



Brüel & Kjær Vibro

A member of the NSK Group



Product specifications and ordering information

VIBRO Condition Monitoring 3

VCM-3 & VCM-3 Ex

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Product specifications and ordering information **VIBRO Condition Monitoring 3**,
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Brüel & Kjær Vibro GmbH

Leydheckerstrasse. 10
64293 Darmstadt
Germany

Phone: +49 6151 428 0
Fax: +49 6151 428 1000

Hotline

Phone: +49 6151 428 1400
E-Mail: support@bkvibro.com

Brüel & Kjær Vibro A/S

Lyngby Hovedgade 94, 5 sal
2800 Lyngby
Denmark

Phone: +45 69 89 03 00
Fax: +45 69 89 03 01

Homepage

www.bkvibro.com

BK Vibro America Inc

1100 Mark Circle
Gardnerville NV 89410
USA

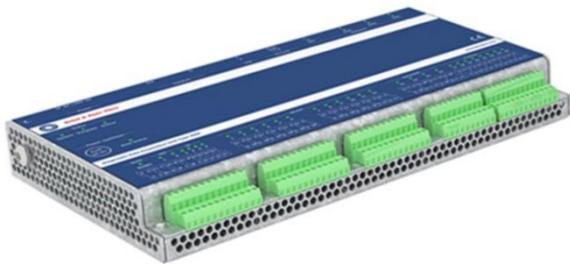
Phone: +1 (775) 552 3110

Corporate E-Mail

info@bkvibro.com

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The VCM-3 is a powerful 24 channels edge device, ideal for monitoring of auxiliary machines. The combination of comprehensive, highly flexible vibration measurements together with process data allows monitoring of your assets and operation at the edge.

This has the benefit of providing:

- Early bearing fault detection.
- Application specific solutions to monitor operations and process.
- Eliminating walkaround programs that may find problems too late.
- Removing personnel from dangerous areas.

VCM-3 provides twelve dynamic channels that can each return measurements for:

- Bandpass (with option for integration)
- Narrowband (with option for integration or double integration) amplitude and phase
- Acceleration enveloping (ECU)
- Narrowband acceleration enveloping (with option for integration)
- Asynchronous, synchronous, and enveloping waveforms
- Bias voltage/gap measurement
- Bearing Condition Unit (BCU)

In addition, the following channels are also provided:

- Four tachometer channels to provide speed and phase reference
- Eight process variable channels (4 to 20 mA inputs)

The VCM-3 provides an easy-to-implement vibration condition monitoring solution to detect potential failure modes of your production assets that could, if not checked, result in a catastrophic failure, downtime, and production loss. The fault detection

measurements offer an "Early Warning System" that brings go/no-go decisions directly into the control room as part of regular plant operations. In addition to actionable information, The VCM-3 instantly also feeds filtered and refined vibration health data to the historian, DCS and/or SCADA systems for subsequent analysis.

Out of the box VCM-3 detects potential rolling element bearing machine problems using a few simple machine fault indicators. One does not need to find the root cause of the vibration problem to make decisions about asset operation. This simple approach prevents DCS or SCADA systems from being flooded with information that can mask other issues. The fast 24/7 reaction of the VCM-3 provides the right information, when and where it is needed, without the shortcomings of data gaps or low-quality data of alternate periodic monitoring strategies.

When machine and process conditions dictate a more comprehensive solution and as condition monitoring capabilities grow, we offer services to extend the built-in functionality to optimize a monitoring solution to meet your needs. VCM-3 can also be used for monitoring fluid film bearing machines, variable speed machines, and process variables with custom templates offered through our services department. Come talk with us about unlocking the full potential of VCM-3 to optimize your uptime.

VCM-3 offers seamless integration into the PI System® and SETPOINT® Condition Monitoring System to enable vibration analyst to remotely monitor and analyze machine condition. With all plant data, including waveforms, located in one repository you can unlock is full potential for advanced analytics and automation.

