VIBER-A+ ™

Manual

Ver. 1.0

Our X series of hand-held instruments

VIBER-A+

VIBER X1

VIBER X2

VIBER X3

VIBER X5

Important information

Safety precautions
Vibration measurement and balancing involves measurement on rotating machines. Keep a safe distance from rotating parts. Secure transducers and cables from rotating parts. Always follow company, local and national security regulations!

VMI International AB and our authorized dealers will take no responsibility for either damages on machines and plants or accidents on people as the result of the use of **VIBER-A⁺™** measurements.

Even though great efforts are made to make the information in this manual free from errors and to make the information complete for the user, there could be items we have missed, because of the large amount of information. As a result of this, we might change and correct these items in later issues without further notice. Also changes in the **VIBER-A⁺™** equipment may take place that affect the accuracy of this information.

Instrument overview

The **VIBER-A⁺™** is a portable vibrometer to be used in preventive and pro-active maintenance work, especially on rotating machinery. A complete set consists of an instrument, soft carrying bag, a vibration transducer with magnet support. **VIBER-A⁺™** measures the velocity (mm/s RMS) in the two frequency ranges 10 - 1000 Hz or 2 Hz – maximum frequency (16000 Hz depending on version of **VIBER-A⁺™** and transducer). The instrument has the capability to measure up to 40 kHz, the limiting factor is the accelerometer.

This range covers most of the frequencies that will occur for the majority of mechanical failures and defects. Examples are unbalance, looseness, resonance, misalignment of shafts, defective gear boxes and cavitation and other fluid generated vibrations.

VIBER-A⁺™ 10 - 1000 Hz is designed for companies that uses the recommendation ISO 10816-3. This standard, is used for decades around the world.
The vibration alerts are supported by several vibration standards. The close comparison between vibration levels and actual machinery wear will build up your knowledge. Use this experience to determine the action required when high vibrations are found.

Functions

Power on the instrument

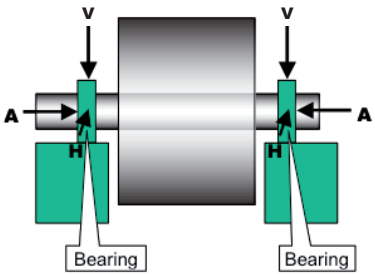
Press the On/Off key and the instrument starts to measure vibration, default is 10 - 1000 Hz or 2 Hz – maximum frequency range depending on version. The instrument shuts off automatically after approximately 4 minutes if no key is pressed.

Bearing condition

Start measuring vibration on the machine then, press the symbol key for bearing condition measurement. The instrument measures instantaneously a Bearing Condition value in the range between 500 Hz to 16 000 Hz. To return to vibration measurement, press the symbol again.

Measuring point location

Measurements should be taken on the bearing housing or as close as possible and in the horizontal, vertical and axial directions. This is also explained in the standard ISO-10816.



How to make good measurements

The sensitivity direction of the transducer coincides with the center axis of the transducer. Place the accelerometer on the measurement point. Wait a few seconds for the accelerometer to come to a steady state to reduce noise from the accelerometer. If you are connecting to a non-magnetic surface, push firmly against the measurement point. Make sure it is a proper contact with the machine. If measurement are taken on a curved surface, make sure the accelerometer is attached and not moving back and forth. Measure a vertical, horizontal and axial direction, if possible. Note if the reading is stable or fluctuating. The non-stable reading is also valuable information used to determine the vibration cause.

When the transducer is mounted with the magnet, the reliable frequency range of the measurement is reduced to about 2000 – 3000 Hz depending on the flatness of the contact between magnet and surface.

Note!
Using the magnet can change the bearing condition value. High frequency vibration can sometimes be difficult to collect because high vibration does not transmit through the machine for long distances. Pressing the transducer more firmly should not change the reading. If in doubt, always try to adjust the contact point first. Secondly, if necessary, mount the transducer with the M6 stud.

All normal measurements on vertical or horizontal machinery should follow the three perpendicular axes of true vertical, horizontal and axial directions.

The **VIBER-A⁺™** is mainly intended for measurements against the machinery housing and bearings. And designed for fans, pumps, chemical motors and compressors.

VIBER-A⁺™ can also be used to measure other components such as piping, valves, etc.

Note: In some cases, the mass of the transducer may influence the reading. A good rule is to avoid readings on things that have only 2-3 times the mass of the transducer.

How to interpret vibration measurements
A user with no previous experience, we recommend to use the ISO 10816-3 standard.

The standard normally calls for a velocity measurement in mm/s RMS. To better understand what this measurement means, think of it as how fast the machine is moving back and forth. This measure gives a good understanding of the amount of "break down energy", causing mainly wear and fatigue in the machine or the structure.

The instrument measures the total RMS vibration value in the frequency range. This RMS value is the average sum of all the measured vibrations.

Example:
If the simultaneous vibration caused by unbalance is (4mm/s), by misalignment (2 mm/s) and by the gear mesh (5 mm/s) then the total vibration measured with **VIBER-A^{+} ™** is 6.7 mm/s.

