

Product Data

Weatherproof Microphone Unit — Type 4184

USES:

- Can be used in:
 - Permanent noise-monitoring systems
 - Semi-permanent noise-monitoring systems
 - Portable noise-monitoring systems
- Noise measurements in most humid and corrosive atmospheres

FEATURES:

- Excellent omni-directional characteristics lead to:
 - High accuracy with fixed orientation
 - Less dependency on the operator's expertise
- Complies with both IEC 651 Type 1 and ANSI S 1.4-1983 Type 1
- Fulfils EMC Specifications
- System noise level typically 25 dB(A)
- Lower limiting frequency of 4 Hz (–3 dB)
- Individually calibrated from 20 Hz to 20 kHz
- Charge Injection Calibration facility
- Built-in Test Sound Source (at 1 kHz)
- Low electrical output impedance
- Can be used with most Brüel & Kjær measuring amplifiers and frequency analyzers
- Rain protected according to IEC 529 IP44

The Weatherproof Microphone Unit Type 4184 is for use in permanent, semi-permanent or portable noise-monitoring systems. The unit can be used in most humid and corrosive atmospheres as the casing is made completely of stainless steel and it has a built-in protection system against humidity. Type 4184 complies with standards IEC 651 Type 1 and ANSI S 1.4-1983 Type 1.

The greatest attribute of Type 4184 is its excellent omni-directional characteristics. It is fully rotational about its vertical axis without any undesirable

reflections from its casing affecting the noise measurements being undertaken.

Type 4184 is based on a probe tube system which has allowed the microphone cartridge to be installed within the casing of the unit itself. This ensures that the microphone is afforded rain protection according to Standard IEC 529 IP44.

Each Type 4184 is individually calibrated and is delivered with a calibration chart giving the frequency responses.

Description

The Weatherproof Microphone Unit Type 4184 (see Fig. 1) consists of three main sections. The upper section comprises the windscreen with windscreen holder, the probe tip and the probe tube.

The middle section contains the microphone, the preamplifier, the impedance matching tubes, the circuit board comprising a filter and cable driver, the built-in test sound source and its transmission tube. The impedance matching tube system comprises four tubes of specific lengths. The test sound source consists of two miniature loudspeakers and a transmission tube which feeds the signal

to a point below the mouth of the probe tube.

The lower section contains the dehumidifier system and a Brüel & Kjær 7-pin microphone plug.

Type 4184 can be fixed to either a pole for use in permanent outdoor noise-monitoring systems or to a tripod for use in semi-permanent or portable noise-monitoring systems. An adapter for pole-mounting of Type 4184 is included as an accessory.

When Type 4184 is used in a permanent set-up, there is nobody to optimize the orientation of the unit for maximum accuracy. Therefore, the variation of sensitivity for different orientations must be small, as proved by the fulfillment of both IEC and ANSI standards.



