

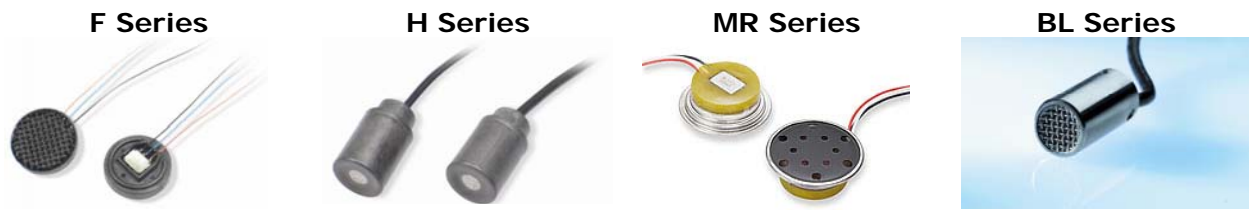
Application Note

Acoustic Sensor Assemblies

Any microphone may be considered an acoustic sensor, in the sense that any microphone may be utilized for an end purpose other than human listening. Typically, however, sensor applications include specific requirements for attributes such as:

- Self noise
- Power consumed
- Acoustic bandwidth
- Maximum sound pressure level
- Immunity to water, dust, etc.
- Form factor

Knowles Acoustics offers microphone assemblies designed specifically for sensor applications.

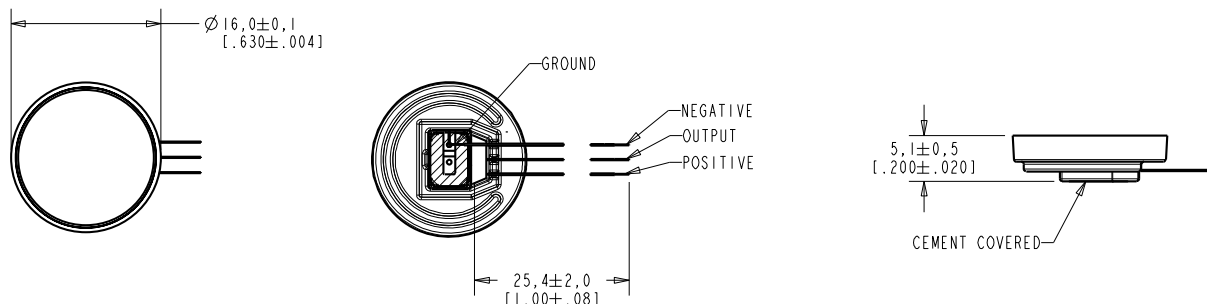


F Series

Construction

F Series is a panel mount package consisting of a plastic housing (glass-filled Nylon), EK Series microphone element, waterproof membrane, stainless steel screen, and lead wires. Two wiring versions are available: 3-wire for 4-wire (for use with external circuit). Some models include a sintered metal plate for additional acoustic damping.

Outline dimensions in mm (inches)



1 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:
Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:
Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:
Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

ASIA:
Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

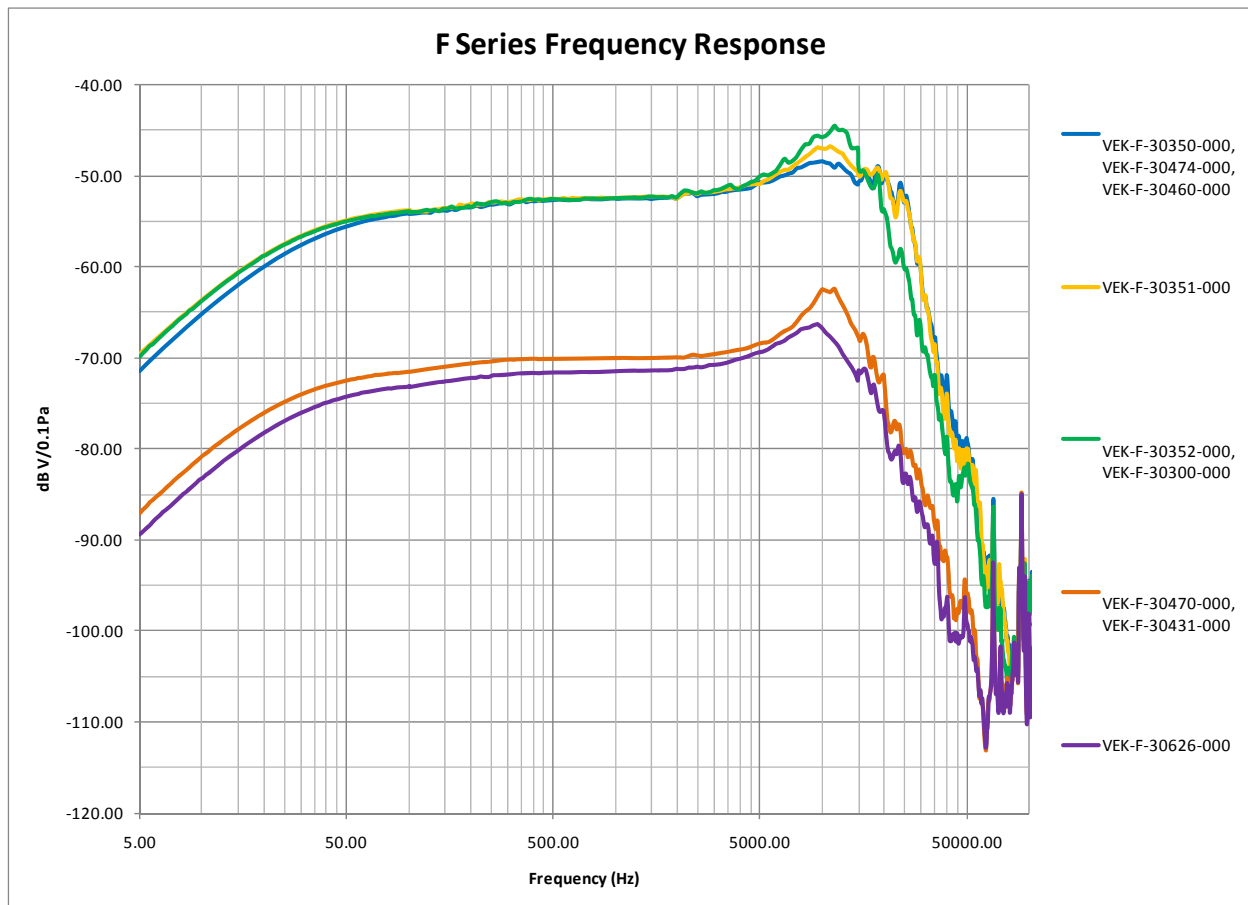
Performance

Frequency Response

F Series has a broad frequency response in a waterproof package. Because dynamic range requirements vary by application, KA offers a variety of high frequency damping options. Without appropriate damping, distortion may occur around peak frequencies for an impulse near the dynamic range limit.