Total vibration = $\sqrt{4 * 4 + 2 * 2 + 5 * 5}$ = 6.7mm

Notice that a reduction of the unbalance from 4 mm/s to 1 mm/s will reduce the total value from 6, 7 mm/s to 5, 5 mm/s.

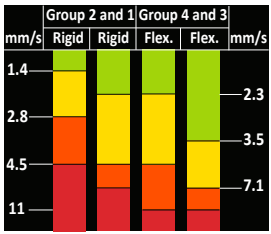
The ISO standard classifies the machines differently if the machines are flexible or rigid. This reflects the location of the machine's stiff-body resonance related to the basic running speed of the machine.

For example, a machine supported by rubber or springs have a resonance at low running speeds. The machine starts vibrate at a low RPM. When the speed is increased above these resonance frequencies, the vibration is reduced. This machine is considered flexible.

Resonance is easily found when a flexible machine is running up or down in speed. The resonances are located at the speed where the vibration has a local maximum level.

Extraction's from ISO 10816-3

Industrial machines with power above 15kW and nominal speeds between 120 - 15000 RPM.



Group 1:

Large machines with rated power above 300kW. Electrical machines with shaft height H > 315mm. Operating speed ranges from 120 to 15000 RPM.

Group 2:

Medium-sized machines with a rated power above 15kW up to and including 300kW. Electrical machines with shaft height between 160 < H < 315 mm. Operating speed normally above 600 RPM.

Group 3:
Pumps with multivane impeller and with separate driver with rated power above 15kW.

Group 4:
Pumps with multivane impeller and with integrated driver with rated power above 15kW.

Modern machines often run at high speed and bearing-supports are flexible, foundations should/can be evaluated as flexible, even when it is not mounted on rubber or springs.

The ISO 10816-3 standard allows for slightly higher limits when a foundation is considered flexible than rigid. A conclusion from this is a resonance condition should not be allowed or at least must be avoided at operating speeds. In practice, this also includes the double speed as well as any other natural excitation frequency such as blade passage.

A great advantage with proper vibration measurements and the use of vibration standards is that you can judge the future maintenance cost reliably at start-up. If you find levels above 3 mm/s RMS, it's a risk that the machine will have higher maintenance cost. The specific cost and action is specific to the machine design.

The next logical step if you want to improve the accuracy of measurements is to use more advanced analyzers like VIBER X2™, X3™ or X5™ to learn and detect the frequency behind the vibration and thus the exact mechanical fault. The practice of this is beyond the scope of this manual.

Recommended vibration levels in mm/s and common findings
The following is an extraction of part of the old standard ISO 2372 class 4, large machines on flexible foundations, with some common findings added.
Use this simplified list as a first indication, when approaching a newly commissioned machine or after some time in operation. Investigate the reason for any machine that vibrates above 3 mm/s RMS.

- **0 – 3 mm/s**

Small vibrations - None or very small bearing wear. Rather lownoise level.

- **3 – 7 mm/s**

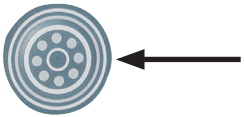
Noticeable vibration levels are often concentrated to some specific part as well as direction of the machine. Visible bearing wear. Seal problems occur in pumps and increased noise level. Keep the machine under observation and measure at smaller time intervals than before to detect a deterioration trend if any. Compare vibrations to other operating variables.

- **7 – 18 mm/s**

Large vibrations. Bearings running hot. Bearing wear-out causes frequent replacements. Seals wear out, leakage of all kinds evident. Cracks in welding and concrete foundations. Screws and bolts are loosening. High noise level. Plan action soonest. Do your best to discover the cause. You are wearing down investments quickly.

- **18 – mm/s**

Very large vibrations and high noise levels. This is detrimental to the safe operation of the machine. Stop operation if technically or economically possible. Few machines can withstand this level without damage. Reduce any further running time to an absolute minimum.



Bearing condition symbol

Press the bearing symbol. The instrument measures the bearing condition value. Bearing condition value is the RMS value of all high frequency vibrations in the range of 500 Hz to 16 000 Hz. Bearing condition are measured in the unit g.

Bearing condition value

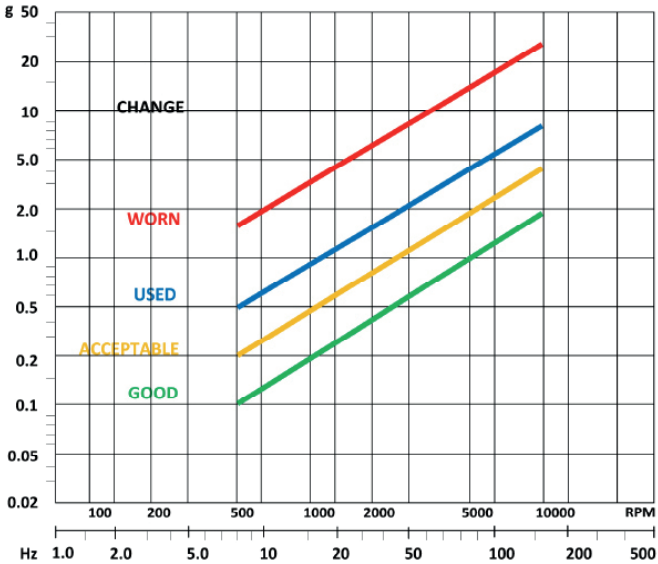
We use acceleration because high frequencies give a larger signal compared to velocity, if measured in acceleration. When the balls or rollers rotate inside the bearing, a wide-band noise and vibration occurs. This noise and vibration increase if the bearing is poorly lubricated, overloaded due to misalignment or has a damaged surface.
If the selected frequency band includes low frequencies, the bearing condition value would also include vibrations from unbalance, misalignment, etc. and not only from bearing vibrations.

