PRODUCT DATA

Falcon Range 1/4-inch Microphone Preamplifier Type 2670

1/4-inch Microphone Preamplifier Type 2670 is a Falcon™ range product for precision acoustic measurements with Brüel & Kjær's wide range of condenser microphones. You can connect 1/4-inch microphones directly and 1/8-inch types using an adapter. The preamplifier, cable and its connectors all fulfil EMC requirements.

You can verify the condition of the microphone, preamplifier and cable on-site using its patented charge injection calibration (CIC) technique. The preamplifier's low output impedance allows the use of long extension cables without problems.

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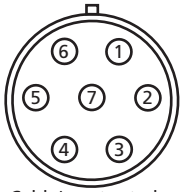

Cable's output plug seen from outside

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Pin	LEMO
1	Calibration input
2	Signal ground
3	Polarization voltage
4	Signal output
5	Not connected
6	Power supply positive
7	Power supply negative/ground
Casing	Connected to instrument chassis

Uses and Features

Uses

- Sound measurements with 1/4- and 1/8-inch Brüel & Kjær and other compatible microphones
- Sound intensity probes

Features

- Full electromagnetic compatibility (EMC)
- LEMO connector for instrument input socket
- Patented charge injection calibration technique for on-site calibration of the whole measuring channel including the microphone
- Wide dynamic range
- Very low inherent noise, high input impedance
- Low output impedance and high output current allow use with long extension cables
- Wide working temperature range
- Excellent phase linearity

Brüel & Kjær

Description

The housing of 1/4-inch Microphone Preamplifier Type 2670 is made completely out of stainless steel and is supplied with a 2-metre fixed cable terminated with a LEMO connector for input at the instrument end. The preamplifier is very compact and operates over a wide range of temperature, humidity and other environmental conditions. It has a very high input impedance presenting virtually no load to the microphone. The high distortion limit together with an extremely low inherent noise level gives a wide dynamic range.

The low output impedance and high output current capability mean that you can use long cables between the preamplifier and your measuring instrument without loss of signal quality. The preamplifier is supplied in an elegant yet strong plastic box made from recyclable materials.

EMC Certification

The preamplifier complies with EMC (electromagnetic compatibility) requirements specified in EN 50082-1 (residential, commercial and light industry) as well as in EN 50082-2 (industrial environment). These are generic European standards for noise immunity, to ensure that electrical instruments are not disturbed by other electrical appliances. To get the full benefit of this certification, the preamplifier must be connected to an instrument which also complies with EMC requirements.

Charge Injection Calibration

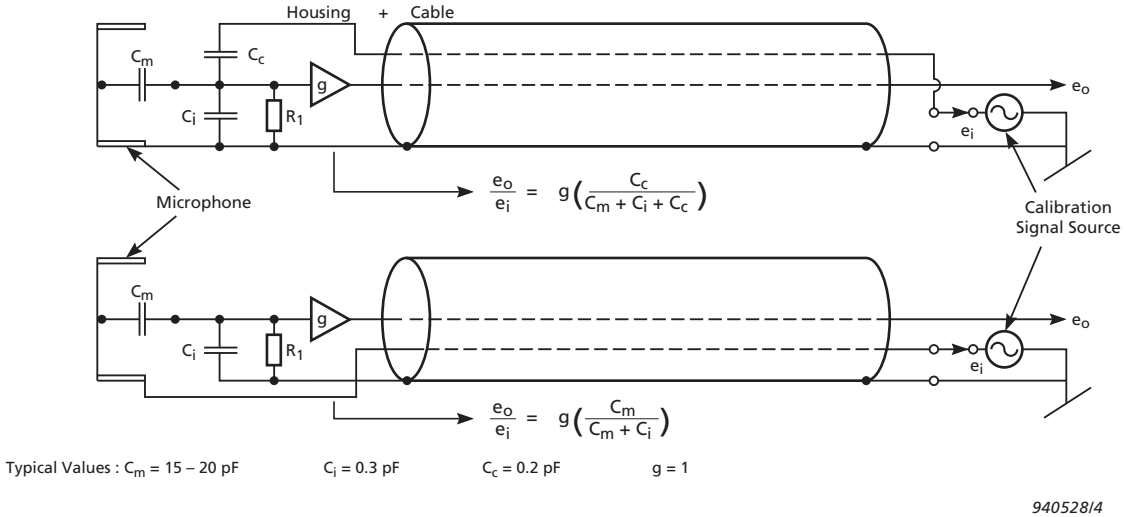
This is a patented technique for verifying the entire measurement setup including the microphone, preamplifier and connecting cable.