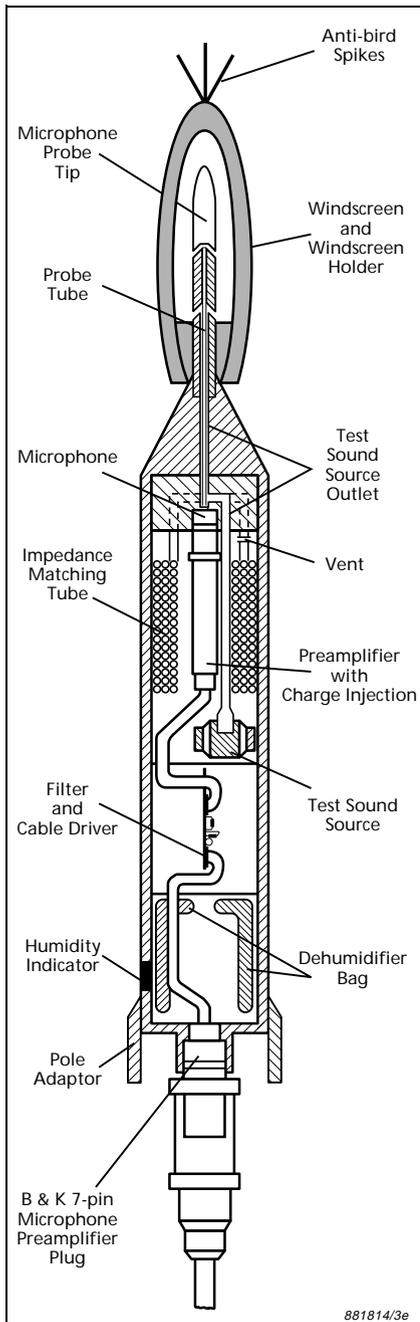


Fig.1 Schematic representation of the Weatherproof Microphone Unit Type 4184

Windscreen

The windscreen (see Fig. 2) comprises two parts. One is the windscreen holder and the other is the windscreen itself. The windscreen is made of specially prepared polyurethane foam. The windscreen holder comprises three steel rods to hold the screen in position and these protrude above the top as spikes to prevent birds from perching.

It is essential that the Weatherproof Microphone Unit Type 4184 is used with the windscreen and windscreen holder to ensure that correct results are obtained.

Probe Tip

The probe tip (see Fig. 2) provides excellent omni-directional characteristics when making noise measurements. It also helps to protect the probe from rain.

Probe Tube System

Type 4184 is based on a probe tube system. The probe tube is housed inside the test sound source transmission tube onto which the probe tip is screwed. A removable protection tube and protection cap ensure that damage to the probe tip does not occur during transportation. When calibration of the system as a whole is required, the protection tube doubles as a sound calibrator adaptor for use with Pistonphone Type 4228.

Microphone

Type 4184 uses a measurement microphone cartridge similar to Type 4134. The construction of this microphone type minimizes variations in sensitivity with temperature changes.

Preamplifier

The preamplifier consists of an input stage and an output stage giving a low output impedance. It has Charge Injection Calibration (CIC) which allows monitoring of the complete measuring system.

Casing

The casing of Type 4184 is made of stainless steel to ensure protection from corrosion. The streamline design of the casing minimizes any reflections which can occur during measurements and as a result interfere with the sound field around the unit. The casing can be fitted to a tripod or fixed to a pole using respectively the tripod adaptor tube or the pole adaptor. The pole adaptor is included as an accessory. The microphone cable is fed down the inside of the pole itself when Type 4184 is pole-mounted.

Dehumidifier

Two small bags of silica gel are stored in the lower section of Type 4184 unit for dehumidifying purposes. There is a small window on the side of the unit casing containing indicator paper to enable any change in moisture content to be monitored. The paper is set to change colour at 50% relative humidity. The window is protected by a stainless steel cover. The silica gel contained in the two bags is normally sufficient for two years protection but after this time the bags should be



Fig.2 Windscreen UA 1070 with Windscreen Holder UA 1071 and Probe Tip

replaced with either new or redried bags to ensure continued protection.

EMC

Type 4184 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 microphone unit must be connected to an instrument that also complies with EMC requirements.

Calibration and Verification

Individual Factory Calibration

Each Weatherproof Microphone Unit Type 4184 is individually calibrated and supplied with a calibration chart (see Fig. 3) showing the frequency responses.

Pistonphone Calibration

For accurate calibration of the complete system including the microphone, either in the laboratory or in the field, the Pistonphone Type 4228 can be used. This calibrator is battery operated and is easy to use. It produces a nominal sound pressure level of 124 dB (± 0.2 dB) at 250 Hz and 1013 mbar. The calibrator fits directly onto the protection tube.

Charge Injection Calibration

CIC is a patented technique which is a very reliable way of remote monitoring the function of the entire measurement set-up including the microphone, preamplifier and connecting cable. The actual attenuation

of the return signal relative to the calibration signal is indicated on the calibration chart.