Higher sensitivity models are intended for applications needing maximum S/N performance; lower sensitivity models are intended for applications requiring dynamic range for extreme SPL.

KA has capability to customize damping and sensitivity beyond options shown.



2 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:
Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:
Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

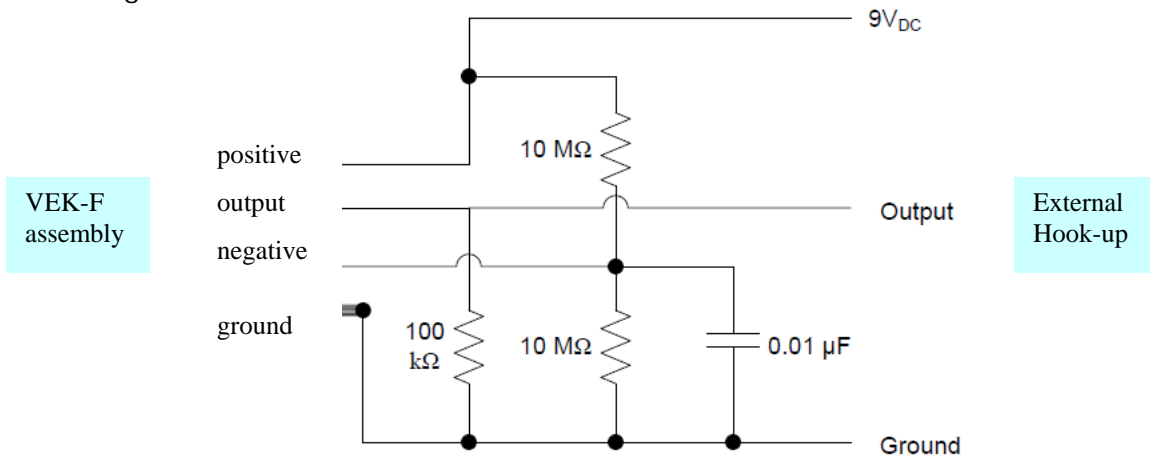
JAPAN:
Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

ASIA:
Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

Sensitivity and Dynamic Range

Standard and reduced sensitivity models are available. The 4-wire versions are intended for use with an external circuit that provides signal bias at ½ supply voltage for expanded dynamic range.

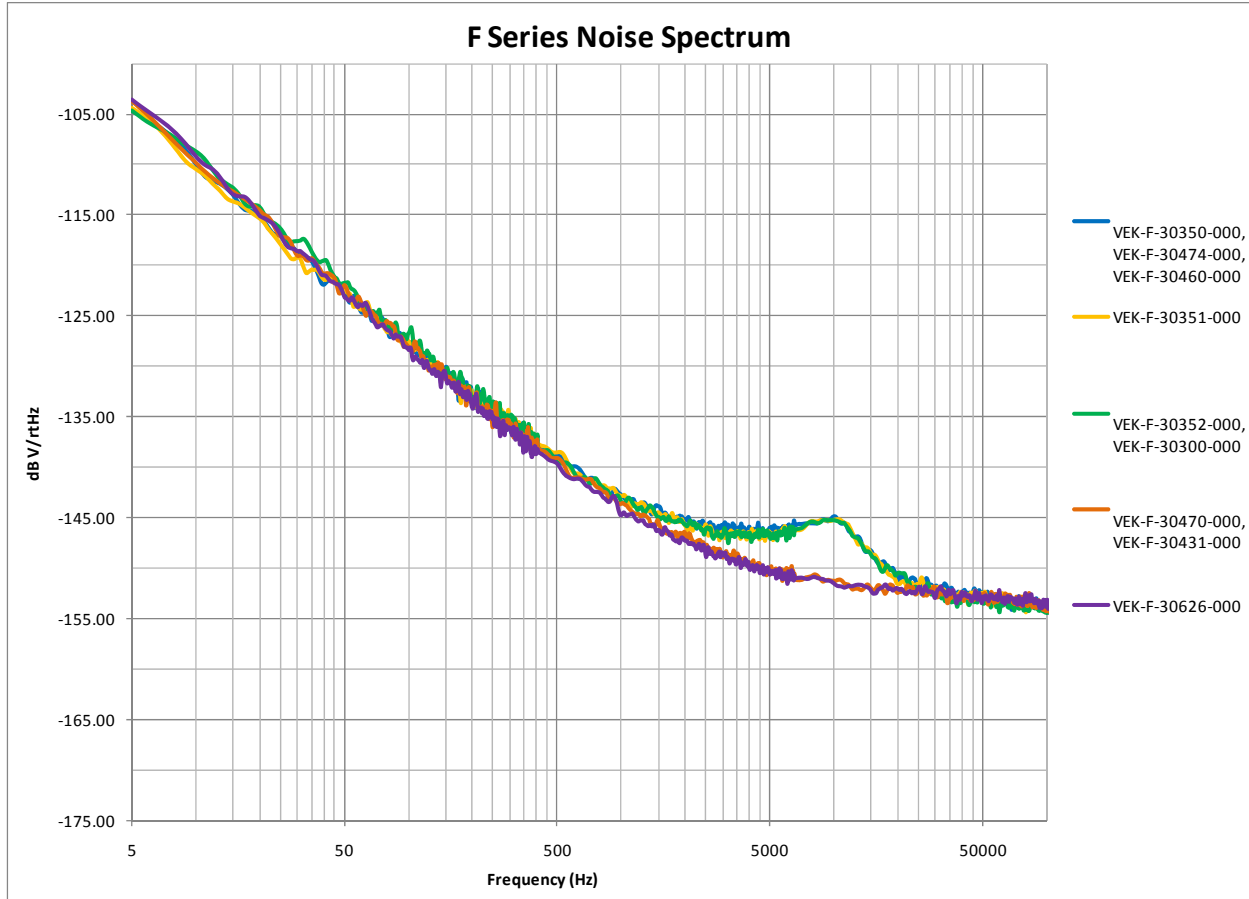


Acoustic Limit by Model (typical)

Models	dB SPL at 1%THD	dB SPL at 10%THD
VEK-F-30350-000 VEK-F-30474-000 VEK-F-30460-000	107	118
VEK-F-30351-000	109	119
VEK-F-30352-000 VEK-F-30300-000	113	121
VEK-F-30470-000 VEK-F-30431-000	122	136
VEK-F-30626-000	125	138
VEK-F-30732-000	124	137

Application Note

Noise



Applications

F Series assemblies are appropriate for low-profile packages and small arrays. They have been used for shot detection, and are suitable for general sensing applications that require a package that resists moisture and dust. The expanded dynamic range circuit is not included, and must be added by the customer as needed.