Brüel & Kjær's Patented Charge Injection Calibration Technique

The charge injection calibration technique is a method for remotely verifying the condition of the entire measurement setup including the microphone. This is a great improvement over the traditional insert-voltage calibration method which virtually ignores the state of the microphone. The CIC technique is very sensitive to any change in the microphone's capacitance, which is a reliable indicator of the microphone's condition.

The technique works by introducing a small but accurately defined capacitance C_C (typically 0.2 pF) with a very high leakage resistance (greater than 50,000 GΩ) into the circuit of the preamplifier, see the upper diagram in Fig. 1. C_m represents the microphone's capacitance; C_i and R_i represent the preamplifier's high input impedance; and g its gain (≈1).

Fig. 1
Illustration of CIC



For a given calibration signal e_i, the output e_o of this arrangement will change measurably, even for small changes in the microphone's capacitance. The CIC technique is about 100 times more sensitive than the insert-voltage calibration arrangement shown in the lower diagram.

In the extreme case where there is significant leakage between the microphone's diaphragm and its backplate (C_M becomes very large), the signal output will change by tens of decibels compared with only tenths of a decibel using the insert-voltage method.

Another important CIC feature is that, unlike the insert-voltage technique, it is far less sensitive to external electrical fields.

Fault Diagnosis with CIC

Those who do the monitoring of the measurement system do not need to know the reasons for the observed changes in the ratio between the output and the input signals. However, those who perform the maintenance and fault-finding may find the following examples of the use of CIC helpful.

Note, the following examples are obtained using a white noise signal as the CIC input.

Normal Working Condition

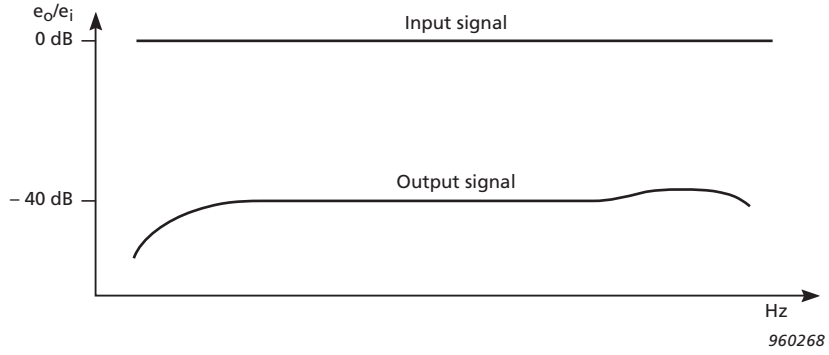


Fig. 2
Signal output of microphone under normal working condition. Notice the attenuation of approximately 40 dB in the mid-frequency range. The low-frequency roll-off is caused by the preamplifier input resistance

Diaphragm Torn or Missing

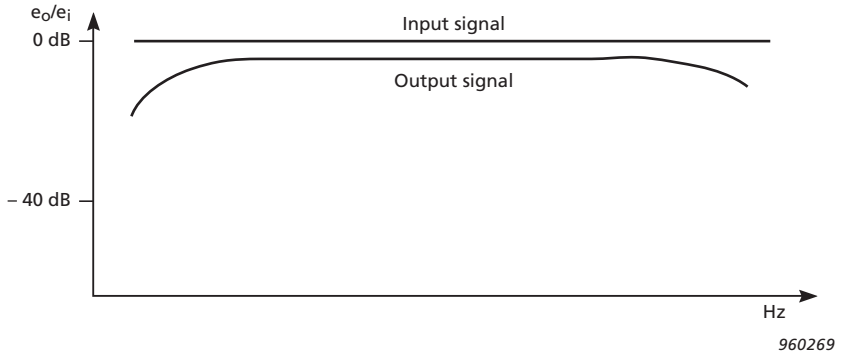


Fig. 3
Signal output indicating either no microphone attached or the diaphragm is torn or missing. The output level is significantly increased due to reduced microphone capacitance