When you need even more flexibility the VCM-3 offers a web API (Application Programming Interface) allowing all data processed at the edge to be brought into a customer's predictive maintenance, advanced analytics, or remote monitoring application. With this web API data can easily be centralized in the cloud. This offers ultimate flexibility when you already have software in place but need additional data to drive a successful plant optimization initiative.

Key Features and System Benefits

- **Fault detection – Descriptors for trending**

VCM-3 uses descriptors to enable fault detection. A descriptor is a measurement produced from the raw vibration (sensor) signal into one or more scalar values. A descriptor value is very well suited for long term trending to indicate failure modes of machines. VCM-3 measures a range of descriptors such as real time standardized bandpass filters for true energy measurements, narrowband filter to detect characteristic fault frequencies and envelope bandpass for bearing fault detection.

- **High number of input channels/High value**

Suitable for advanced condition monitoring of several machines in one device.
All input channels are sampled simultaneously (synchronous sampling).

- **Field mountable edge device**

Environmentally robust -40 to +60 °C (-40 °F to +140 °F) operation with built in protocols for MODBUS TCP and OPC UA. VCM-3 can be installed as field monitors mounted at remote locations next to the machines* or in an instrument cabinet. It can also operate in a hazardous environment**

*in a suitable field housing

**when ordered with approvals (VCM-3 Ex) and installed according to the hazardous area installation instructions.

- **Robust cybersecurity**

The ports in our VCM-3 hardware have been hardened with encryption and designed to push data out to upper networks without exposing critical infrastructure to external vulnerabilities.

It is specifically designed to work with firewalls, and multi-tiered networks to meet industry's most stringent data security requirements

- **OPC UA Server embedded in the device**

Remove the need for additional software and PC/Server hardware infrastructure for the OPC UA Server application as OPC UA is embedded directly into the VCM-3 hardware device.

- **Open Application Programming Interface (API)**

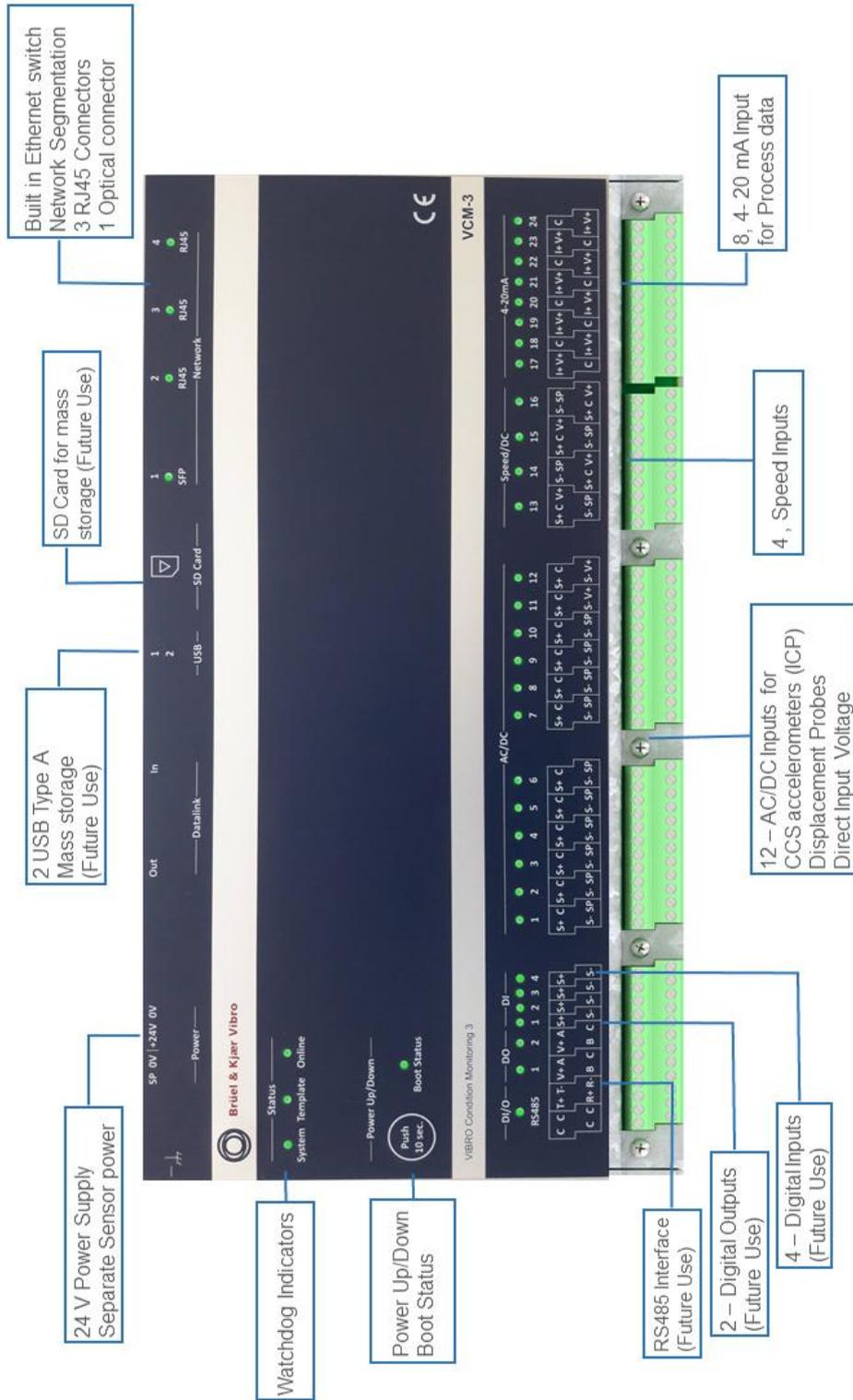
The VCM-3 API allows a flexible transfer of data from the device to a remote server over a secure connection. Data is pushed to a remote server. This requires only an outgoing network firewall port to be opened, which maintains compliance with operational network security policies. Network outages can seamlessly be recovered from through internal buffered historical data. This enables a bring your own software solution ideal for combining best in class edge computing with customer specific analytics packages.