Application Note

Standard Models

Model Number	Element	Rating	Damping	Wires	Lead length	Wire Type
VEK-F-30626-000	EK-26899-P58	1m	yes	4	38mm	litz
VEK-F-30350-000	EK-23132-C36	1m	no	3	200mm	28 gage stranded hook-up
VEK-F-30351-000	EK-23132-C36	10m	no	3	200mm	28 gage stranded hook-up
VEK-F-30352-000	EK-23132-C36	20m	no	3	200mm	28 gage stranded hook-up
VEK-F-30460-000	EK-23132-C36	1m	no	3	10mm	29 gage solid (no insulation)
VEK-F-30300-000	EK-23132-C36	20m	no	3	9mm	litz
VEK-F-30470-000	EK-26899-P58	1m	no	4	25.4mm	litz
VEK-F-30431-000	EK-26899-P58	1m	no	4	105mm	28 gage stranded hook-up
VEK-F-30474-000	EK-23132-C36	1m	no	3	203mm	litz

AMERICAS:

Knowles Acoustics
 1151 Maplewood Drive
 Itasca, IL 60143
 U.S.A.
 Phone: 630-250-5930
 Fax: 630-250-5932

EUROPE:

Knowles Acoustics
 York Road, Burgess Hill
 West Sussex, RH15 9TT
 England
 Phone: +44-1444-235432
 Fax: +44-1444-872772

JAPAN:

Knowles Electronics Japan, KK
 2-2-16, Sangerjaya,
 Setagaya-ku, Tokyo
 154-0024 JAPAN
 Tel. +81-3-5779-8503
 Fax: +81-3-5779-8523

ASIA:

Knowles Acoustics
 5F, No. 129, Lane 235, Bauchiau Rd.
 Shindian City, Taipei 231, Taiwan
 Republic of China
 Phone: 886-2-8919-1799
 Fax: 886-2-8919-1798

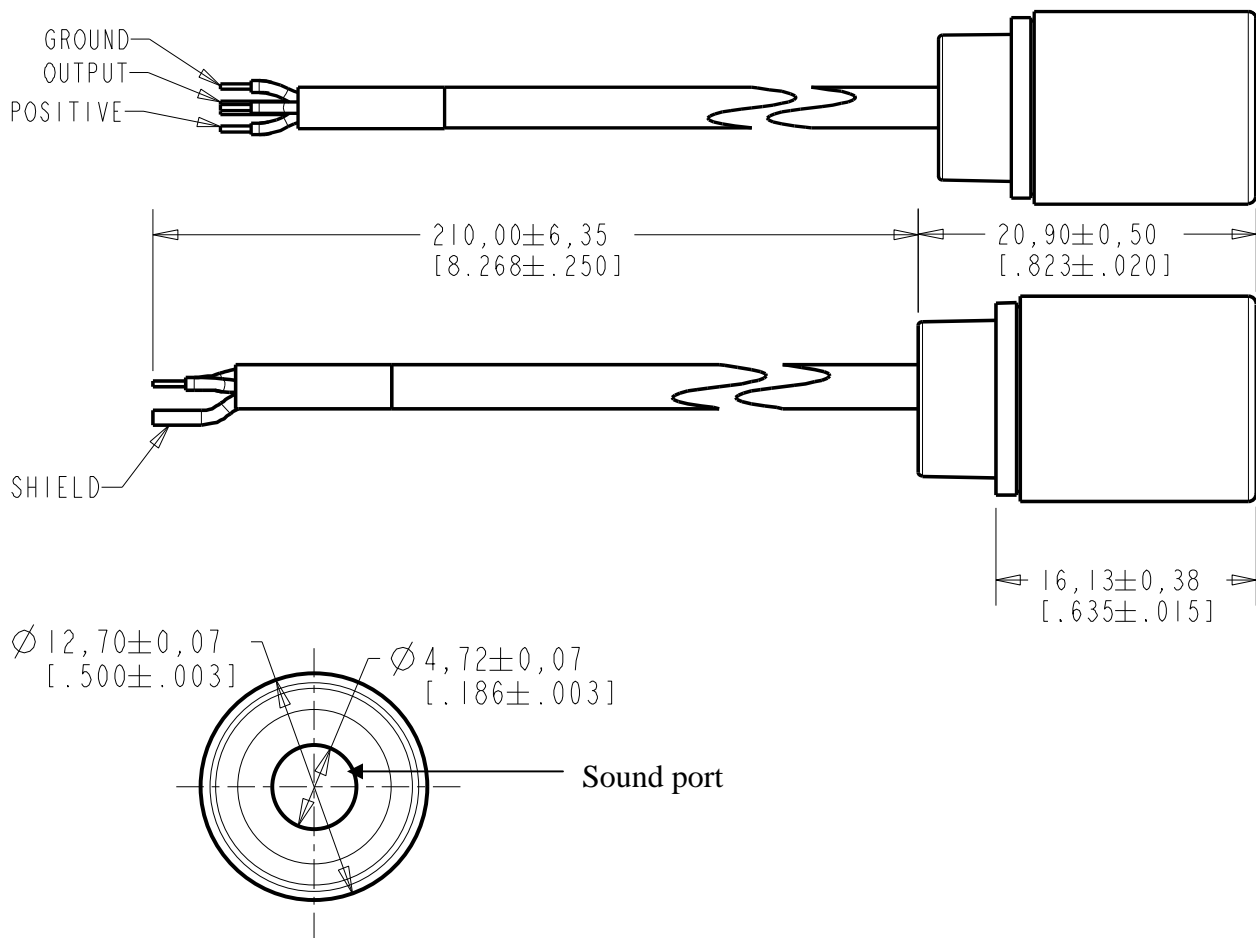
Application Note

H Series

Construction

H Series is a shielded cylindrical package with cable. The housing is made from conductive plastic, and contains an EK or WP Series microphone element along with a PCB. Sound enters through a porous stainless steel disc (treated for water resistance). Electrical connections are isolated from the shield.

Outline Drawing in mm (inches)



6 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:
Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:
Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:
Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

