 1B 7-pin (F)
AO-0479	Microphone cable, BNC (M) to LEMO 1B 7-pin (M)
AO-0645	Microphone cable, LEMO 1B 7-pin (F) to LEMO 1B 10-pin (M)

To 105 °C (221 °F)

AO-0587	Single-screened coaxial cable, SMB (F) to BNC (M)
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To 150 °C (302 °F)

AO-0419	Microphone cable, LEMO 1B 7-pin (M) to LEMO 0B 7-pin (F)
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To 250 °C (482 °F)

AO-0699	Super low-noise coaxial cable, 10–32 UNF (M) to SMB (F)
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NOTE: SMB connector is to max. 105 °C (221 °F)

CABLING ACCESSORIES

JP-0145	BNC (M) to 10–32 UNF (F) adapter
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CALIBRATION

Type 4231	Sound Calibrator
Type 4228	Pistonphone
Type 4226	Multifunction Acoustic Calibrator
DP-0776	Adapter for ½" microphones, use with Type 4228
UA-0033	Electrostatic Actuator for ½" microphones

OTHER ACCESSORIES

DB-3420	Protection grid for ½" microphones
UA-1260	Angle adapter for ½" microphones to ½" preamplifiers (approx. 80°)
UA-1317	Holder for mounting ½" preamplifiers on a tripod, holder swivels and locks
UA-0386	Nose cone for ½" microphones
UA-0237	Windscreen for ½" microphones, spherical, 90 mm diameter
UA-0459	Windscreen for ½" microphones, spherical, 65 mm diameter

Service and Support

HBK local and global service and support teams and certified calibration centres, are another guarantee of the quality of Brüel & Kjær® microphones.

SECONDARY CALIBRATION

MIC-TEDS-CAI	Initial accredited calibration
MIC-TEDS-CAF	Accredited calibration
MIC-TEDS-CFF	Factory standard calibration

TEDS TEMPLATE

BK-0068-010	Remapping to TEDS template V1.0
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Local representatives and service organizations worldwide

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