# Product Data

**Falcon™ Range 1/2″ Microphone Preamplifier — Type 2673**

**USES:**
- Insert voltage calibration of condenser microphones for open-circuit voltage determination
- Calibration of condenser microphones with respect to reciprocity calibration methods
- General sound measurements in connection with Brüel & Kjaer condenser microphones

**FEATURES:**
- Full electromagnetic compatibility (EMC)
- Detachable cable for easy installation
- Compact LEMO connector for connection to instrument input socket (adaptor for Brüel & Kjaer connectors provided)
- Wide dynamic range
- Very low attenuation

---

**Description**

This 1/2″ Falcon™ Range microphone preamplifier is designed especially to allow calibration of 1/2″ and 1″ condenser microphones by the insert-voltage technique, either in conjunction with the reciprocity method or with a known sound source. These methods are described in IEC Norm 1094–1 and ANSI S 1.10 - 1966 (R 1976). Type 2673 fulfils the requirements of these standards and allows insert voltage calibration to be made. To comply with these standards, the preamplifier is delivered with a Driven Guard configuration. The configuration can be changed to Grounded Guard at Brüel & Kjaer service centres. The difference in preamplifier attenuation in these two configurations satisfies the requirements in the standards mentioned above.

Type 2673 consists of a high impedance input stage and an output stage giving a low output impedance for driving long cables and the Driven Guard surrounding the input stage. The thread which accepts the microphone cartridge is isolated from the preamplifier housing to allow an insert-voltage signal to be applied in series with the microphone for determination of the microphone's open-circuit sensitivity.

**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). However, the immunity to external RF fields is limited because of the wiring principle required for the insert voltage calibration facility. If RF immunity is a critical parameter, we recommend Falcon™ Range 1/2″ Microphone Preamplifier Type 2669 for best immunity performance.

**Microphones and Sockets**

The preamplifier can be fitted with 1/2″ microphones directly and 1″, 1/4″ and 1/8″ microphones using adaptors.
For insert voltage calibration of 1" microphones the adaptor (UA0786) provided with the preamplifier must be used. This adaptor fulfils the requirements of microphone calibration standard IEC 1094–1.

The preamplifier is delivered with a 3 m detachable cable (AO0419) which fits the new LEMO standard preamplifier input socket. Adaptor UA1405 is provided for converting the preamplifier to traditional 7-pin Brüel & Kjær sockets.

For insert voltage calibration, the preamplifier may be connected directly to the preamplifier input socket of Frequency Analyzers Types 2010 or 2120 and Measuring Amplifiers Types 2606 and 2607, which also supply the insert voltage. This may originate either from the 1 kHz reference oscillator built into these instruments or from an external signal source such as Sine Generators Types 1049/1051, allowing calibration at other frequencies and signal levels.

For other Brüel & Kjær instruments other frequencies and signal levels. For other Brüel & Kjær instruments such as Measuring Amplifiers Types 2610 and 2636, which do not provide direct insert voltage calibration, the cable included with UA1405 can be used, or adaptor WB0850 (not included) and an external oscillator.

Type 2673 is also used together with Reciprocity Calibration Apparatus Type 4143 which is designed for the reciprocity calibration of condenser microphones in accordance with IEC 1094, insert-voltage calibration, comparison calibration, and the measurement of the frequency response of condenser microphones using the electrostatic-actuator technique.

**Note:** When used in association with an electric actuator, it is recommended that you connect an external ground wire between the Preamplifier body and the actuator supply, to avoid interference from the actuator current. A clip (DM0270) is provided for this purpose.

**Accessories**

Use adaptor UA0035 for connecting 1/2" microphones, adaptor UA0036 for connecting 1/4" microphones the supplied adaptor UA0786 for 1" microphones. It is possible to use Adaptor DB0375 for 1" microphones, but the geometry of the guard used in this adaptor does not comply with the microphone calibration standards.