ASIA:
Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

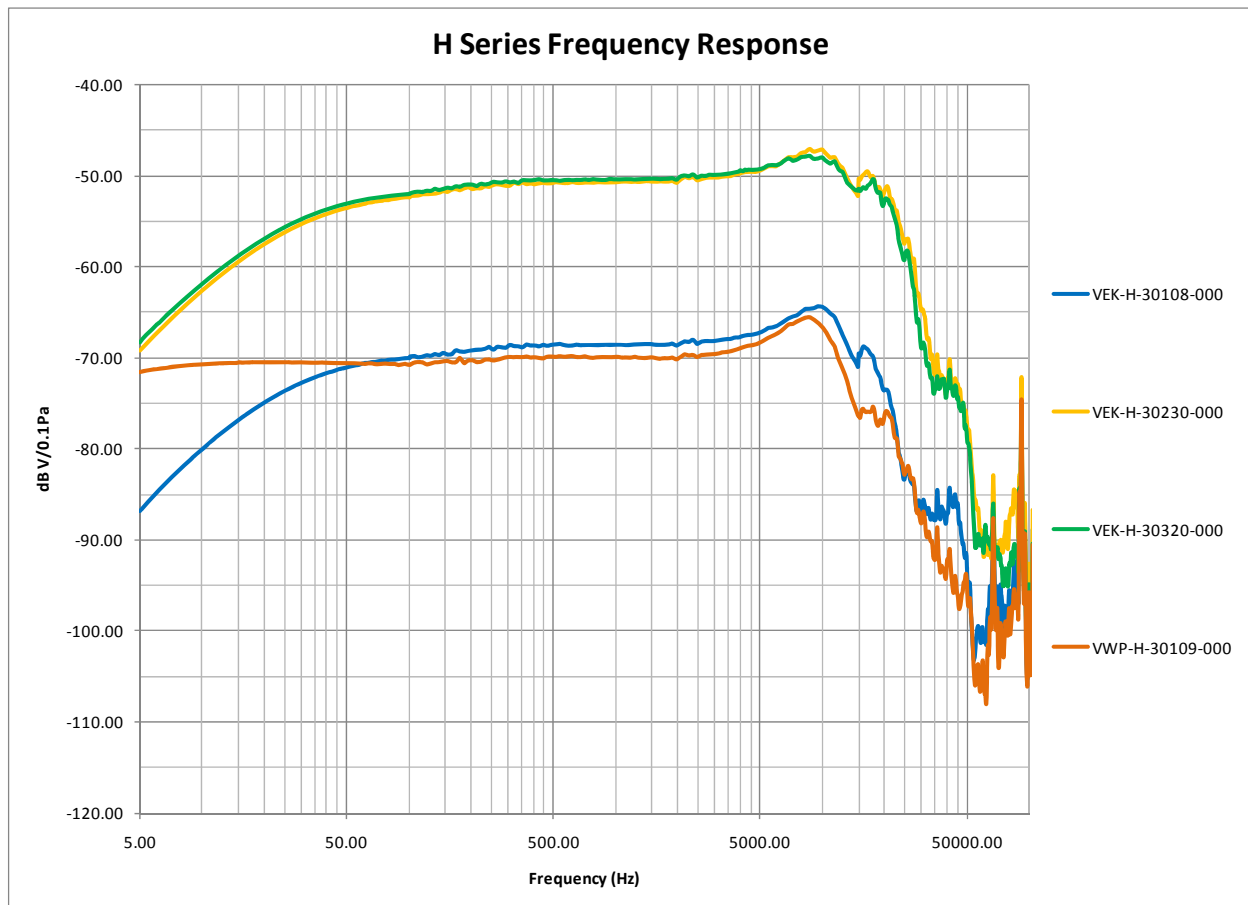
Performance

Standard and reduced sensitivity models are available. Some models include an internal circuit that provides signal bias at ½ supply voltage for expanded dynamic range. Models containing a WP element are recommended for environments where frost or condensing humidity is expected.

Frequency Response

F Series has a broad frequency response in a water resistant package.

Higher sensitivity models are intended for applications needed maximum S/N performance; lower sensitivity models are intended for applications requiring dynamic range for extreme SPL. KA has capability to customize damping and sensitivity beyond options shown.



7 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:
Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:
Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:
Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

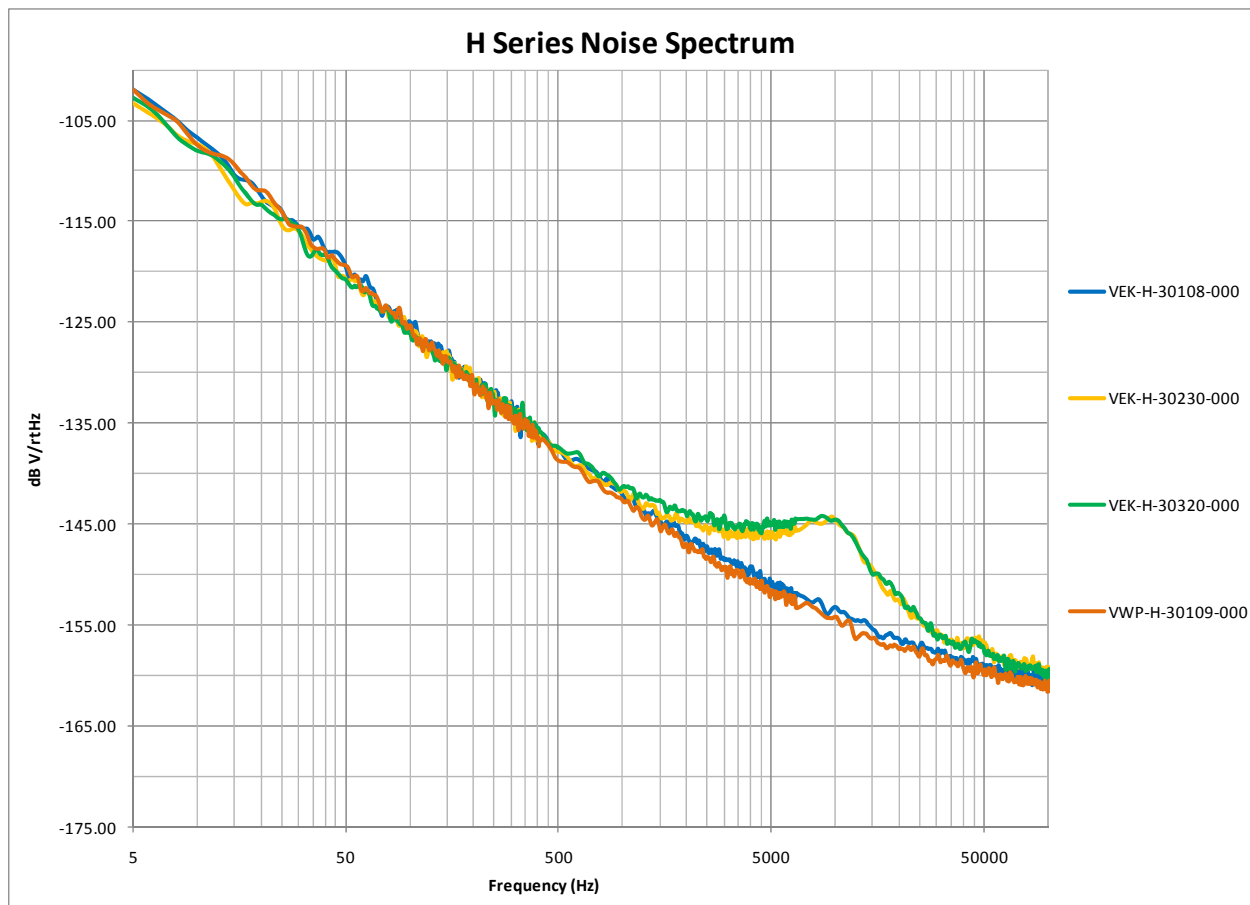
ASIA:
Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

Acoustic Limit by Model (typical)

Models	SPL at 1%THD	SPL at 10%THD
VEK-H-30108-000	124	154
VEK-H-30230-000	105	117
VEK-H-30320-000	131	136
VWP-H-30109-000	127	155

Noise



8 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:

Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:

Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:

Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

ASIA:

Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

Applications

H Series microphones are appropriate for general sensor applications that do not support panel mounting or that require EMI shielding. Models with extended dynamic range are recommended for gunshot or other impulse sensing. The H Series package is also convenient for use as a low cost reference microphone.

