

# VIBER X2™



## Manual

Ver. 2.5

Refers to VIBER X2™ rev: 1.7

Software 5.0



Our x-series of hand-held instrument



VIBER X1™



VIBER X2™



VIBER X3™



VIBER X5™



*Vibration measurements in progress*

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## **1 Important information**

### **Safety precautions**

Vibration measurement and balancing involves collecting measurement on rotating machines. Keep a safe distance away from rotating parts. Secure transducers and transducer 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 takes no responsibility for any accidents on people and machines.**

VMI and our authorized distributors take no responsibility for damages on machines or plants as the result of the use of VIBER X2™ 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 X2™ equipment may take place that affect the accuracy of this information.

## 2 Introduction

VIBER X2™ is designed for technicians, mechanics, and machine operators that need a reliable, fast, and easy to use tool for basic condition monitoring checks in rough conditions. The VIBER X2™ instrument has the following features:

- Accurate measurements in 4 selectable frequency ranges.
- Real-time measurement of the total vibration level and the Bearing Condition (BC), shown simultaneously.
- Measurement units and display are user selectable from the following list:
  - g-value = (RMS, Peak or Peak-Peak)
  - a =  $m/s^2$  (RMS, Peak or Peak-Peak)
  - V = mm/sec (RMS, Peak or Peak-Peak)
  - V = inch/sec (RMS, Peak or Peak-Peak)
  - D = mils (RMS, Peak or Peak-Peak)
  - D =  $\mu m$  (RMS, Peak or Peak-Peak)
- Bearing Condition measurements in the frequency range (0.5 -16 kHz).
- Bar indicator shows measurement stability.
- Fast and easy fault analysis displaying the five highest peaks frequency in RPM or Hz in main screen display.
- Large dynamic range of the vibration signal (up to 50g).
- Low power consumption.
- High performance accelerometer.
- Easy to understand and operate.
- Advanced technology with DSP processor.
- Several languages are available.
- Adjustable Auto-shut off for energy saving.
- Dust and waterproof, for rough use (IP 65).

## 2.1 Scope of supply



A complete delivery is:

- VIBER X2™, machine condition analyzer
- Embedded Lithium Battery
- Accelerometer
- 1 m transducer cable
- AC adapter
- Carrying case

## 2.2 Instrument keypad and LED's

The VIBER X2™ keypad has:

- 1 ON/OFF key
- 1 Green menu key
- 4 Arrow keys
- 3 LED lights\*



\***Green LED lights**, when any key is pressed.

\***Yellow LED lights**, when the measurement is above the set warning level.

\***Red LED lights**, when the measurement is above the set danger level.



### 2.2.1 ON/OFF and Menu Key

Press the ON/OFF key to start or stop the instrument.

If the setting Auto-shut off is ENABLED, the instrument will automatically shut off after 60 seconds if no key is pressed. Five seconds before the auto-stop, a warning window will appear on the screen. The user has 5 seconds to press any key, to avoid the shut off.

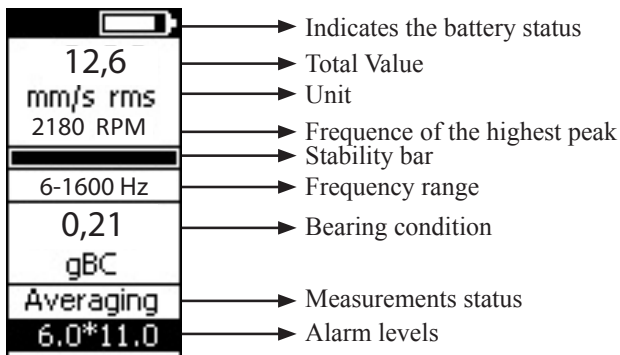
The Menu key activates the settings menu from any measurement screen. To return to measurement press the Menu key when the BACK function is selected.

### 2.2.2 Arrow keys

The LEFT and RIGHT arrows are used to change the value of the selected item. The UP and DOWN arrows are used to make choice available on the screen like enable, disable, units, alarms frequency etc.

## 3 Vibration measurement screen

Initial screen, shown when starting the instrument.

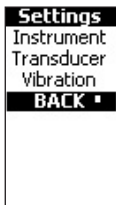


Vibration measurement status can be one of following:

- **Measuring** (Vibration measuring is ongoing)
- **Ranging** (The instrument is calculating the best measurement level range)
- **Averaging** (Averaging of the measured data)
- **Stable** (The measurement is stabilized)
- **Overflow** (The signal is too high – the measurement is incorrect/not readable.)

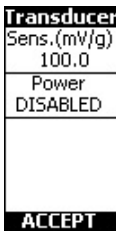
In case of amplitude out of range, the value is shown as 3 stars (\*\*\*) .