Built-in Test Sound Source

The test sound source comprises two miniature loudspeakers. The signal from the test sound source is fed to the probe tube via the transmission tube. The transmission tube is vented for static-pressure equalization purposes.

The built-in test sound source produces a way of monitoring the probe tube system and hence gives an indication of whether the system is in need of service.

Capacitive Loading

Frequency Response

The capacitive load of extension cables on the output of the Weatherproof Microphone Unit Type 4184 influences the frequency response and the upper distortion limit. The influence on the upper distortion limit is dealt with in the following section. The curve given in Fig. 4 shows the influence on the high frequency cutoff at different load capacitances corresponding to the extension cables.

Due to their capacitive load, a high current is required to drive long cables at high frequencies and high sound pressure levels. The signal will be distorted at the upper current limit for Type 4184. Fig. 5 shows, for a typical unit, the sound pressure level

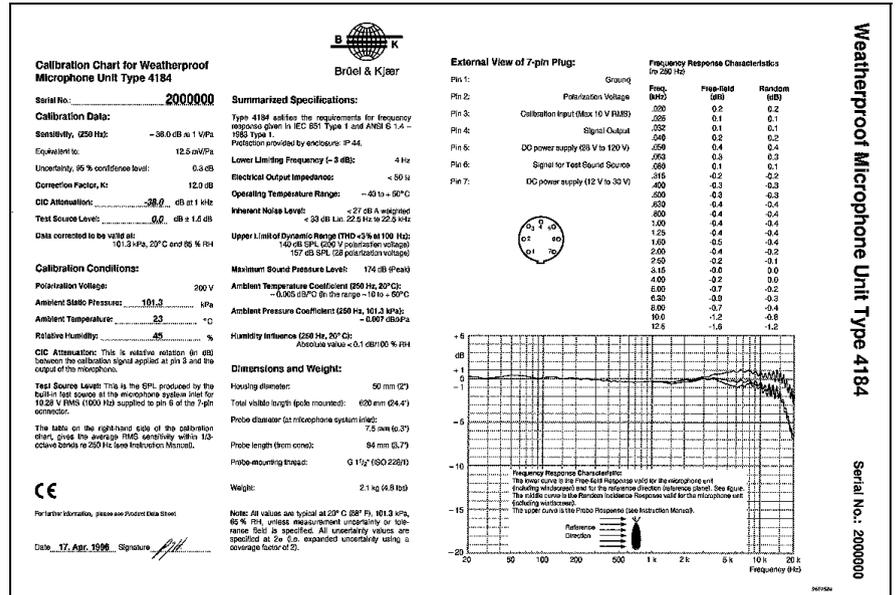


Fig. 3 Calibration chart showing typical free-field, random-incidence and probe frequency response characteristics

as a function of frequency at which 3% distortion occurs for various lengths of cables.

Examples of Use

A good example of a use of the Weatherproof Microphone Type 4184 is in the Noise-monitoring Terminal Type 3543.

When Type 4184 is used as part of a portable noise-monitoring system, the measurement accuracy is less dependant on the operators expertise. This is due to the excellent omni-directional characteristics of the unit.

Extension Cable	AO 0027	AO 0028	AO 0029
Length	3 m (10 ft.)	10 m (33 ft.)	30 m (100 ft.)
Diameter	6 mm (1/4")	9 mm (3/8")	9 mm (3/8")
Capacitance to ground of the signal conductor	300 pF (100 pF/m)	570 pF (57 pF/m)	1700 pF (57 pF/m)