Standard Models

Model Number	Element	Sensitivity
VEK-H-30230-000	EK-23169-P03	high
VEK-H-30320-000	EK-30436-P03	high
VEK-H-30230-000	EK-26899-P03	low
VWP-H-30109-000	WP-30113-P03	low

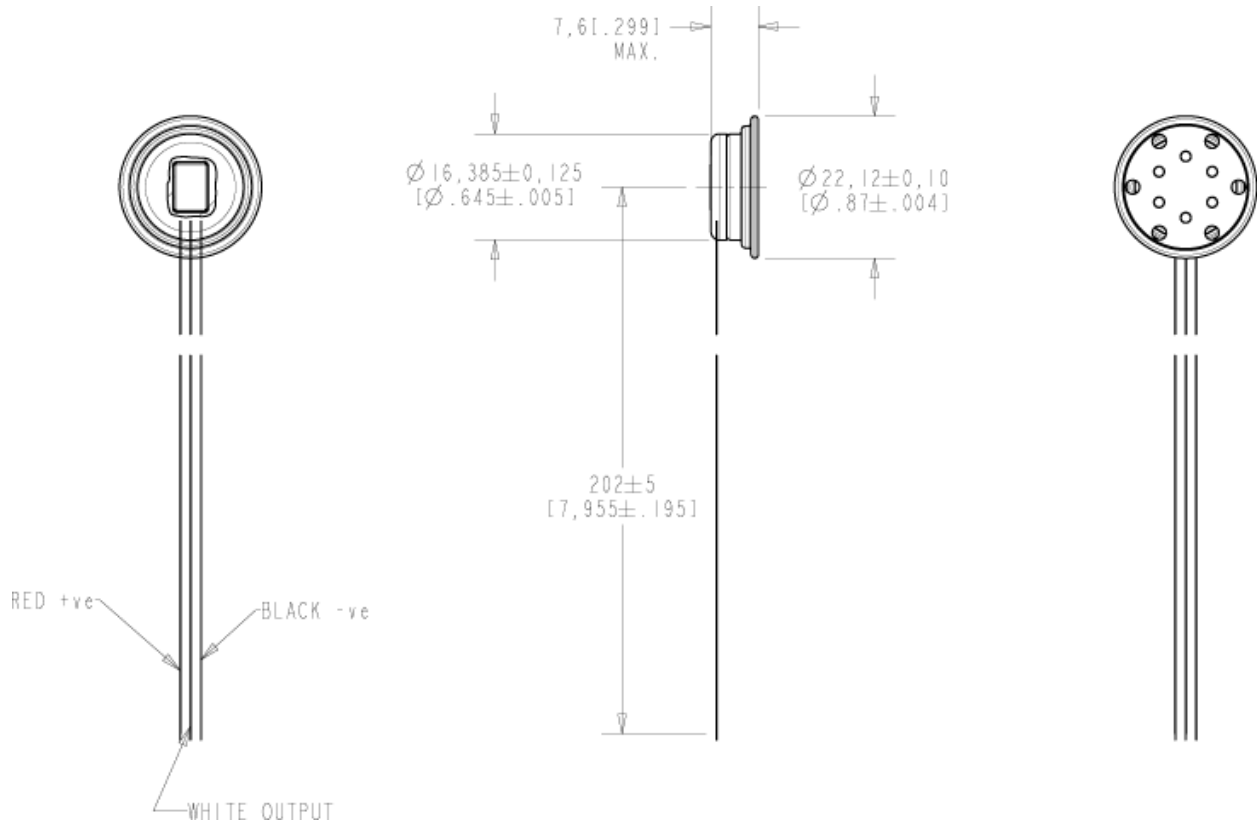
MR Series

Construction

All MR Series assemblies are based on a bellows that attaches to a transducer element (microphone or speaker). The bellows is made of urethane film, and is vented with millipore material for barometric pressure equalization. The transducer element is attached with an epoxy formulated to be mechanically robust over a wide temperature range. The MR housing components (cup and grill) are made of stainless steel. The grill is black, non-reflective, and drains water quickly.

Application Note

Outline Drawing in mm (inches)



