

# PRODUCT DATA

## Falcon Range<sup>®</sup> 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 adaptor. 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.*

### 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

### Description

The housing of Falcon Range 1/4-inch Microphone Preamplifier Type 2670 is made completely out of stainless steel and is supplied with a 2 m 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

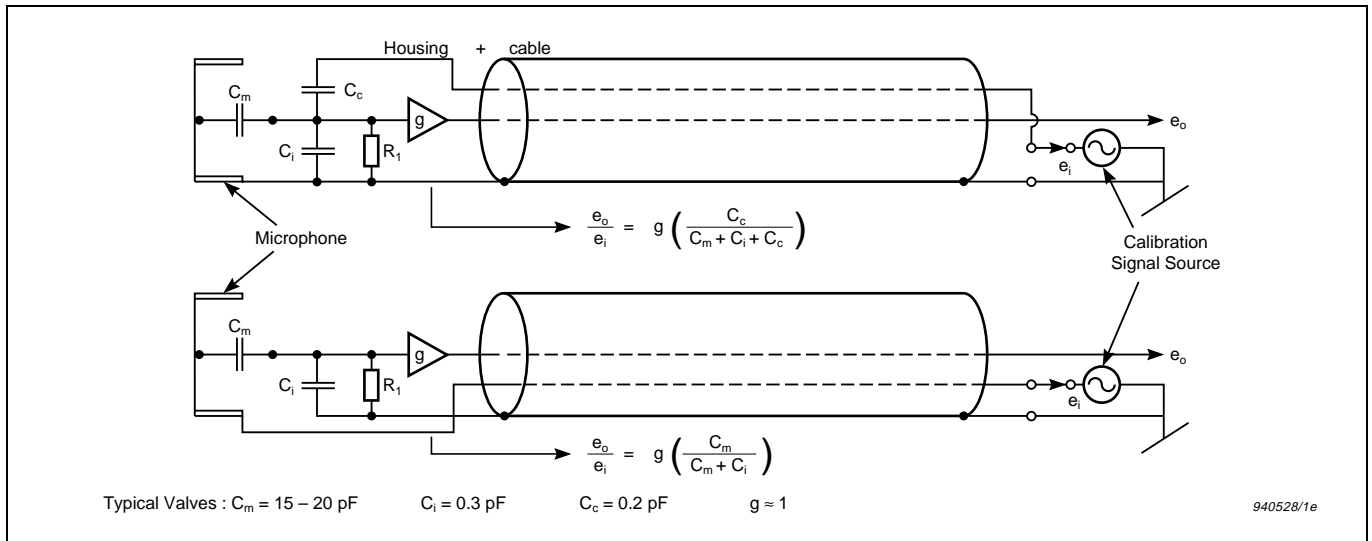
The charge injection calibration technique is a method for remotely verifying the condition of the entire measurement setup including the microphone. This is a great improvement over the traditional insert-voltage calibration method which virtually ignores the state of the microphone. The CIC technique 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 50000 GΩ) into the circuit of the preamplifier, see illustration below (upper diagram).  $C_i$  and  $R_i$  represent the preamplifier's high input impedance and  $A$  its gain ( $\approx 1$ ).

For a given calibration signal  $V_i$ , the output  $V_o$  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.



## TEDS

The microphone preamplifier support TEDS (Transducer Electronic Data Sheet) and can be used with the Smart Transducer interface according to IEEE P1451.4. 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 (1/2-inch Sound Intensity Microphone Pairs can also be fitted directly) and 1/8-inch microphones using Adaptor UA 0160.

The preamplifier has a fixed cable with a LEMO connector which fits directly into the standard preamplifier input socket on newer Brüel & Kjær instruments. Adaptor ZG 0350 is available for use with the traditional 7-pin Brüel & Kjær preamplifier sockets. The cable is only 4 mm thick and is made of silicone. The result is a very flexible cable with a working temperature range from  $-60^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  ( $-76^{\circ}\text{F}$  to  $302^{\circ}\text{F}$ ).