Microphone Short-circuited

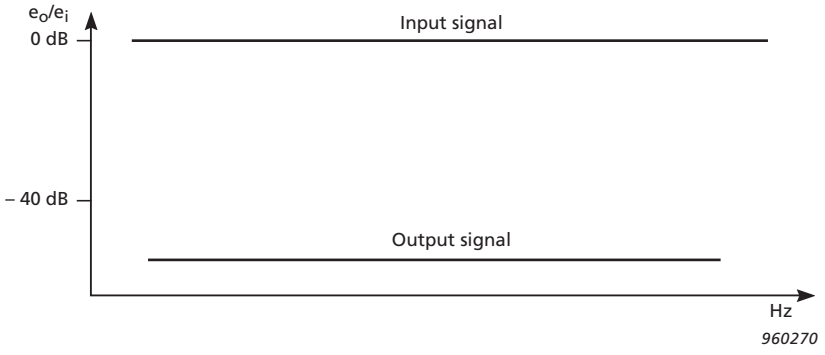


Fig. 4
Signal output indicating the microphone short-circuited. The output level is significantly reduced relative to the normal condition

Disconnected or Broken Cable

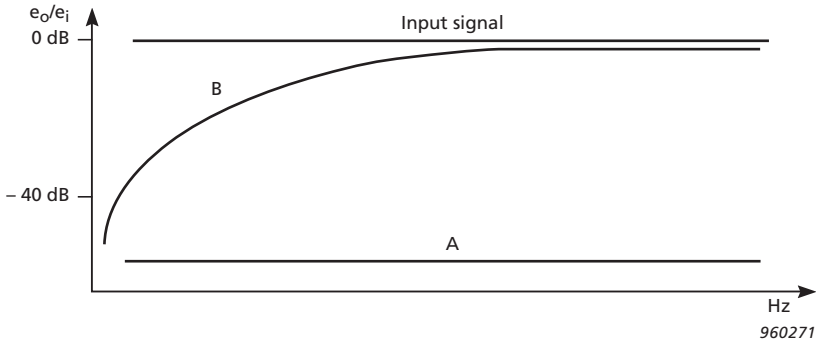


Fig. 5
Signal output indicating a disconnected or broken cable. The output level will differ significantly depending on the distance between the conditioning amplifier and the cable break:
A: *Break near power supply*
B: *Break near microphone*

TEDS

The microphone preamplifier support TEDS (Transducer Electronic Data Sheet) and can be used with the Smart Transducer interface according to IEEE P 1451.4. The ability to store and recall TEDS data drastically reduces test setup time and allows cost savings in most measurement situations.

Microphones and Sockets

You can fit 1/4-inch microphones directly (½-inch Sound Intensity Microphone Pairs can also be fitted directly) and 1/8-inch microphones using Adapter UA-0160.

Fig. 6
Available adapters for use with Type 2670

The preamplifier has a 2-metre fixed cable with a LEMO connector that fits directly into the standard preamplifier input socket on Brüel & Kjær instruments. Adapter ZG-0350 is available for use with the traditional 7-pin Brüel & Kjær preamplifier sockets.

Power Supply

You can use a dual (plus/minus) or single power supply for the preamplifier. When using a balanced power supply, the offset voltage at the output – and at the preamplifier guard ring – will be almost zero. This protects you against electric shocks when you mount or remove the microphone, and gives a faster stabilisation time for a measurement setup. You can use the preamplifier with traditional power supplies with Brüel & Kjær sockets by means of Adapter ZG-0350.

The small and large signal frequency responses of the preamplifier depend on the capacitance of the microphone connected to its input and the capacitive load (for example, extension cables) connected to the output.

Small Signal Frequency Response

The curves in Fig. 7 show the low-frequency small signal response of the preamplifier for 6.2 pF and 20 pF microphone capacitances. 6.2 pF is typical for 1/4- and 1/8-inch microphones with Adapter UA-0160.

20 pF is typical for Sound Intensity Microphone Pair Type 4197. Note that they do not show or take into account the lower cut-off frequencies of the microphones. The effects of various capacitive output loads (cable length) on the high-frequency small signal response are also shown. The curves in Fig. 7 apply for signal levels within the large signal limits shown in .