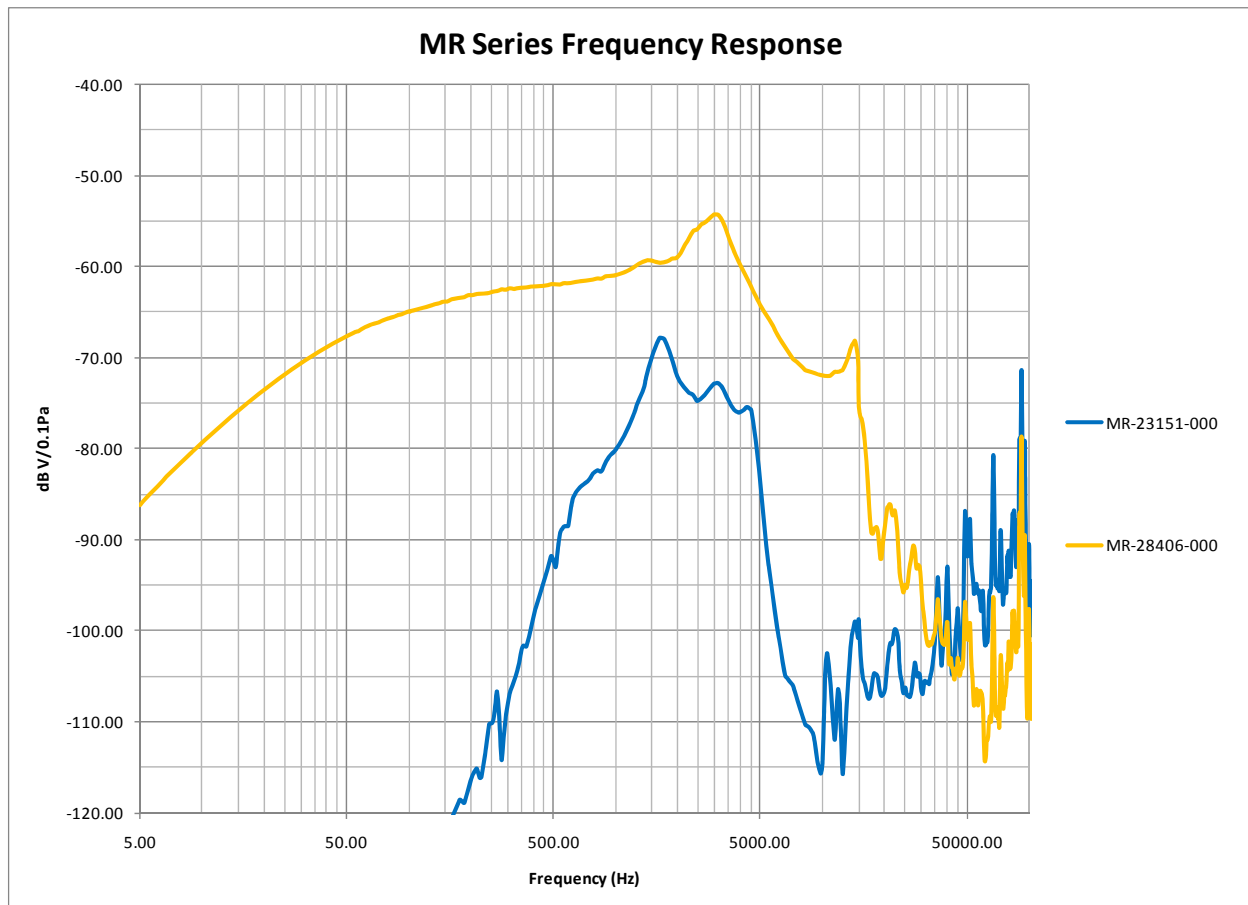
Performance

Electret and balanced armature versions are available. The electret version has wideband response; the balanced armature version has pass-band response. MR microphones survive submersion in 50 feet of water and function immediately after water is drained. The front bellows assembly is robust, and may be cleaned with a hose if needed.

Application Note

Frequency Response

Note MR-23151-000 response is suited to telephony bandwidth 300Hz to 4kHz and effectively filters out-of-band noise.



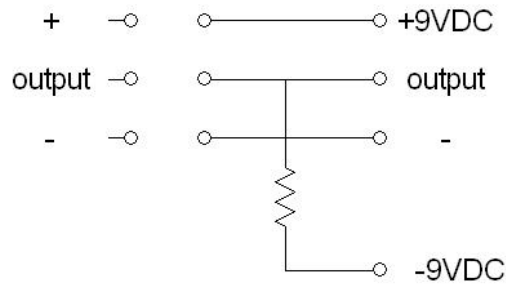
Acoustic Limit by Model (typical)

Acoustic limit of MR-28406-000 may be expanded by using an external circuit as shown.

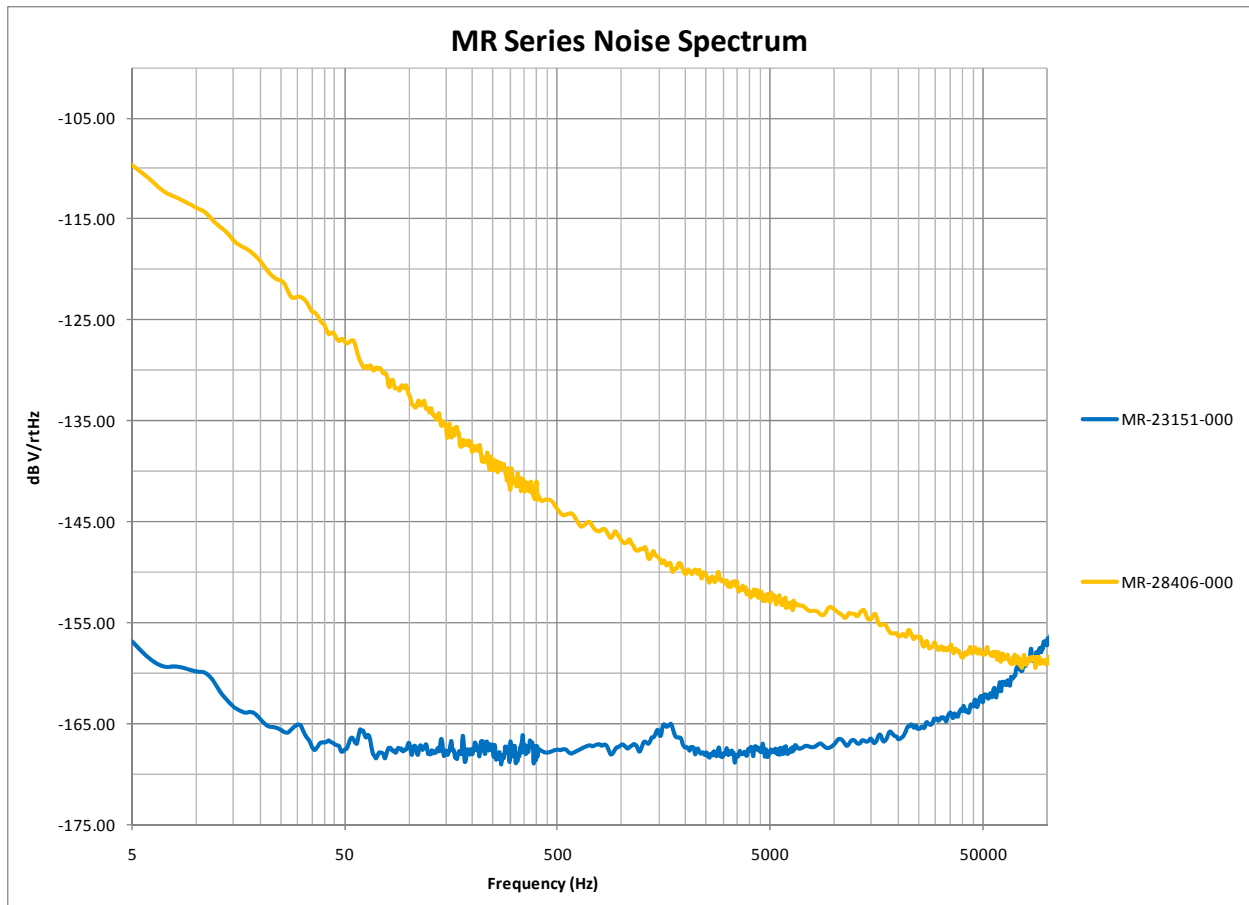
Models	SPL at 1%THD	SPL at 10%THD
MR-23151-000	131	153
MR-28406-000	112	126

Application Note

Microphone



Noise



12 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:

Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:

Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:

Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

ASIA:

Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

Applications

MR Series microphone packages are suitable for permanent outdoor sensor or voice installations, or for applications requiring repeated submersion. The package may be cleaned to remove particles, dirt, salt, or other residue. The balanced armature version pass-band response improves voice intelligibility by acoustically filtering out-of-band sounds. MR has been proven in demanding applications such as dive helmets and sea-rescue beacons dropped from airplanes.

