Product Data

Falcon™ Range

Falcon™ Range 1/2″ Microphone Preamplifier — Type 2669

USES:

- ❍ Sound measurements with Brüel & Kjær 1/2″ (1″, 1/4″ and 1/8″ with adaptor) and compatible microphones
- ❍ General-purpose preamplifier and high-impedance input probe for Brüel & Kjær measuring instruments

FEATURES:

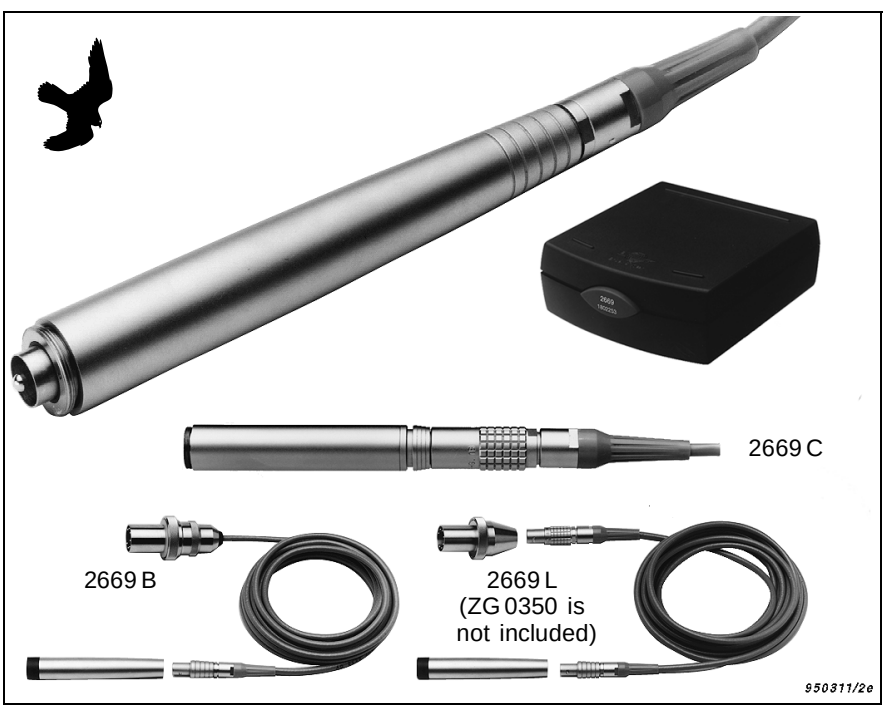
- ❍ Full electromagnetic compatibility (EMC)
- ❍ Detachable, thin cable for easy installation
- ❍ Compact LEMO connector at preamplifier
- ❍ Patented charge-injection calibration technique for on-site calibration of the whole measuring channel including the microphone
- ❍ Wide dynamic range
- ❍ Very low inherent noise, high input impedance
- ❍ Low output impedance and high output current allows use with long extension cables
- ❍ Wide working temperature range
- ❍ Falcon™ Range product with a three-year guarantee

1/2″ Microphone Preamplifier Type 2669 is a Falcon™ Range product for making precision acoustic measurements with Brüel & Kjær's wide range of condenser microphones. You can connect 1/2″ microphones directly and 1″, 1/4″ and 1/8″ types using adaptors.

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 technique.

The preamplifier's low output impedance allows the use of long extension cables without problems.



Description

This 1/2″ Falcon™ Range microphone preamplifier operates over a wide range of temperature, humidity and other environmental conditions. It is available in three versions: the cylindrical Type 2669 C and the conical Types 2669 L and 2669 B. Apart from the shape of the housing, the only difference is the connectors. The conical form is optimized with respect to acoustical properties, whereas the cylindrical form will fit existing specialized holders.

The preamplifier has a very high input impedance presenting virtually no load to the microphone. The high output voltage together with an extremely low inherent noise level gives a wide dynamic range.

The low output impedance and high output current capability means that you can use long cables between the preamplifier and your measuring instrument without loss of signal quality. Furthermore, this Falcon™ Range microphone preamplifier comes with an extended guarantee period of three years. It is supplied in an elegant and 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 electrical noise immunity, to ensure that instruments do not interfere with each other. 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 set-up

including the microphone, preamplifier and connecting cable (see box below).