### Power Supply

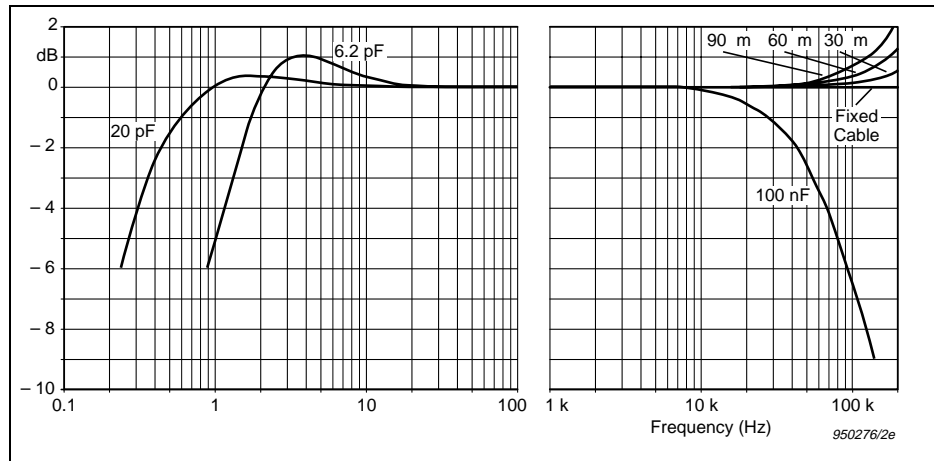
You can use a dual (plus/minus) or single power supply for the preamplifier. When using a balanced power supply, the offset voltage at the output – and at the preamplifier guard ring – will be almost zero. This protects you against electric shocks when you mount or remove the microphone, and gives a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

## Characteristics

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

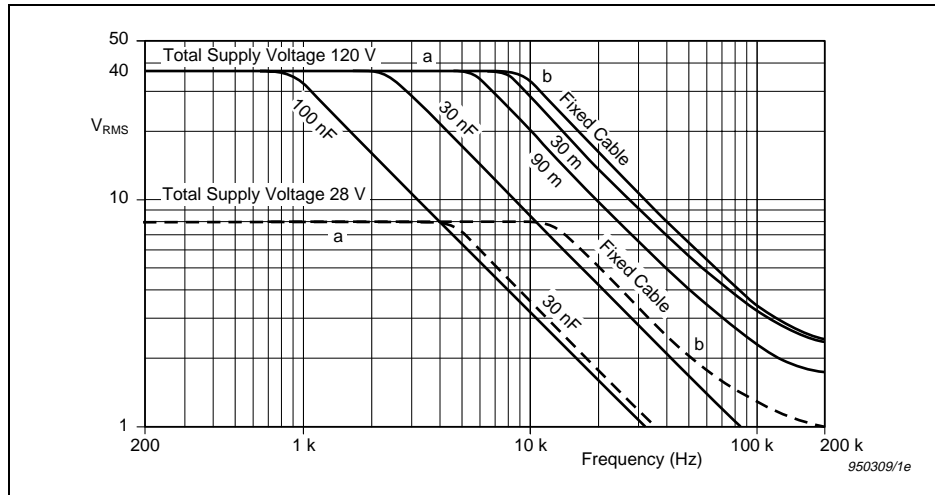
**Fig. 1**  
Small signal frequency response of the preamplifier at low frequencies for 6.2 pF and 20 pF microphone capacitances and at high frequencies for cable lengths of 2 m (fixed cable), 30 m, 60 m and 90 m, corresponding to capacitive loads of 200 pF, 2.9 nF, 5.8 nF and 8.6 nF respectively with cable AO 0416. 100 nF corresponds to approx. 1000 m cable



The curves in Fig. 1 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 Adaptor 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. 1 apply for signal levels within the large signal limits shown in Fig. 2.

**Fig. 2**

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



### 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, 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 ( $\pm 60$  VDC and  $\pm 14$  VDC dual supply voltages respectively). Fig. 3 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. 3**

Typical phase response curves measured with equivalent microphone capacitances of 6.2 pF and 20 pF. The typical phase deviation at 50 Hz is  $0.3^\circ$  with 6.2 pF loading and  $0.1^\circ$  with 20 pF loading