- **Field proven**

Based off the third generation of the world's most popular wind turbine monitoring system with over 30,000 installed units.

- **Seamless integration with SETPOINT® and the PI System®**

Balance of plant condition monitoring has never been easier and more valuable with seamless integration to the PI System® and SETPOINT®. Now all plant users can benefit from rich vibration and process data.



Technical Specification

For additional information and instructions, refer to the following companion documents:

Document/Description	Document No.
VCM-3 Installation Instruction	C107758.002
CM360/CG-VCM-3 Datasheet	C107897.002
CM360-CG/VCM-3 Hardware Installation Instruction	C107899.002
VCM-3 Safety (short) Instruction	C107761.001
VCM-3 On-Site Commissioning Manual	C107759.002
VCM-3 Master Monitoring Template – S01 Standard Product specification	C108041.002
VCM-3 Editor Software Manual	C107762.002
SETPOINT® Specification for VCM-3	S000025.002

12, AC/DC Analog Input Channels	
A/D converter – one per channel	24 Bit
Sampling Frequency	204.8kHz synchronous on all channels
Analysis Frequency Range	0.1Hz - 80kHz (6 CPM – 4800000 CPM) Lower to upper (filter) corner frequency span minimum 1 : 3 but may not exceed 1 : 5000
Input Type	Differential, bipolar (-25.5V to +25.5V)
Dynamic Range	> 100dB at 1kHz, > 94dB at 0.1kHz
Channel Interference	>-100dB
AC Amplitude Accuracy	±0.5dB
DC Amplitude Accuracy	1% relative of full scale with ±40mV Offset.
Total Harmonic Distortion	< 0.01%/250Hz/4Vpp
Input Impedance	>100kΩ
Common Mode Rejection	>50dB at 50Hz
Phase Match Between Channels	<0.3° at 80kHz

4, Speed/Phase Reference/DC Analog Input Channels*

As Speed/REF Channel (pulse input)	Industrial switches: NPN and, PNP (Namur compatible) Analog: Displacement sensors
Input Range	0-150.000 RPM
Speed Accuracy	500RPM < 0.04RPM, 1500RPM < 0.1RPM
Pulse Divider	For use with tachometer signals with multiple pulses per revolution
Sampling Frequency	8kHz
Accuracy	<±5mV Absolute
Dynamic Range	> 100dB