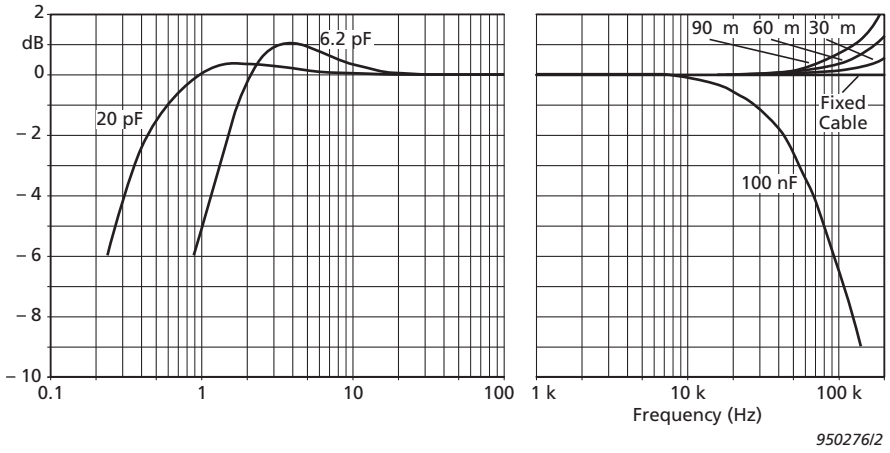


Fig. 7
Small signal frequency response of the preamplifier at low frequencies for 6.2 pF and 20 pF microphone capacitances and at high frequencies for cable lengths of 2 m (fixed cable), 30 m, 60 m and 90 m, corresponding to capacitive loads of 200 pF, 2.9 nF, 5.8 nF and 8.6 nF, respectively

Large Signal Frequency Response

The capacitive load of extension cables on the output of the preamplifier influences its frequency response and available output voltage. If the specified maximum output current of the preamplifier is exceeded, the signal will be distorted.

The curves in show, for various situations, the upper distortion limits (3%) as a function of preamplifier output voltage, frequency and capacitive loading (cable length). The curves are shown for total supply voltages of 120 VDC and 28 VDC (±60 VDC and ±14 VDC dual supply voltages respectively).

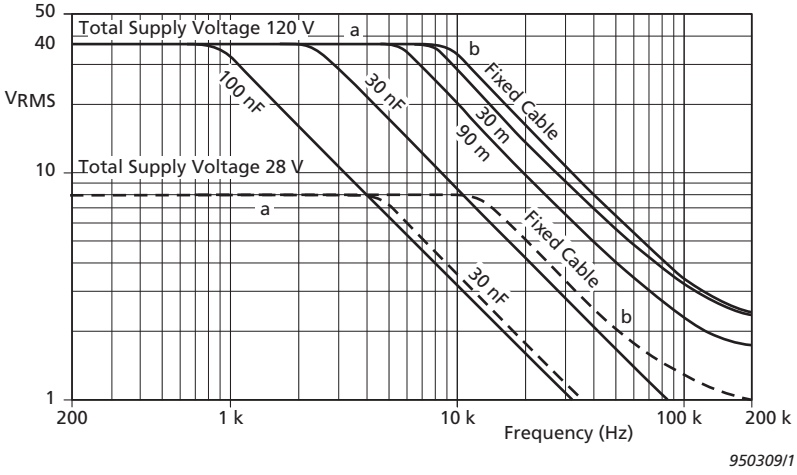


Fig. 8
Large signal frequency response showing upper distortion limit (3%) as a function of preamplifier output voltage and frequency for various capacitive loads. The full-drawn curves are valid for a preamplifier powered with 120 VDC and the dotted curves are for 28 VDC

Fig. 9 shows the phase characteristics for equivalent microphone loadings of 6.2 pF and 20 pF, and various cable lengths from 2 m to 90 m.

Fig. 9
Typical phase response curves measured with equivalent microphone capacitances of 6.2 pF and 20 pF. The typical phase deviation at 50 Hz is 0.3° with 6.2 pF loading and 0.1° with 20 pF loading