Microphones and Sockets

You can fit $^1/_2$″ microphones directly and 1″, $^1/_4$″ and $^1/_8$″ microphones using adaptors DB 0375, UA 0035 and UA 0036 respectively.

Preamplifier Type 2669 L is delivered with a cable which fits the LEMO preamplifier input socket on new Brüel & Kjær instruments (as well as instruments from Hewlett-Packard and Nortronic). Adaptor ZG 0350 is available for converting it to traditional 7-pin Brüel & Kjær preamplifier sockets. Alternatively, Type 2669 B is available for direct use with traditional Brüel & Kjær instruments. This cable has the same diameter and flexibility, but is equipped with a traditional Brüel & Kjær plug. Both types are fitted with a LEMO 0B connector at the preamplifier.

In contrast the cylindrical Type 2669 C is fitted with a LEMO 1B connector, which means that it can be connected directly to LEMO to LEMO extension cables. Type 2669 C is supplied without a cable.

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 harmless, but unpleasant, electrical shocks if you accidentally mount or remove the microphone with power on, and gives a faster stabilisation time for a measurement set-up.

Detachable Cable (2669L and B)
The 4 mm thick connecting cable is made of silicone and is very flexible. It has a wide working temperature range (–60°C to 150°C). It has a small high-quality connector at the preamplifier end for easy detachment during installation.

Accessories
In addition to the previously mentioned adaptors for 1″, $^1/_4$″ and $^1/_8$″ microphones, other useful accessories are available. The Coaxial Input Adaptor JJ 2617 is used for measuring electrical signals by connecting the preamplifier directly to cables with microplugs (Cables AO 0038, AO 0122). The Flexible Extension Rod UA 0196 gives directional flexibility to the microphone and increases the distance between the microphone and the preamplifier. This allows continuous exposure of the microphone to high temperatures (up to 150°C, 302°F) while avoiding electrical noise otherwise generated by the preamplifier at high temperatures. For short periods the UA 0196 tolerates temperatures up to 300°C (572°F). Microphone Holder UA 1317 is used for mounting the preamplifier on a tripod without compromising the acoustical properties of the preamplifier. It can hold all Brüel & Kjær $^1/_2$″ preamplifiers. Adaptor DP 0901 is supplied with the preamplifier for use with holders that require a cylindrically shaped preamplifier.

Characteristics

The small and large signal frequency response 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. 1 show the low-frequency response of the preamplifi-

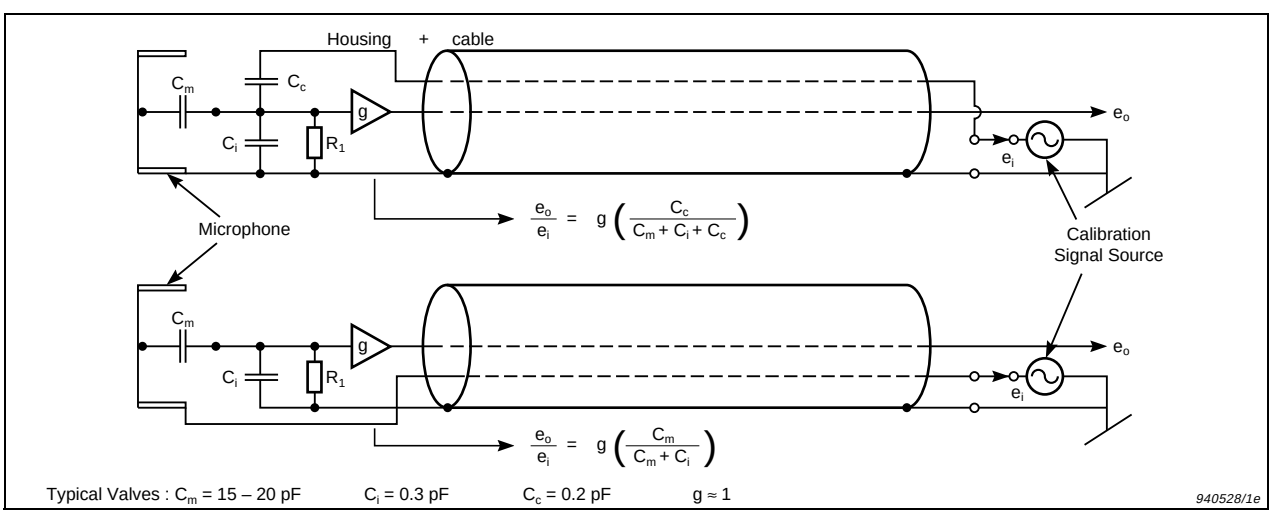
Brüel & Kjær's Patented Charge-injection Calibration Technique
The Charge-injection Calibration (CIC) technique is a method for remotely verifying the condition of the entire measurement set-up **including the microphone**. This is a great improvement over the traditional insert-voltage calibration method 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 50000 GΩ) into the circuit of the preamplifier, see below (upper diagram). C_i and R_i represent the preamplifier's high input impedance and g its gain (≈ 1).