Standard Models

Model Number	Element Series	Type	Comment
MR-28406-000	BT	Electret	Broadband, high sensitivity
MR-23151-000	BJ	Balanced Armature	Voice band, self powered

BL Series

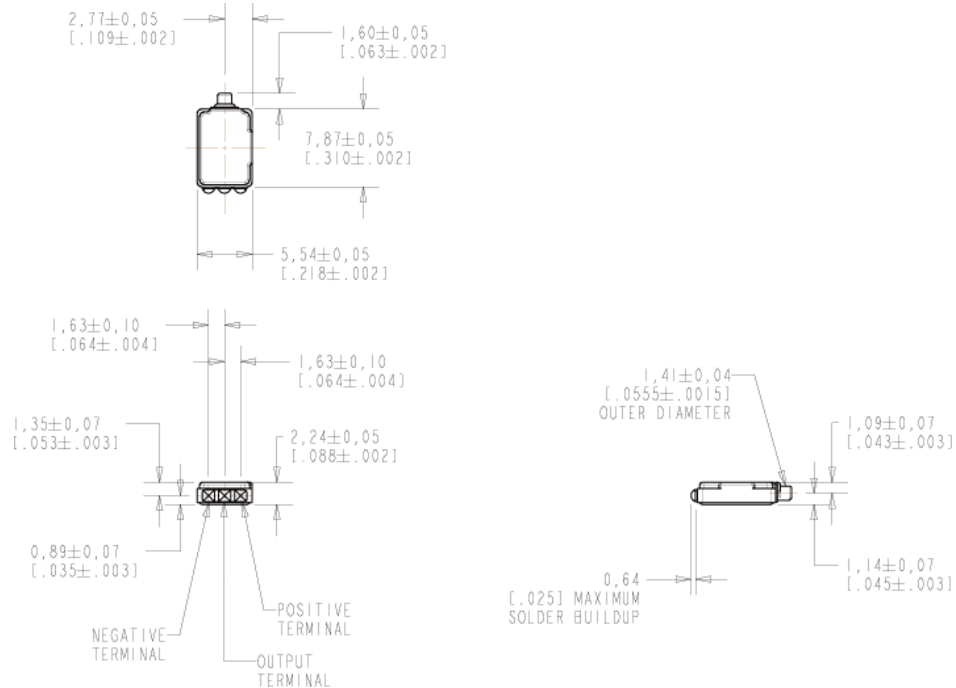
Construction

For the BL microphone element, a diaphragm paddle structure rigidly links to a cantilevered piezoceramic beam. Beam deflections cause a voltage signal across the electrodes, which is buffered by an internal circuit.

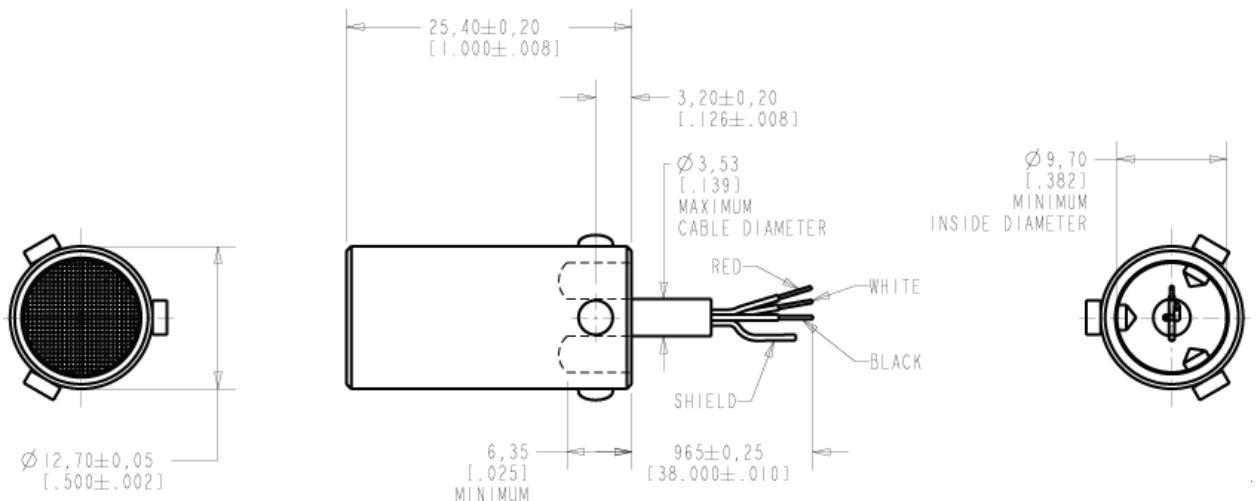
The BL cylindrical package is a rugged stainless steel cylinder, ½ inch diameter and 1 inch long with shielded cable. The grill is made from rugged multilayer stainless steel. Set screws for mounting are provided. The package model BL-21994-000 contains model BL-21785-000 as the active element.

Application Note

BL-21785-000 Outline Drawing
Dimensions in mm (inches)



BL-21994-000 Outline Drawing
Dimensions in mm (inches)



Revision 1.1

www.knowlesacoustics.com

AMERICAS:
Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:
Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:
Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

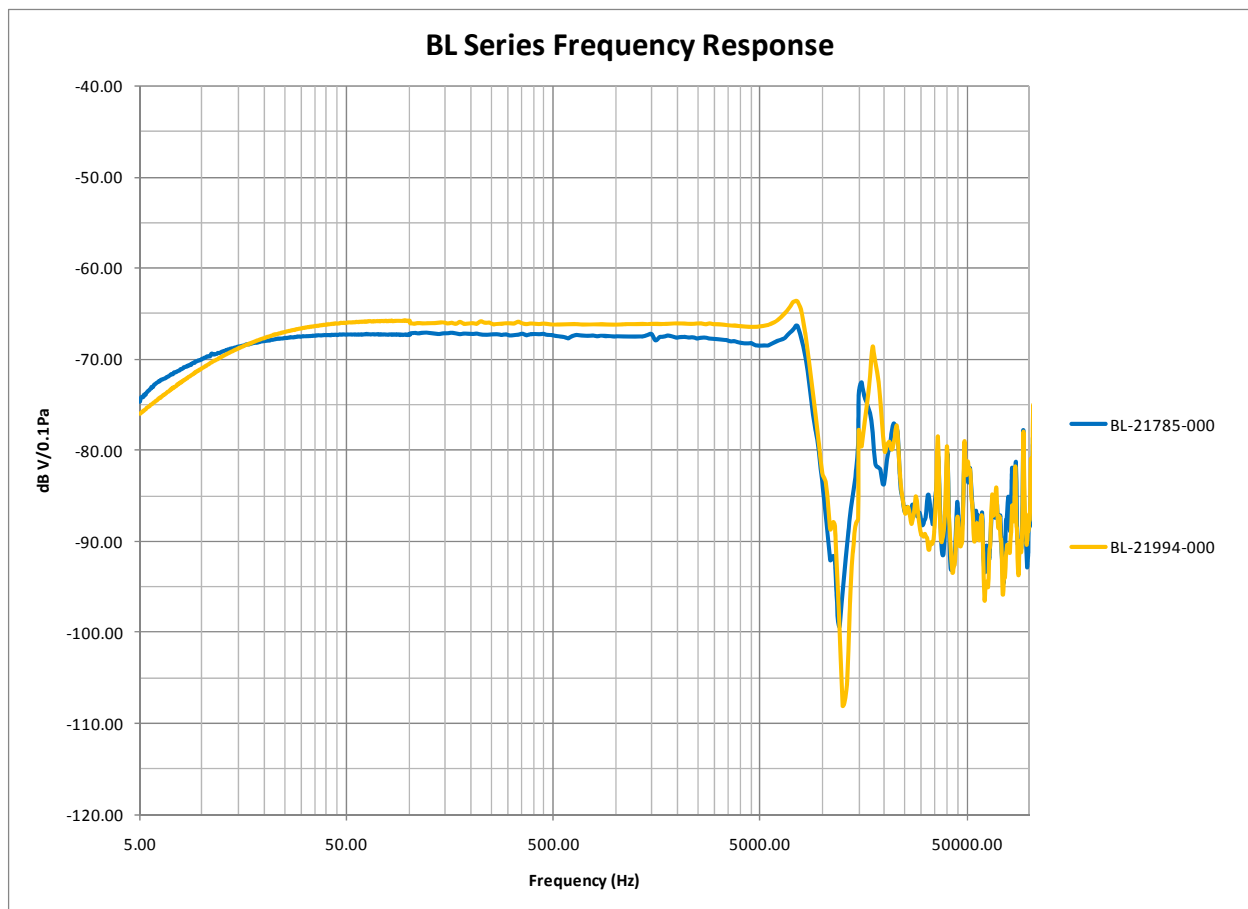
ASIA:
Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