If the selected frequency band only includes very high frequency noise and vibrations, we would need special vibration transducers that are very rigidly and closely mounted to the bearing because the machine structure works as a mechanical filter for high frequencies. **VIBER-A⁺™** measures the bearing condition value between 500 Hz to 16 kHz. Normal machinery vibrations rarely have vibrations above 500 Hz.

Note!
A high bearing condition value is an indication and a recommendation to continue with other fault analysis. High bearing condition values can appear at gear boxes, converting machines with cutters and similar machines without any bearing faults because they "naturally" produce frequencies above 500 Hz.

Bearing condition value with unit “g” RMS

The diagram below is a guide to identify the bearing condition value. If vibrations of other causes (e.g. flow surge, gear mesh) are within in the frequency range 500 – 16 000 Hz this can give a high bearing condition value, without the bearing being damaged. A high bearing condition value can also be indicated if the bearing is poorly lubricated or overloaded.



Technical data VIBER-A+

Vibration transducer	Accelerometer	Standard nom 100 mV/g	(Adjusted to the instrument)
Input amplitude range	Vibration	Max 20 g RMS	With other sensor up to 200 g
	Bearing condition	Max 20 gBC	
Dynamic range	60 dB (159 Hz)		
Frequency range	Vibration	10 - 1000 Hz 2 - 16 000 Hz	Note 1, Note 2
	Bearing condition	0.5 to 16 kHz	
Vibration and BC units	mm/s and g-value		
Amplitude presentation	RMS		
Signal processing	Analogue		
Accuracy	Vibration	± 3 %	Note 3
	Bearing condition	± 5 %	Note 4
Battery	Alkaline AAA		Note 5
Operating time	Min 12 hours continuous measuring		
LED display	7 segment		
Enclosure protection	IP65		
Operating temp. range	-20 to 60°C		
Weight	285 gram		Note 6
Size (L x W x H)	125mm x 70mm x 40mm		

Technical data VIBER-A+™

Note 1. Frequency range depending on version of the **VIBER-A+™**.

Note 2. Maximum frequency depending on transducer.

Note 3. Full scale is 199,9 mm/s for vibration.

Note 4. Over 0,05 gBC

Note 5. External charged NiMH AAA can be used.

Note 6. Instrument, including battery and transducer.

Obs. You should avoid using other accelerometers because of instrument calibration. If you change the accelerometer, the instrument must be calibrated to preserve the accuracy.

• We reserve the right to modify or improve the designs or specifications of our products at any time without notice.

Declaration of conformity

VMI declares that the **Viber-A⁺™** is manufactured in conformity with national and international regulations.
The system complies with, and is tested according to, following requirements:

EMC Directive:	2004/108/EC
Low Voltage Directive:	2006/95/EC

8 August 2011

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Vibration Measurement Instrument International AB (VMI)

Warranty disclaimer
VMI warrants the products to be free from defects in material and workmanship under normal use and service within 2 years from the date of purchase and which from our examination shall disclose to our reasonable satisfaction to be defective. Warranty claimed products shall be returned prepaid to VMI for service. We reserve the right to repair or to replace defective products. Always try to explain the nature of any service problem by filling in the form found on the website www.vmiab.com and attach it in an email to VMI. Check first all natural problems, like empty batteries, broken cables, etc. If returning the product, be sure to indicate that the purpose is to make repairs and indicate the original invoice number and date of shipment.

Warranty exclusions
Damage not resulting from a defect in material or workmanship or by other than normal use. Damage resulting from repairs performed other than by an authorized service center. The limited two year warranty and remedies contained herein are in lieu of all other warranties, expressed or implied including any warranty of merchantability and any warranty of fitness for a particular purpose, and all other remedies, obligations or liabilities on our part. In addition, we hereby disclaim liability for consequential damages for breach of any expressed or implied warranty, including any implied warranty of merchantability and any implied warranty of fitness for a particular purpose. The duration of any implied warranty which might exist by operation of law shall be limited to one year from the date of original retail purchase.

NOTE: Some countries do not allow the exclusion or limitation of consequential damages, and some countries do not allow limitation on how long an implied warranty lasts, so the above exclusions or limitations may not apply to you. This warranty gives you specific legal rights and you may also have other rights that vary from country to country. If you have problems with your instrument during or after the warranty period, first contact your distributor you purchased the unit from.

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