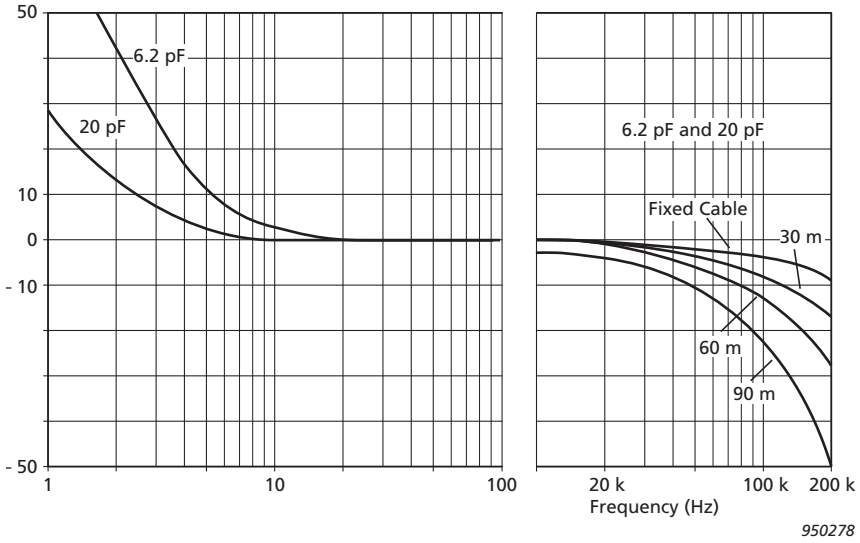
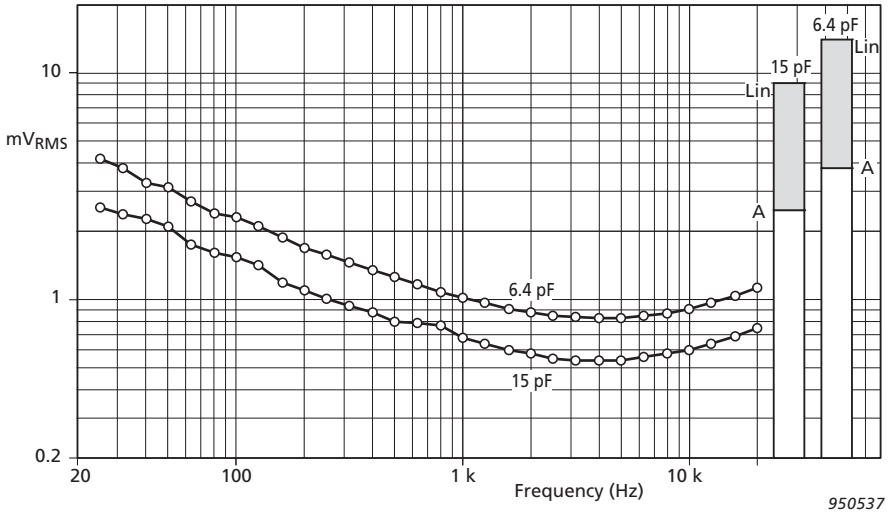


Fig. 10 shows typical noise frequency spectra when loading the preamplifier with 6.4 pF and 15 pF microphone capacitances. The low noise of the preamplifier ensures that the noise floor for a microphone/preamplifier assembly is determined mainly by the associated microphone over most of the frequency range.

Fig. 10
Typical noise frequency spectra in μV measured with 6.4 pF and 15 pF microphone capacitances. The spectra are measured in 1/3-octave bands with levels at centre frequencies indicated by circles. The bar graphs represent broadband (22.4 Hz to 300 kHz) and A-weighted noise levels for both microphone capacitances



Extension Cables

All Brüel & Kjær extension cables with LEMO connectors are fully EMC certified. These cables are made of polyurethane and are flexible at low temperatures. The preamplifier can also be used with traditional cables with Brüel & Kjær connectors (with Adapter ZG-0350), but EMC compatibily is not guaranteed. The cables in Table 1 have a working temperature range from −20 to +80 °C. They are very robust, have low capacitance and extremely good shielding so that most of them can be connected in series without loss o signal quality.

Table 1
Standard extension cables

	AO-0414	AO-0027	AO-0028
Connector	LEMO	Brüel & Kjær	
Length (m)	3	3	10
Diameter (mm)	4	6	9
Capacitance (pF)	290	300	570

Compliance with Standards

CE, C-Tick	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
Safety	EN 61010-1 and IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111-1: Standard for Safety – Electrical measuring and test equipment
EMC Immunity	EN 50082-1: Generic standards – Immunity for residential, commercial and light industrial environments. EN 50082-2: Generic standards – Immunity for industrial environments. EN 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: –20 to +60 °C (–4 to +140 °F), 120 °C (248 °F) with increase in noise. Storage Temperature: –25 to +70 °C (–13 to +158 °F)
Humidity	IEC 60068-2-78: Damp Heat: 95% 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: 4000 bumps at 400 m/s^2
Enclosure	IEC 60529: Protection provided by enclosures: IP 20
Reliability	MI-HDBK 217F, GB (part-stress): MTBF >40000 hours (max. 2.5% errors/1000 h)

Specifications – Falcon Range 1/4-inch Microphone Preamplifier Type 2670

The following is valid for the fixed 2-metre cable and 6.2 pF microphone capacitance unless otherwise specified.

FREQUENCY RESPONSE (re 1 kHz)
15 Hz to 200 kHz, ±0.5 dB. See Fig. 7

ATTENUATION
0.4 dB (max.)