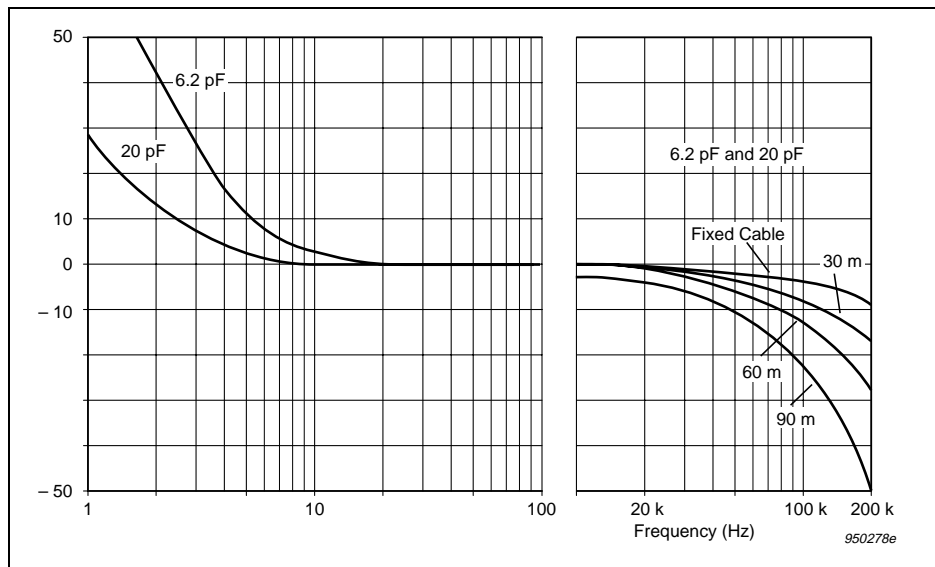
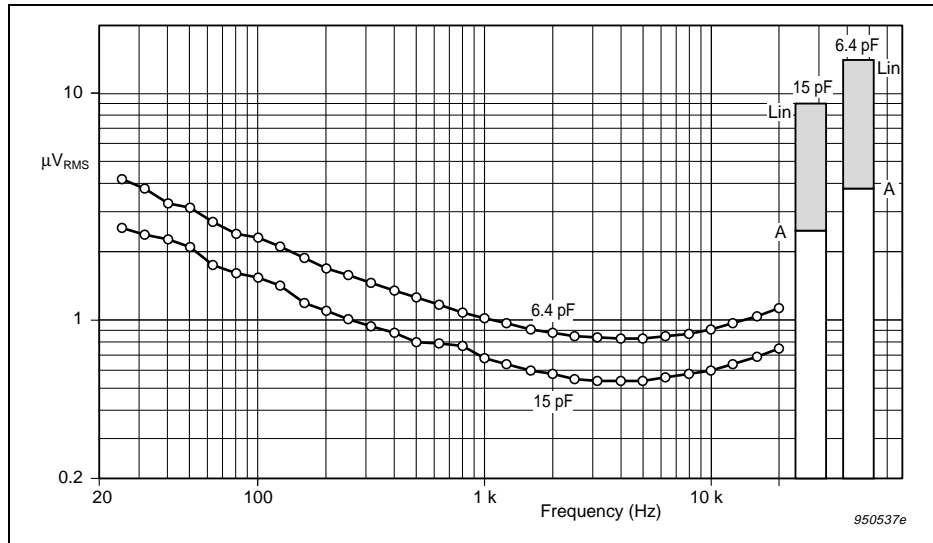


Fig. 4 shows typical noise frequency spectra when loading the preamplifier with 6.4 pF and 15 pF microphone capacitances. The low noise of the preamplifier ensures that the noise floor for a microphone/preamplifier assembly is determined mainly by the associated microphone over most of the frequency range. See Microphone Handbook BA 5105 for more information on preamplifiers and other Falcon Range products.

**Fig. 4**  
 Typical noise frequency spectra in mV 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 (see Table 1) are fully EMC certified. These cables are made of polyurethane and are flexible at low temperatures. The preamplifier can be used with traditional cables with Brüel & Kjær connectors (with Adaptor ZG 0350), but EMC compatibility is not guaranteed. The cables in Table 1 have a working temperature range from  $-20$  to  $+80^{\circ}\text{C}$ . 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.

**Table 1**  
 Extension cables

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

## Compliance with Standards

 	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
<b>Safety</b>	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
<b>EMC Immunity</b>	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. <b>Note:</b> The above is only guaranteed using accessories listed in this Product Data sheet.
<b>Temperature</b>	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: $-20$ to $+60^{\circ}\text{C}$ ( $-4$ to $+140^{\circ}\text{F}$ ), $120^{\circ}\text{C}$ ( $248^{\circ}\text{F}$ ) with increase in noise. Storage Temperature: $-25$ to $+70^{\circ}\text{C}$ ( $-13$ to $+158^{\circ}\text{F}$ )
<b>Humidity</b>	IEC 60068-2-78: Damp Heat: 95% RH (non-condensing at $40^{\circ}\text{C}$ ( $104^{\circ}\text{F}$ ))
<b>Mechanical</b>	Non-operating: IEC 60068-2-6: Vibration: $0.3\text{ mm}$ , $20\text{ m/s}^2$ , $10\text{--}500\text{ Hz}$ IEC 60068-2-27: Shock: $1000\text{ m/s}^2$ IEC 60068-2-29: Bump: 4000 bumps at $400\text{ m/s}^2$
<b>Enclosure</b>	IEC 60529: Protection provided by enclosures: IP 20
<b>Reliability</b>	MI-HDBK 217F, GB (part-Stress): MTBF $>40000$ hours (max. 2.5% errors/1000h)

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

### FREQUENCY RESPONSE (re 1 kHz)

15 Hz to 200 kHz,  $\pm 0.5$  dB. See Fig. 1

### ATTENUATION

0.4 dB (max.)