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 C_m. 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.



er for various microphone capacitances. These capacitances (47 pF, 15 pF and 6.2 pF) are typical for 1″, 1/2″ and 1/4″ microphones respectively. 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 response are also shown. The curves in Fig. 1 apply for signal levels within the large signal limits in Table 2.

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 Fig. 2 show 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 V DC and 28 V DC (±60 V DC and ±14 V DC dual supply voltages respectively).

Noise

Fig. 3 shows typical noise frequency spectra when loading the preamplifier with 6.4 pF and 15 pF microphone capacities. 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. The preamplifier can work at temperatures up to 150°C, but reduced specifications for noise and output capability will apply.

More information on preamplifiers and other Falcon™ Range products are given in the Microphone Handbook BA 5105.

Extension Cables

Extension Cable	AO 0414/15 /16	AO 0027	AO 0028/29
Connectors	LEMO	Brüel & Kjær	
Length	3/10/30 m	3 m	10/30 m
Diameter	4 mm	6 mm	9 mm
Capacitance	290/960 /2900 pF	300 pF	570/ 1700 pF

Table1 Extension cables

All the extension cables with LEMO connectors (see Table 1) are fully EMC certified. The preamplifier can be used with traditional cables with Brüel & Kjær connectors, but EMC compatibility 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 several of them can be connected in series without loss of signal quality.

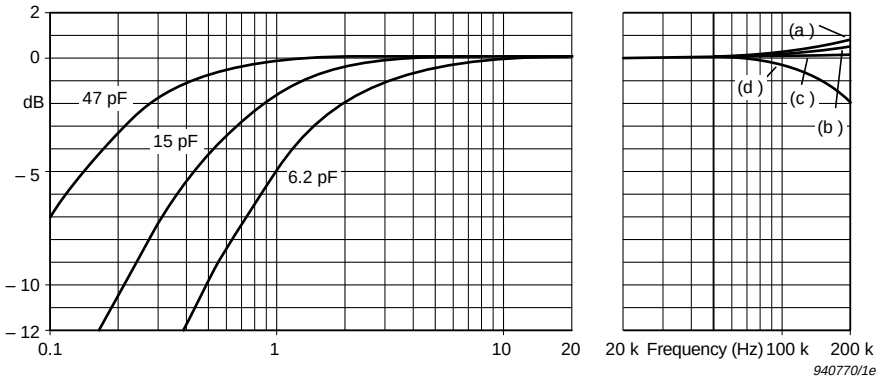


Fig.1 Small signal frequency response of the preamplifier at low frequencies for various microphone capacitances and at high frequencies for various capacitive loads which are (a) 10 nF (b) 3 nF (c) with the 3 m cable supplied (d) 30 nF

