

VIBER X1™



Manual

Ver. 1.4

Our X series of hand-held instrument



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 away from rotating parts. Secure transducers and cables from rotating parts. Always follow company, local and national security regulations! When working with weights on the rotor, always follow “lock out tag out” procedures. Secure the start switch with a lock and also use the emergency switch for double safety. This is especially important when the machine is remote controlled. VMI International AB takes no responsibility for any accidents on people and machines.

VMI International AB and our authorized dealers will take no responsibility for damages on machines and plants as the result of the use of VIBER X1™ 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 X1™ equipment may take place that affect the accuracy of this information.

Instrument overview

The VIBER X1™ 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, carrying bag, a vibration transducer with magnet support and charger. VIBER X1™ measures the velocity (mm/s RMS) in the frequency range 2 Hz – maximum frequency. The instrument has the capability to measure up to 40 kHz, the limiting factor is the accelerometer. The accelerometer provided with the Viber X1 measures up to 15 kHz. The frequency range can be set by adjustable filters. High pass filters can be set to 2 Hz or 10 Hz.

Low pass filters can be set at 1000 Hz or maximum frequency. 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 and gears, cavitation and other fluid generated vibrations.

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. A common standard for vibration is ISO 10816-3 and may be available from domestic standardisation authority.

This standard, in use for decades worldwide, is an upgrade and excellent for continuous and long lasting operation of machinery.

Functions



← **Power on the instrument**

Press the On/Off key and the instrument starts to measure vibration, default is 2 Hz – maximum frequency range, the LED's indicate the low and high pass filter setting. The instrument shuts off automatically after approximately minutes if no keys are pressed.



← **Increase display brightness**

Use this button to increase display brightness.



← **Changing frequency range**

The Viber X1™ is one of few analog instrument available with adjustable frequency ranges. Use the up/down arrows to change the filters. The LED lights up to show the filter in use. Use this to compare measurements in the same range. Note: the old ISO standard had 10 -1000 Hz as frequency range. We recommend you to use 2 – 1000 Hz as a standard range.

Battery check

VIBER X1™ features a battery check. When less than 10 % of the battery capacity remains, the battery LED will flash.



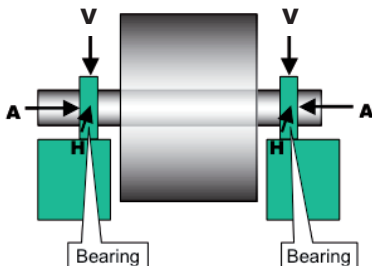
← **Bearing condition**

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.



How to make good measurements

The sensitivity direction of the transducer coincides with the center axis of the transducer. Use the built in magnetic mount by gently placing the accelerometer onto the measurement point. Wait a few seconds for the accelerometer to come to a steady state to reduce unwanted noise. If you are connecting to a non-magnetic surface, push firmly against the measurement point. Make sure you have good contact with the machine. If you are measuring on a curved surface, make sure the accelerometer is attached and not moving back and forth. Attach the transducer in a vertical, horizontal or 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 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 X1™ is mainly intended for measurements against the machinery housing and bearings to compare to standards.

VIBER X1™ 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 surfaces that are 10 times lower in mass of the transducer.

How to interpret vibration measurements

A user with no previous experience, should 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 X1™ is 6.7 mm/s.

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

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 r/min				
Unit	Group 1 and 3		Group 2 and 4	
	Rigid	Flexible	Rigid	Flexible
0-1.4	Green	Green	Green	Green
1.4-2.3	Green	Green	Yellow	Green
2.3-2.8	Yellow	Green	Yellow	Yellow
2.8-3.5	Yellow	Green	Orange	Yellow
3.5-4.5	Yellow	Yellow	Orange	Yellow
4.5-7.1	Orange	Yellow	Orange	Orange
7.1-11	Red	Orange	Red	Orange
11--	Red	Red	Red	Red



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 low noise 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 maximum frequency. This average has the unit g

Bearing condition value

This value is an average with the unit “g”.

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.



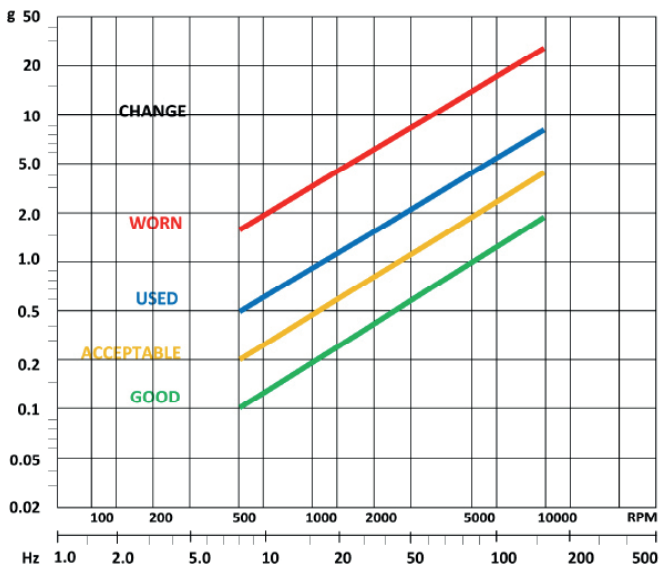
If the selected frequency band only includes very high frequency noise and vibrations, we would need special vibration transducers that are very rigidly and closely mounted to the bearing because the machine structure works as a mechanical filter for high frequencies. VIBER X1™ measures the bearing condition 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 X1

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	2 - 1000 Hz 10 - 1000 Hz 2 - Max Hz 10 - Max Hz	Note 1
	Bearing condition	0.5 to 16 kHz	
Vibration units	g-value, mm/s		Note 2
Amplitude presentation	RMS		
Signal processing	Analogous		
Accuracy	Vibration	± 3 %	Note 3
	Bearing condition	± 5 %	Note 4
Battery	Rechargeable Lithium or NiMH (AAA)		Note 5
Operating time	Min 24 or 12 hours for a full charged battery pack		Note 6
External charger	5,0 V Lithium or 7,5 V NiMH (AAA)		
LED display	7 segment		
Enclosure protection	IP65		
Operating temp. range	-20 to 60°C		
Weight	285 gram		Note 7
Size (L x W x H)	125mm x 70mm x 40mm		

Technical data VIBER X1

Note 1. User selectable

Note 2. User selectable

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

Note 4. Over 0,05 gBC

Note 5. Capacity of batteries is 2300 mA/h for lithium and 1100 mA/h for NiMH. If using alkaline batteries, never connect a charger to the instrument.
(storage temp. -20 to max 60 °C).

Note 6. Operating times depends on intensity on the LED:s and type of batteries. Ca: 24 hours for Lithium and Ca: 12 hours for NiMH.

Note 7. 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 X1™ 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	



8 August 2011

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 two 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 e-mail or telephone. 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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