### PHASE LINEARITY

$\leq \pm 1^\circ$  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/ $\mu$ s

### INPUT IMPEDANCE

15 G $\Omega$  || 0.25 pF (typical)

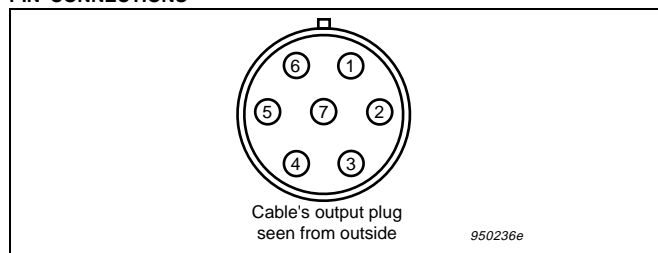
### OUTPUT IMPEDANCE

50  $\Omega$  (max.)

### CONNECTOR TYPE

LEMO type FGG.1B.307

### PIN CONNECTIONS



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

### 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  $\mu$ V Lin. 20 Hz – 300 kHz (typical)

30.0  $\mu$ V Lin. 20 Hz – 300 kHz (max.)

4.0  $\mu$ V A-weighted (typical)

7.0  $\mu$ V A-weighted (max.)

### POWER SUPPLY, DUAL

$\pm 14$  V to  $\pm 60$  V

### POWER SUPPLY, SINGLE

28 V to 120 V

### OUTPUT DC OFFSET

$\approx 1$  V for a dual supply, or

$\approx 1/2$  the voltage of a single supply

### CURRENT CONSUMPTION

3 mA plus output current

### CALIBRATION INPUT

Charge insert capacity, typically 0.2 pF

Max. 10 V RMS, input capacitance: 1 nF

### DIMENSIONS

**Diameter:** 6.35 mm (0.25")

**Length:** 89.5 mm (3.5")

### MAX. CABLE RELEASE

5 kg

**Note:** The above are valid for the fixed 2 metre cable and 6.2 pF microphone capacitance unless otherwise specified.

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

## Ordering Information

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

### Optional Accessories

<b>ZG 0350</b>	LEMO to 7-pin Brüel & Kjær adaptor
<b>UA 0160</b>	Adaptor (1/4- to 1/8-inch)
<b>BA 5105</b>	Microphone Handbook
<b>WB 0850</b>	Insert Junction Adaptor for Charge-injection Calibration

### Extension Cables

#### LEMO to LEMO:

<b>AO 0414</b>	3 m (9.8 ft.)
<b>AO 0415</b>	10 m (32.8 ft.)
<b>AO 0416</b>	30 m (98.4 ft.)
<b>EL 4004/xx</b>	Length xx m (specified by customer)
<b>AR 0014</b>	Flat Cable

### TRADEMARKS

LEMO is a trademark of Interlemon Holding SA

Brüel & Kjær reserves the right to change specifications and accessories without notice.

HEADQUARTERS: DK-2850 Nærum · Denmark · Telephone: +45 4580 0500  
Fax: +45 4580 1405 · bksv.com · e-mail: info@bksv.com

Australia (+61) 2 9889-8888 · Austria (+43) 1 865 74 00 · Brazil (+55) 11 5188-8166  
Canada (+1) 514 695-8225 · China (+86) 10 680 29906 · Czech Republic (+420) 2 6702 1100  
Finland (+358) 9-755 950 · France (+33) 1 69 90 71 00 · Germany (+49) 421 17 870  
Hong Kong (+852) 2548 7486 · Hungary (+36) 1 215 83 05 · Ireland (+353) 1 803 7600  
Italy (+39) 0257 68061 · Japan (+81) 3 3779 8671 · Republic of Korea (+82) 2 3473 0605  
Netherlands (+31) 318 55 9290 · Norway (+47) 66 77 11 55 · Poland (+48) 22 816 75 56  
Portugal (+351) 21 47 11 453 · Singapore (+65) 377 4512 · Slovak Republic (+421) 25 443 0701  
Spain (+34) 91 659 0820 · Sweden (+46) 8 449 8600 · Switzerland (+41) 1 880 7035  
Taiwan (+886) 22 713 9303 · United Kingdom (+44) 14 38 739 000 · USA (+1) 800 332 2040

Local representatives and service organisations worldwide

**Brüel & Kjær**