Table 1 Extension Cables AO 0027, AO 0028 and AO 0029

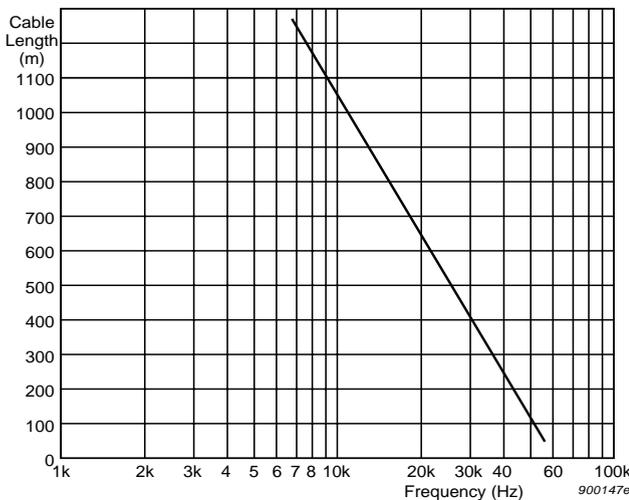


Fig. 4 Upper frequency limit (-1 dB) as a function of load (extension cable length)

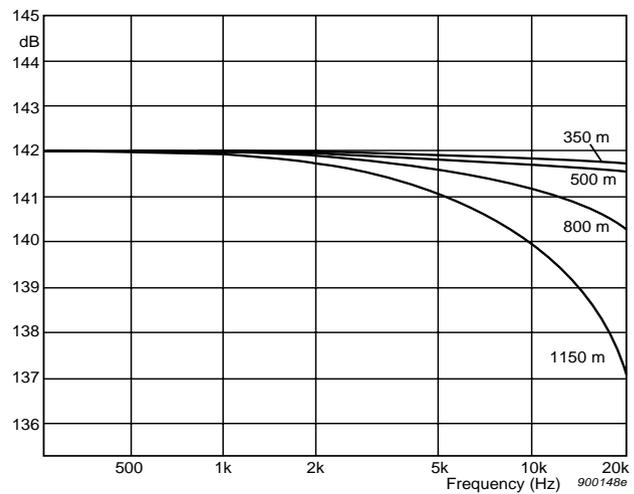


Fig. 5 Upper limit of dynamic range (3% distortion) due to various cable loads at the output terminals as a function of frequency

Specifications 4184*

PRESSURE RESPONSE:

In accordance with IEC 651 Type 1 (ref. direction 90° to probe axis) and ANSIS 1.4-1983 Type 1
 250 Hz ±0 dB (ref.)
 20 Hz to 5 kHz ±1 dB
 20 Hz to 8 kHz +1 dB, -2 dB
 4 Hz to 10 kHz +1 dB, -3 dB
 4 Hz to 12.5 kHz +1 dB, -4 dB
 4 Hz to 16 kHz +1 dB, -5 dB

SENSITIVITY (250 Hz, 200 V Pol. V.):

12.5 mV/Pa nom. or -38 dB ±0.3 dB

DYNAMIC RANGE:

Upper Limit (THD <3% at 100 Hz):
 140 dB SPL (200 V Pol. V.)
 157 dB SPL (28 V Pol. V.)

SAFETY LIMIT: 174 dB

SYSTEM NOISE LEVEL:

<27 dB (A)
 <33 dB (Lin. 22.5 Hz to 22.5 kHz)

ACOUSTICAL PROBE TUBE IMPEDANCE:

$5 \times 10^6 \text{ N s/m}^5$

ELECTRICAL OUTPUT IMPEDANCE:

From preamplifier: <50 Ω

OUTPUT CURRENT: >1.5 mA

CHARGE INJECTION CALIBRATION†:

Max. 10 V (RMS)

TEST SOURCE (1 kHz):

SPL (20°C (68°F)): 92 dB ±4 dB
 SPL (20°C (68°F)) is given individually
 (±1.5 dB)
 SPL (-10 to +50°C (14 to 122°F)): SPL (20°C
 (68°F)) ±3 dB
 Typical SPL curve is given for the range -40°C
 to 50°C (-40 to 122°F), (see manual)

Environmental

HUMIDITY RANGE: <100% RH. Maximum
 humidity as at 40°C (104°F) and 90% RH

**HUMIDITY INFLUENCE (at 250 Hz, 20°C
 (68°F)):** <0.1 dB

**TEMPERATURE RANGE FOR ±0.5 dB
 (250 Hz):**

-10 to +50°C re 20°C (14°F to 122°F re 68°F)