8, 4-20mA Analog Input Channels*

Sensor Types	Normal and NAMUR sensor types are accepted
Bandwidth	0-20 Hz
Sampling Frequency	4kHz
Accuracy	Absolute accuracy < 0.5%. Non-linearity (typical) < 0.03%, non-linearity (worst case) < 0.2%
Offset Current Drift	< 6.5µV/°C
Current Source	Internal or External

Real Time Descriptor Types (Scalar measurements)*

Time Domain Analysis	Low pass, High pass, Band pass (tracking and fixed), ECU-Envelope Condition Unit (tracking and fixed), BCU-Bearing Condition Unit, DC, Speed, Process Inputs
Frequency Domain Analysis (DFT)	Narrowband – CPB (constant percentage bandwidth) - fixed or tracking Narrowband Envelope Condition Unit – CPB Envelope filter - fixed or tracking
Detectors	RMS, Peak, Peak-Peak, Crest factor, Phase
Physical Parameters	Acceleration, Velocity, Displacement (with proximity probes)
Speed (for tracking analysis)	Either direct from sensor, or derived speed using pulse divider and/or gearbox exchange ratio.



Process	Any 4-20mA transducer signal. DC via AC/DC or Speed/DC (high accuracy measurements)
Networking	
Network Connections	3x (RJ45), 1x optical SFP connector
Low level protocol	Ethernet TCP/IP, IPv4
Switch functionality	4 network ports with built-in switch functionality
System Integration	
OPC UA Server	For data export to controllers, SCADA systems or other system components (internal update rate 5 seconds)
Modbus TCP Server	For data export to SCADA systems or other system components (internal update rate 1 seconds)
Cyber Security	
Secure protocols	Communication takes place through secure and encrypted protocols, such as Web-sockets, HTTPS, SCP.
Port configuration	All services using a TCP/IP port (e.g. https, default port 443) can be configured to use another port
NERC Compliance	The VCM-3 can be part of solutions complying with NERC CIP Standards. (North American Electric Reliability Corporation – Critical Infrastructure Protection).
Strong passwords	The use of strong passwords is enforced. Compliance with NIST SP800-118 – Guide to enterprise Password Management. Can be changed by user.
Environmental	
Ambient Temperature	In operation. -30°C to +60°C (-22F to +140F) in accordance to EN/IEC 60068-2-2. Applies to device and to device mounted in cabinet. -40°C (-40F) with reduced accuracy, -70°C (-94F) with de-rated Mean Time Between Failures (MTBF).
Ambient Temperature	Storage. -40°C to +85°C (-40F to +185F) in accordance to EN/IEC 60068-2-2

Temperature Change	Operational during a temperature change rate of 1°C per minute in accordance to EN/IEC 60068-2-14
Static Damp Heat, Cyclic Damp Heat	In operation. According to EN/IEC 60068-2-78, EN/IEC 60068-2-30 and EN/IEC 60068-2-38
Random & Sine Vibration	According to EN/IEC 60068-2-6.
Rough Handling	Storage. According to EN/IEC 60068-2-31.
High Altitudes	According to EN/IEC 60068-2-13. Air pressure equivalent to 3500m altitude.
Inclination	According to IEC 60092-504.
IP Rating	The device IP rating is IP20 according to EN/IEC 60529.
HALT Test	Has been subject to HALT test. Excessive vibration and temperatures and combinations hereof
CE-compliant with	EMC acc. 2014/30/EU EN 61326-1 ROHS acc. 2011/65/EU EN IEC 63000:2018 ATEX acc. 2014/34/EU EN 60079-0 EN 60079-7
Hazardous Area Approval (Only available for VCM-3 Ex)	24V dc / max. 1,6 A / max. 30 W T4 Tamb -30 ° C to +60° C UL Hazardloc Area Approval Class I, Division 2, Groups A-D Class I, Zone 2, Group IIC 2 IECEX Approval IECEX UL 20.0034X Ex IIC ec T4 Gc ATEX Approval UL 20 ATEX 2467 X ⊕ 3G Ex IIC ec T4 Gc