The principle of open-circuit sensitivity, determination using the insert voltage technique is shown below. A well-defined sound pressure level of known frequency is first applied to the microphone. This causes the microphone to generate an internal voltage \( V_e \) (the open-circuit output voltage of the microphone) which, when loaded by the preamplifier, produces an output voltage \( V \) at the preamplifier output. The sound source is then switched off and a calibration voltage \( V_f \) (the insert voltage) of the same frequency is applied in series with the microphone. The level of the insert voltage is then adjusted until the output voltage of the preamplifier is the same as that when the reference sound source was applied (\( V \)). The open-circuit sensitivity of the microphone cartridge is then given by the magnitude of the insert voltage divided by the reference sound pressure.

1/2" Microphone Preamplifier Type 2673 has been especially designed for performing open-circuit sensitivity calibration of condenser microphones using the insert voltage technique. This technique is described in IEC 1094–1 (1992), 486 (1974) and ANSI S 1.10–1966 (R 1976).

**The Insert Voltage Calibration Technique**

The Insert voltage technique is primarily used in calibration laboratories for determining the open-circuit sensitivity of a condenser microphone. The open-circuit sensitivity is defined as the voltage appearing at the output terminals when the microphone is working into an infinitely large electrical impedance.

The insert voltage technique may also be used to provide a convenient field-check of the electrical sensitivity of a complete sound measurement system including preamplifier and cables. However, in this case the method does not account for the mechanical parameters which determine the acoustic properties of the microphone cartridge itself.

The principle of open-circuit sensitivity determination using the insert voltage technique is shown below. A well-defined sound pressure level of known frequency is first applied to the microphone. This causes the microphone to generate an internal voltage \( V_e \) (the open-circuit output voltage of the microphone) which, when loaded by the preamplifier, produces an output voltage \( V \) at the preamplifier output. The sound source is then switched off and a calibration voltage \( V_f \) (the insert voltage) of the same frequency is applied in series with the microphone. The level of the insert voltage is then adjusted until the output voltage of the preamplifier is the same as that when the reference sound source was applied (\( V \)). The open-circuit sensitivity of the microphone cartridge is then given by the magnitude of the insert voltage divided by the reference sound pressure.

**Accessories**

Use adaptor UA0035 for connecting 1/2" microphones, adaptor UA0036 for connecting 1/4" microphones the supplied adaptor UA0786 for 1" microphones. It is possible to use Adaptor DB0375 for 1" microphones, but the geometry of the guard used in this adaptor does not comply with the microphone calibration standards.

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 preamplifier for 50 pF and 20 pF microphone capacitances. Note that they do not show or take into account the lower cut-off frequencies of the microphones. The effects of various capac-
itive 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 current output 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 20 pF and 50 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 is given in the Microphone Handbook BA5105.

**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 Bruel & Kjaer 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.

**Table 1 Extension cables**

<table>
<thead>
<tr>
<th>Extension Cable</th>
<th>AO0414/15 (\text{/})6</th>
<th>AO0027</th>
<th>AO0028/29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors</td>
<td>LEMO</td>
<td>Bruel &amp; Kjaer</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>3/10/30 m</td>
<td>3 m</td>
<td>10/30 m</td>
</tr>
<tr>
<td>Diameter</td>
<td>4 mm</td>
<td>6 mm</td>
<td>9 mm</td>
</tr>
<tr>
<td>Capacitance</td>
<td>390/960 pF</td>
<td>300 pF</td>
<td>570/1700 pF</td>
</tr>
</tbody>
</table>

Fig. 1 Small signal frequency response of the preamplifier at low frequencies for 50 pF and 20 pF 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 \(\mu\)V measured with 20 pF and 50 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 2673

FREQUENCY RESPONSE (re 1 kHz):
30 Hz to 20,000 Hz, ±0.5 dB. See Fig. 1
ATTENUATION: ±0.5 dB (max.)