PHASE LINEARITY
≤±1° from 20 Hz to 100 kHz (20 pF mic. capacitance)

PHASE MATCHING
0.015° at 50 Hz (20 pF mic. capacitance)

OUTPUT SLEW RATE
2 V/μs

INPUT IMPEDANCE
15 GΩ || 0.25 pF (typical)

OUTPUT IMPEDANCE
50 Ω (max.)

CONNECTOR TYPE
LEMO type FGG.1B.307

MAX. OUTPUT CURRENT
20 mA (peak)
Note: The max. output current can be limited by the power supply

MAX. OUTPUT VOLTAGE
Maximum output voltage V_{p-p} is equal to total supply voltage minus 10 V

DISTORTION (THD)
Less than –80 dB at 25 V out, 1 kHz

NOISE
14.0 μV Lin. 20 Hz to 300 kHz (typical)
30.0 μV Lin. 20 Hz to 300 kHz (max.)
4.0 μV A-weighted (typical)
7.0 μV A-weighted (max.)

POWER SUPPLY, DUAL
±14 to ±60 V

POWER SUPPLY, SINGLE
28 to 120 V

OUTPUT DC OFFSET
≈1 V for a dual supply, or
≈½ the voltage of a single supply

CURRENT CONSUMPTION
3 mA plus output current

CALIBRATION INPUT
Charge insert capacity, typically 0.2 pF
Max. 10 VRMS, input capacitance: 1 nF

DIMENSIONS
Diameter: 6.35 mm (0.25 in)
Length: 89.5 mm (3.5 in)

MAX. CABLE RELEASE
5 kg

Charge Injection Calibration technique patented according to US Patent No. 5,400,297

Type 2670 **1/4-inch Microphone Preamplifier (2 m fixed cable with LEMO connector). Supplied in a robust plastic box**

Optional Accessories

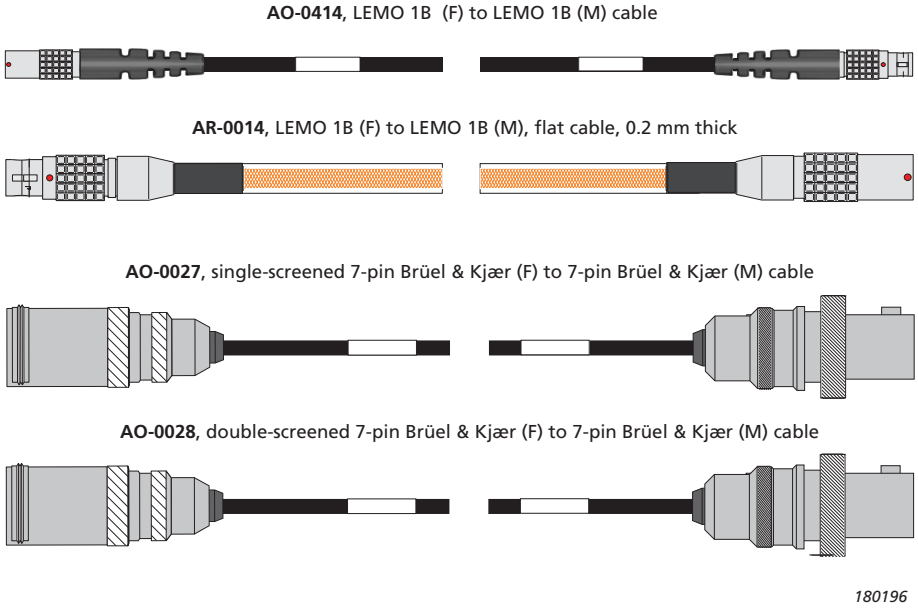
ZG-0350	LEMO to 7-pin Brüel & Kjær Adapter
UA-0160	Adapter (1/4- to 1/8-inch)

EXTENSION CABLES

AO-0414-D-xxx*	LEMO to LEMO Microphone Cable
AR-0014	LEMO to LEMO Flat Microphone Cable, 0.5 m (1.6 ft)
AO-0027-D-xxx*	7-pin Brüel & Kjær to 7-pin Brüel & Kjær Microphone Cable
AO-0028-D-xxx*	7-pin Brüel & Kjær to 7-pin Brüel & Kjær Microphone Cable

* Available in various lengths: D = decimetres, xxx = length. Please specify when ordering

Fig. 11 *Overview of compatible extension cables*



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