Mechanical	
Dimensions	280 x 153.5 x 35 mm (11.02 x 6.02 x 1.38 in)
Weight	1.5 kg (3.31 lbs)
Mounting	DIN Rail Mounting or Wall mount
Power Supply	
Voltage/Power Consumption	18-26 V DC/10W + power consumption of each sensor.
Fuses	Power supply inputs are fused to protect against over-voltage and fire

Operational	
Fully remote operation	Upload of firmware updates and monitoring templates via network
VCM-3 Homepage	For remote or local service. Commissioning, view of trend and array data, view Log files
Calibration	Factory calibrated. (for re-calibration please contact B&K Vibro)
Service	No specific onsite service required. VCM-3 has no moving parts, or other parts which requires regular service
Design lifetime	20 years

VCM-3 Editor Computer Hardware Requirements	
Processor:	Intel 64 Bit or compatible
Main Memory	1GB
Required disk space	300 MB

VCM-3 Editor Supported Operating Systems	
Microsoft Operating System	<ul style="list-style-type: none"> - Windows 10 (64 Bit) - Windows Server 2016 (64 Bit)

Additional Software	
For editing the VCM-3 Monitoring Template parameter a spreadsheet editor is required. Excel 2010 or newer.	

*Ships with solution for constant speed rolling element bearings (see C108041.002 for details). All other solutions delivered through Custom Template (Service) see page 10.

Ordering Information

VCM-3, Spares and Services

Use the following order codes when ordering a VCM-3 device or associated accessories. All VCM-3 devices ship with VCM-3 Editor software, standard templates, and product documentation.

VCM-3 MONITOR	
Order Code	Description

VCM-3-DIN	"VIBRO Condition Monitoring 3" base monitor hardware type VCM-3. including two DIN- rail mounting clips (screwed on).
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VCM-3 Ex MONITOR	
Order Code	Description

VCM-3 Ex	"VIBRO Condition Monitoring 3" hazardous area monitor hardware type VCM-3 Ex. including two DIN- rail mounting clips (screwed on).
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EA2039 DIN clip for VCM-3	
Order Code	Description

EA2039	2x DIN clip (set) including screws, for mounting a VCM-3 to a DIN-rail (One set required for one VCM-3).
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EP2136 Adapter plate for VCM-3	
Order Code	Description

EP2136	1x stainless aluminum mounting plate including screws for wall mounting a VCM-3.
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Weatherproof Housing

Painted steel housing (IP66) with a viewing window is available with a VCM-3, 24 V power supply and circuit breaker included.



CM360/CG-VCM-3 ¹	
Order Code	Description
CM360/CG-VCM-3	Weatherproof housing for VCM-3. Includes VCM-3, breaker, 24V supply, and housing.

¹This housing is not rated for hazardous area. Please contact our service department for appropriate housing solutions when deploying in hazardous areas.

Custom Template (Service)

Custom templates offer solutions for specific machines and customer application needs. When additional measurements are needed to monitor specific machinery failure modes or process related issues B & K Vibro application engineers can provide these solutions (Asset Health Monitoring Strategy) as a Service offering. The resulting asset health monitoring strategy provides additional information and notification of developing machine and process failures in simple to use trends and alarms of core structural machine failures modes and machine specific components. This simplifies the process of identifying defects and analyzing the root cause so that decisive go no go actions can be taken to maintain operations and optimize maintenance.

Order one custom template per type of machine train.¹

CORE Monitoring Template ²	
Order Code	Description
VCM-3-TEMP-CORE	Service to create a customized configuration (monitoring template) for VCM-3 that provide an early indication of developing faults linked to the core structure of the asset.