PHASE LINEARITY:
±2° from 250 Hz to 50 kHz

INPUT IMPEDANCE: 1 GΩ || 0.05 pF

OUTPUT IMPEDANCE: 25 Ω

CONNECTOR TYPE:
LEMO type FGJ.OB.307 at preamplifier
LEMO type FGJ.1B.307 for instrument input

PIN CONNECTIONS:

Noise:
11.0 µV Lin. 20 Hz – 3000 Hz
20.0 µV Lin. 20 Hz – 30000 Hz (max.)
1.875 µV A weighted
2.75 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 V supply voltage minus 10 V

CURRENT CONSUMPTION:
3 mA plus output current

CALIBRATION INSERT VOLTAGE:
Max. 10 V RMS, input impedance: 1 nF

* See EMC Note 2

Cable's output plug seen from outside

COMPLIANCE WITH STANDARDS:


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.
Note 1: The above is guaranteed only with extension cables AO 0414, AO 0415 and AO 0416.
Note 2: Susceptibility to radiated RF (response measured on output when exposed to levels specified in EN 50082–2): <200 mV.

Temperature

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: Protection Provided by Enclosure: IP 20

Mechanical
IEC 68–2–6: Vibration: 0.3 mm, 20 m/s², 10–500 Hz
IEC 68–2–27: Shock: 1000 m/s²
IEC 68–2–29: Bump: 4000 bumps at 400 m/s²

Reliability
Mi-HDBK 217F, GB (Part-Stress): MTBF >4000 hours
(max. 2.5% errors/1000 h)

Dimensions and Weight:
Diameter: 12.7 mm (0.51")
Length: 110 mm (4.3")
Weight: 40 g (1.41 oz) (without cable)

Note: All values are typical at 25 °C (77 °F), unless measurement uncertainty or tolerance field is specified. All uncertainty values are specified at 2σ (i.e. expanded uncertainty using a coverage factor of 2).

The values are measured with the preamplifier in Driven Guard mode, and are valid for 20 pF mic. capacitance and a 3 metre cable unless otherwise specified.

Specifications 2673

Ordering Information

Type 2673 Includes the following accessories:

UA 0786: 1/2" Microphone Preamplifier
UA 1405: CIC Adaptor LEMO to 7-pin Briel & Kjær (insert voltage)
DM 0270: Clip for Actuator Measurement
DP 0901: 1/2" Cylindrical Adaptor

Optional Accessories

JJ 2617: Input Adaptor (51 pF), is screwed directly onto a preamplifier for connection to 10–32 UNF cables
AO 0038: 10–32 UNF cable
JP 0145: 10–32 UNF to BNC Plug Adaptor
UA 0196: Flexible Extension Rod
UA 0036: 1/2" to 1/4" Adaptor
UA 1317: 1/2" Microphone Holder

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

Brüel & Kjaer

WORLD HEADQUARTERS:
DK-2850 Naerum · Denmark · Telephone: +45 45 80 05 00 · Fax: +45 45 80 14 05 · Internet: http://www.bk.dk · e-mail: info@bk.dk

Australia (02) 9450-2066 · Austria 00 43-1-865 74 00 · Belgium 016/44 92 25 · Brazil (011) 246-8166 · Canada: (514) 695-8225 · China 10 6841 9625 / 10 6843 7426 · Czech Republic 20 67 01100 · Denmark 9-02-20 301 · France 01 69 99 94 14 · Germany 0 2631 7000 · Hong Kong 4 7486 · Hungary 1 215 83 05 · Italy (02) 57 65 4114 · Japan 03-3779-8671 · Republic of Korea (02) 3473-9605 · Norway 66 90 4410 · Poland (02) 220 93 82 · Portugal (1) 47114 53 · Slovenia (63) 275-8816 · Slovak Republic 07 37 0816 · Spain (91) 36810 00 · Sweden (08) 71127 30 · Switzerland 01/94 6 09 09 · Taiwan (02) 713 9303 · United Kingdom and Ireland (0181) 954-236 6 · USA 1 – 800 – 332 – 2040 ·

Local representatives and service organisations worldwide

BP 1645 – 12