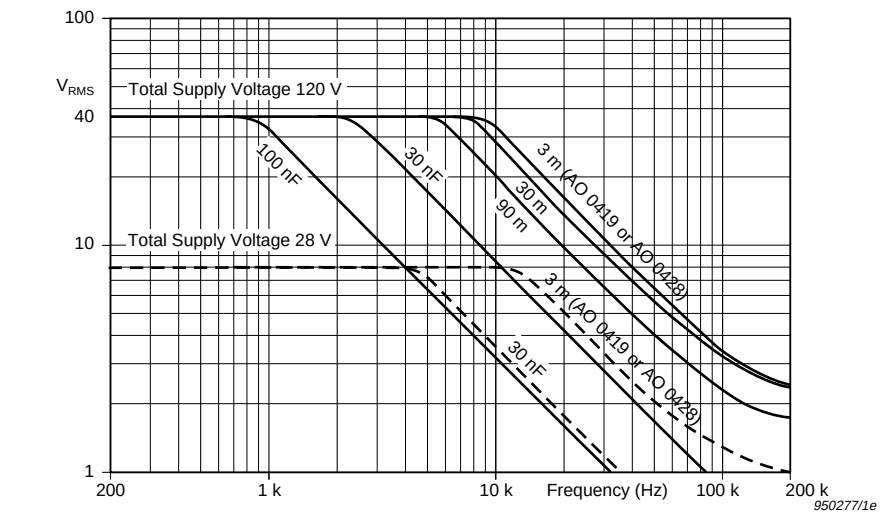


Fig.2 Upper distortion limit (3%) as a function of preamplifier output voltage and frequency for various capacitive loads. The full-drawn curves are valid for a preamplifier powered with 120 V DC (±60 V DC) and the dotted curves are for 28 V DC (±14 V DC)

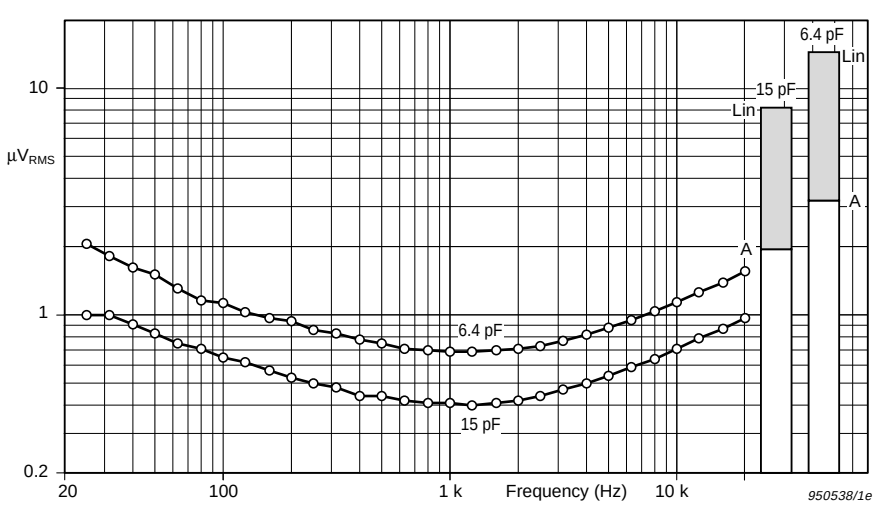
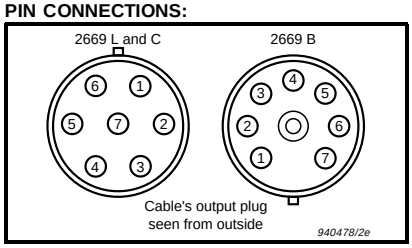


Fig.3 Typical noise frequency spectra in µV measured with 6.4 pF and 15 pF microphone capacities. The spectra are measured in 1/3-octave bands with levels at centre frequencies indicated by circles. The bar graphs represent broad-band (22.4 Hz to 300 kHz) and A-weighted noise levels for both microphone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

Specifications 2669

FREQUENCY RESPONSE (re 1 kHz):
3 Hz to 200 kHz, ±0.5 dB. See Fig. 1
ATTENUATION: 0.35 dB (max.)
PHASE LINEARITY:
≤±3° from 20 Hz to 100 kHz
PHASE MATCHING: 0.3° at 50 Hz
INPUT IMPEDANCE: 15 GΩ ‖ 0.45 pF
OUTPUT IMPEDANCE: 25 Ω (max.)
CONNECTOR TYPE:
LEMO type FGJ.OB.307 at preamp. (2669 L & B)
LEMO type FGG.1B.307 (2669 L), or Brüel & Kjær JP 0715 (2669 B) to measuring device
LEMO type FWG.1B.307 at preamp. (2669 C)

PIN CONNECTIONS:



Pin	LEMO (L & C)	Brüel & Kjær (B)
1	Calibration input	Ground
2	Signal ground	Pol. voltage
3	Pol. voltage	Calibration input
4	Signal output	Signal output
5	Not connected	Power supply positive
6	Power supply positive	Not connected
7	Power supply negative/ground	Not connected
Casing	Connected to instrument chassis	