	<p>Templates are applicable to constant speed, variable speed, rolling element bearing and fluid film bearing machines.</p> <p>Typical errors and problems that can be recognized are e.g., bearings, imbalances, misalignment, looseness, and excessive stress on the machine structure due to vibrations.</p>
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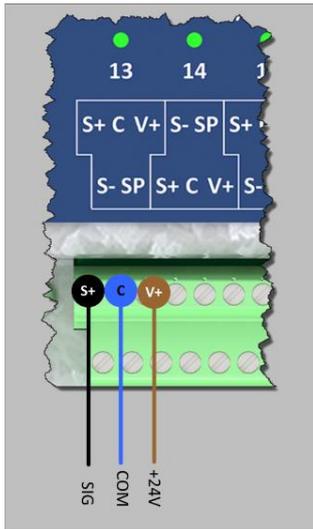
COMPONENT Monitoring Template ²	
Order Code	Description
VCM-3-TEMP-COMP	<p>Service to create a customized configuration (monitoring template) for VCM-3 that provide not only with an early indication of developing faults linked to the core structure of the asset (see VCM-3-TEMP-CORE) but will also indicate the health of machine components. For example, the inner race bearing frequency vibration amplitude can be measured to track this specific component failure.</p> <p>Additional measurements (descriptors) to cover rolling element bearing, gear, blade, and other mechanical components simplify monitoring by providing more precise information on each failure mode of the machine.</p>

Monitoring Template CHANGE	
Order Code	Description
VCM-3-TEMP-CH	<p>Service to change an existing configuration (monitoring template) for VCM-3.</p> <p>Minor and straight forward changes to an existing (CORE or COMPONENT) monitoring template (monitoring configuration).</p>

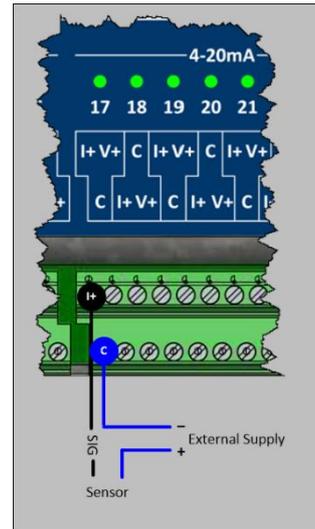
¹VCM-3 Editor can adjust all relevant settings for a custom template.

²Template may be delivered with asynchronous and enveloping waveform or with asynchronous and synchronous waveforms but not all three together.

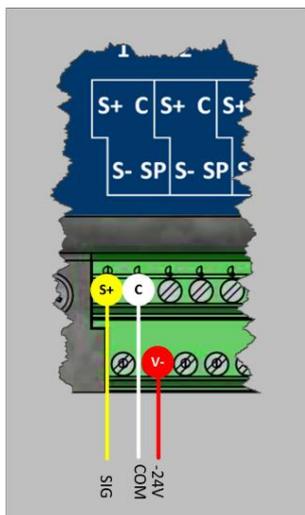
Wiring Diagrams*



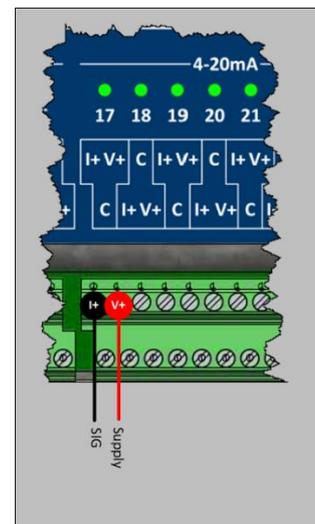
Constant Current Sensors



4 to 20 mA inputs



Displacement Sensors*



4 to 20 mA Inputs with external supply

*Refer to the installation manual for instructions on sensor installation and wiring (C107758.002)

Contact

Brüel & Kjær Vibro GmbH

Leydheckerstrasse 10
64293 Darmstadt
Germany

Phone: +49 6151 428 0
Fax: +49 6151 428 1000

Corporate E-Mail: info@bkvibro.com

Brüel & Kjær Vibro A/S

Lyngby Hovedgade 94, 5 sal
2800 Lyngby
Denmark

Phone: +45 69 89 03 00
Fax: +45 69 89 03 01

Homepage: www.bkvibro.com

BK Vibro America Inc

1100 Mark Circle
Gardnerville NV 89410
USA

Phone: +1 (775) 552 3110