**AMBIENT TEMPERATURE COEFFICIENT
 (250 Hz):**

-0.005 dB/°C (in the range -10°C to +50°C)
 (14°F to 122°F)

**AMBIENT PRESSURE COEFFICIENT (250 Hz,
 101.3 kPa):** -0.006 dB/kPa

VIBRATION SENSITIVITY (<60 Hz):

Max. 74 dB SPL for 1 ms⁻² or 0.1 Pa/ms⁻²

MAGNETIC SENSITIVITY:

Typically 34 dB SPL, max. 40 dB SPL at 50 Hz
 and 80 A/m (worst direction)

DEHUMIDIFIER: Contains silica gel which is
 replaceable. There is a visible indication of the
 condition of the silica gel.

Dimensions and Weight

PROBE DIAMETER (at microphone slit):

7.5 mm (0.3")

PROBE LENGTH (from cone):

94.0 mm (3.7")

HOUSING DIAMETER:

50.0 mm (2")

TOTAL VISIBLE LENGTH (pole mounted):

622.0 mm (24.8")

WEIGHT (excluding tripod mounting adap- tor):

2.1 kg (4.6 lbs)

TRIPOD-MOUNTING THREAD:

$\frac{3}{8}$ " 16 UNC or $\frac{1}{4}$ " 16 UNC (modified DIN 4503)

POLE ADAPTOR THREAD:

G 1 1/2" (ISO 228/1)

Note: All values are typical at 20°C (68°F), un-
 less measurement uncertainty or tolerance field
 is specified. All uncertainty values are specified
 at 2σ (i.e. expanded uncertainty using a cover-
 age factor of 2)

* Patented. The probe tube system of Type 4184
 is patented in several countries. US Patent No.
 5,136,655

† Patented. The Charge Injection Calibration
 technique is patented according to US Patent
 No. 5,400,297

COMPLIANCE WITH STANDARDS:

CE	CE-mark indicates compliance with: EMC Directive.
Safety	EN 61010-1 and IEC 1010-1: Safety requirements for electrical equipment for measurement, control and laboratory use.
EMC Emission	EN 50081-1: Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081-2: Generic emission standard. Part 2: Industrial environment. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
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 1: The above is guaranteed using accessories listed in this Product Data sheet only.
Temperature	IEC 68-2-1 & IEC 68-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: -40 to +50°C (-40 to +122°F), (see manual) Storage Temperature: -40°C to +70°C (-40 to +158°F) IEC 68-2-14: Change of Temperature: -10 to +55°C (2 cycles, 1°C/min.)
Humidity	IEC 68-2-3: Damp Heat: 90% RH (non-condensing at 40°C (104°F))
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: 1000 bumps at 250 m/s ²
Reliability	MIL-HDBK 217 F, GB (Part-stress): MTBF >200000 hours (max. 0.5% errors/1000 h)
Enclosure	IEC 529 (1989): Protection provided by enclosures: IP 44

Ordering Information

Type 4184 Weatherproof Microphone Unit

Includes the following accessories:

- UA 1072: Protection Tube (also Sound Calibrator Adaptor)
- UA 1073: Protection Cap
- UA 1046: 4x Dehumidifier Bag
- UA 1071: Windscreen Holder with Anti-bird Spikes
- UA 1070: Windscreen (1 extra included)
- DB 3068: Pole Adaptor

- QA 0177: Spanner
- QA 0178: Pin Wrench
- JE 0002: Adapter for preamplifier

- Type 4231:** Sound Level Calibrator
- UA 1112:** Tripod Adaptor Tube and Base

Microphone Preamplifier Extension Cables:

- AO 0027:** Brüel & Kjær Microphone Extension Cable, (3 m)
- AO 0028:** Similar to AO 0027 but double screen, (10 m)
- AO 0029:** Similar to AO 0028, (30 m)

Optional Accessories

- Type 5935:** Microphone Power Supply
- Type 4228:** Pistophone

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



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