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

MAX. OUTPUT VOLTAGE:
Maximum output voltage V_{p-p} is equal to total supply voltage minus 10 V
OUTPUT SLEW RATE: 2 V/µs
DISTORTION (THD):
Less than –80 dB at 25 V out, 1 kHz
NOISE:
≤8.2 µV Lin. 20 Hz – 300 kHz
≤10.0 µV Lin. 20 Hz – 300 kHz (max.)
≤1.9 µV A weighted
≤2.2 µV A weighted (max.)
POWER SUPPLY, DUAL: ±14 V to ±60 V
POWER SUPPLY, SINGLE: 28 V to 120 V
OUTPUT DC OFFSET:
≈1 V for a dual supply, or
≈1/2 the voltage of a single supply

CALIBRATION INPUT:
Charge insert capacity: 0.2 pF
Max. 10 V RMS, input impedance: 1 nF
DIMENSIONS:
Diameter: 12.7 mm (0.5″)
Length: 110 mm (4.3″), (2669 L and B)
120 mm (4.7″), (2669 C)
Weight: 40 g (1.41 oz) (preamplifier only)

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). The above are valid for 15 pF mic. capacitance and a 3 metre cable unless otherwise specified.

COMPLIANCE WITH STANDARDS:

CE	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive.
Safety	EN 61010–1 and IEC 1010–1: Safety requirements for electrical equipment for measurement, control and laboratory use.
EMC Immunity	EN 50082–1: Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082–2: Generic immunity standard. Part 2: Industrial environment. **Note:** The above is guaranteed only with extension cables AO 0414, AO 0415 and AO 0416.
Temperature	IEC 68–2–1 & IEC 68–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: –20 to +60°C (–4 to +140°F), (150°C (302°F) with increase in noise) Storage Temperature: –25 to +70°C (–13 to +158°F)
Humidity	IEC 68–2–3: 95% RH (non-condensing at 40°C (104°F))
Enclosure	IEC 529: IP 20
Mechanical	Non-operating: IEC 68–2–6: Vibration: 0.3 mm, 20 m/s^2, 10–500 Hz IEC 68–2–27: Shock: 1000 m/s^2 IEC 68–2–29: Bump: 4000 bumps at 400 m/s^2
Reliability	MI-HDBK 217F, GB (Part-Stress): MTBF >40000 hours (max. 2.5% errors/1000 h)

Charge Injection Calibration Technique patented according to US Patent No. 5,400,297. The patent includes the measurement method and its implementation.

Ordering Information

Type 2669 L 1/2″ Microphone Preamplifier (LEMO connector)
Includes the following accessories:
DP 0901: 1/2″ Cylindrical Adaptor
AO 0419: Microphone Cable 3 m (9.8 ft.)
or as a special order:
EL 4006-AC 0219-x: Microphone Cable length x m (specified by customer)

Type 2669 B 1/2″ Microphone Preamplifier (Brüel & Kjær connector)
Includes the following accessories:
DP 0901: 1/2″ Cylindrical Adaptor
AO 0428: Microphone Cable 3 m (9.8 ft.)
or as a special order:
EL 4005-AC 0219-x: Microphone Cable length x m (specified by customer)

Type 2669 C 1/2″ Microphone Preamplifier (no cable included)

Optional Accessories

ZG 0350: LEMO to 7-pin Brüel & Kjær adaptor
JJ 2617: Input Adaptor (51 pF). Is screwed directly onto a preamplifier for connection to microplug cables
UA 0196: Flexible Extension Rod
DB 0375: 1/2″ to 1″ Adaptor
UA 0035: 1/2″ to 1/4″ Adaptor
UA 0036: 1/2″ to 1/8″ Adaptor
UA 1317: 1/2″ Microphone Holder
BA 5105: Microphone Handbook
WB 0850: Insert Junction Adaptor for Type 2669 B/2669 L with Adaptor ZG 0350. For Charge-injection Calibration

Extension Cables
LEMO to LEMO:
AO 0414: 3 m (9.8 ft.)
AO 0415: 10 m (32.8 ft.)
AO 0416: 30 m (98.4 ft.)
EL 4004-AC 0079-x: Length x m (specified by customer)
AR 0014: Flat Cable, 0.5 m (1.64 ft)

Brüel & Kjær
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