Performance

Frequency response is nominally flat from 20Hz to 9kHz. Due to the piezoceramic construction, BL microphones have excellent long-term stability. Sensitivity does not vary with humidity. BL microphones are sensitive to vibration – the elements may be used as band-pass accelerometers.

Frequency Response

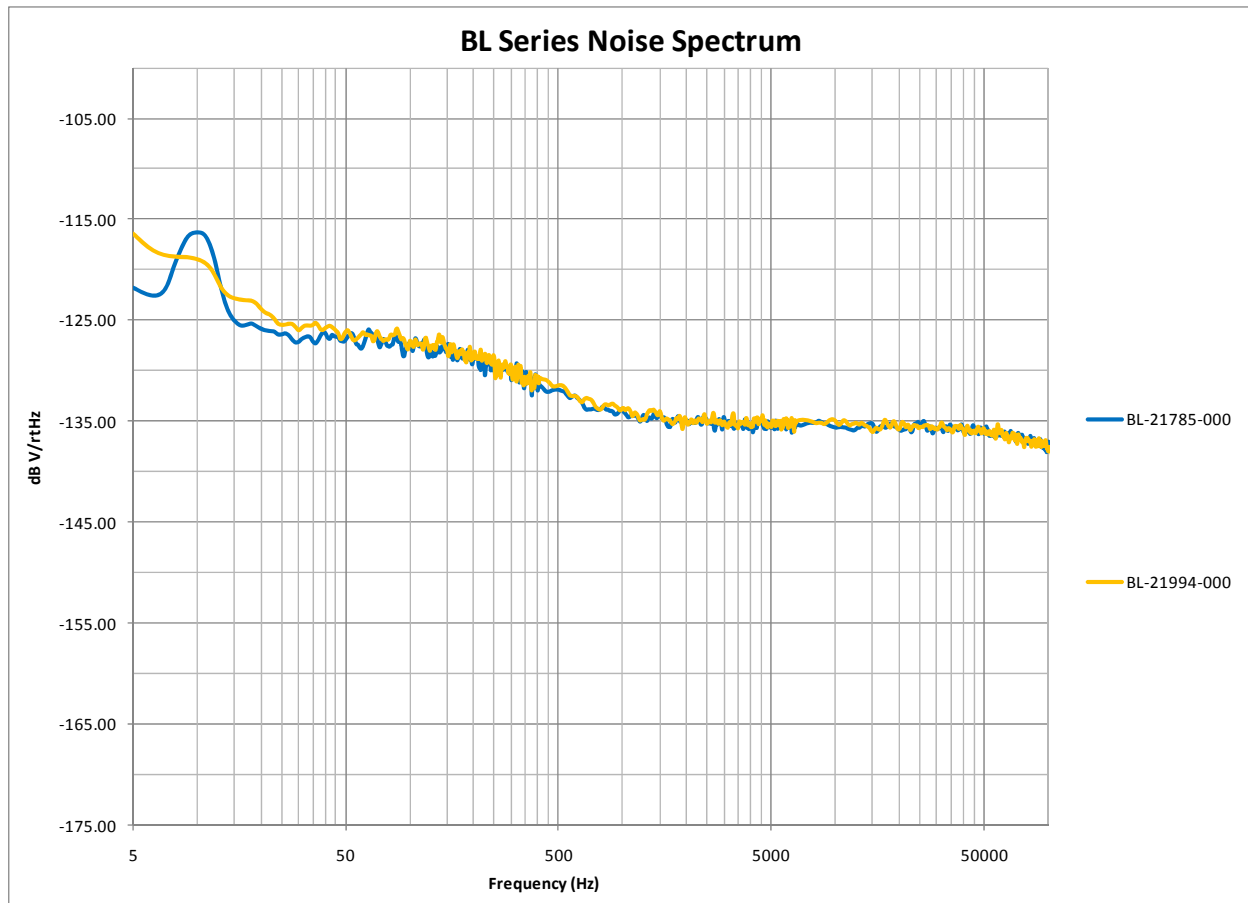


Application Note

Acoustic Limit by Model (typical)

Models	SPL at 1%THD	SPL at 10%THD
BL-21785-000	137	144
BL-21994-000	137	143

Noise



Applications

BL elements may be used in sound level meters, or as a low cost reference microphone for acoustic measurements. An external circuit is used may be used to expand dynamic range for high sound pressures. Alternately, a 3-wire hookup provides maximum sensitivity, which is useful for electronic stethoscope and other applications.

16 of 17

Revision 1.1

www.knowlesacoustics.com

AMERICAS:

Knowles Acoustics
1151 Maplewood Drive
Itasca, IL 60143
U.S.A.
Phone: 630-250-5930
Fax: 630-250-5932

EUROPE:

Knowles Acoustics
York Road, Burgess Hill
West Sussex, RH15 9TT
England
Phone: +44-1444-235432
Fax: +44-1444-872772

JAPAN:

Knowles Electronics Japan, KK
2-2-16, Sanganjaya,
Setagaya-ku, Tokyo
154-0024 JAPAN
Tel. +81-3-5779-8503
Fax: +81-3-5779-8523

ASIA:

Knowles Acoustics
5F, No. 129, Lane 235, Bauchiau Rd.
Shindian City, Taipei 231, Taiwan
Republic of China
Phone: 886-2-8919-1799
Fax: 886-2-8919-1798

Application Note

Standard Models

Model Number	Type	Comment
BL-21785-000	Piezoceramic	Element
BL-21994-000	Piezoceramic	Cylinder package with shielded cable