When the **Menu** key is pressed, the **Settings menu** is displayed. Note that all accept/back are made with the green menu key. The following settings are available:



Select an item in the menu with the UP and DOWN arrow keys. Open the selected item with the green menu key.

If transducer setting is chosen, the following menu is displayed:



→ Set actual sensors sensitivity

→ Disable power if sensor is external powered

If instrument setting is chosen, the following menu is displayed

Instrument	
Backlight DISABLED	→ Enable or disable
Auto-shutoff DISABLED	→ Enable or disable
Shutdown 1 min	→ 20, 30, 40 sek / 1, 2 or 3 minutes
Language English	→ Choose language by pressing Arrow key
<b>ACCEPT</b>	

\* Available languages are: English, Swedish, French, German, Romanian, Spanish, Portuguese, Czech, and Finnish. For another language please contact VMI's distributors for availability.

If vibration setting is chosen, the following menu is displayed.

Vibration	
mm/s rms	→ Change of unit (see below)
RPM	→ Choose Hz or RPM
6-1600 Hz	→ Change of frequency range (see below)
Alarm ENABLED	→ Enable* or disable alarms
Warning 6.00	→ Alarm* settings
Danger 11.00	→ Alarm* settings
<b>ACCEPT</b>	

\*Note: Can only be used for velocity unit RMS

Change the settings of the selected item with the LEFT and RIGHT arrow keys.

Frequency range Hz	Frequency range, where the highest peak is displayed
2 - 400 Hz	2 - 400 Hz
6 - 1600 Hz	6 - 1600 Hz
11 - 3200 Hz	11 - 2000 Hz
10 - 1000 Hz	10 - 1000 Hz

g (RMS, Peak or P-P)
mm/s (RMS, Peak or P-P)
m/s <sup>2</sup> (RMS, Peak or P-P)
µm (RMS, Peak or P-P)
inch/sec (RMS, Peak or P-P)
mils(RMS, Peak or P-P)

#### 4 Warning messages

The following message may appear in normal operation:

##### Calibration

This message may appear if the calibration data is lost from the permanent FRAM memory or if the calibration data are corrupted. In such cases, the instrument must be recalibrated; otherwise it will measure incorrectly. The message appears only once, and then default calibration data is used.

##### Battery too low

When this message appears, the battery is low to ensure a correct running condition. The measurements may be invalid! The instrument battery must be charged immediately, using the external charger. To temporarily decrease the power consumption, the backlight automatically will be switched OFF. The instrument can still work, but only for a short while.

##### Shut-off in 5 sec

This message appears only if the Auto shut off setting is enabled. The user may cancel the shut off condition, pressing any key except ON/OFF. If no key is pressed the instrument will shut off in 5 seconds.

##### Missing transducer

This message appears only if the Transducer power setting is enabled and indicates that the transducer is missing or is out of order.

When the **Transducer power** setting is disabled, the user has the possibility to use another external source for the vibration input (a signal generator or a buffered output from another device).

When the instrument starts, the *Transducer power* setting is always **ENABLED**. When this message appears, it will remain on the screen, even if the transducer is plugged-in. To continue the normal running mode in such a condition, switch the screen temporarily to another menu. When you switch back, the message disappears.

## 5 Battery status bar

In every measurement screen, at the upper side, a battery status bar is shown.

The status bar indicates the battery voltage/energy content.



When the battery is charged, a connector symbol is displayed. If voltage drops to less than 3.3 Volt, the instrument will shut off.

### 5.1 Changing Battery

The unit has an embedded Lithium battery and we recommend that a VMI reseller or service center makes the replacement.

## 6 How to interpret vibration levels

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. In the actual frequency range.

#### CALCULATION:

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 on the VIBER X2 is 6.7 mm/s.

$$\text{Total vibration (RMS)} = \sqrt{4*4+2*2+5*5} = 6,7 \text{ mm/s}$$

### 6.1 ISO standard 10816-3

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 has a resonance at low running speeds. The machine starts vibrate at low RPM. When the speed is increased above the resonance frequency, 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 RPM where the vibration has a local maximum level. Modern machines that have high RPM's and

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	Yellow	Orange	Yellow
3.5-4.5	Orange	Yellow	Orange	Yellow
4.5-7.1	Red	Orange	Red	Orange
7.1-11	Red	Red	Red	Red
11--	Red	Red	Red	Red

flexible bearing supports and foundations, can be treated as flexible, even when they aren't mounted on rubber or springs.

**Group 1:**

Large machines with rated power above 300kW.  
Electrical machines with shaft height  $H > 315\text{mm}$ .  
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  $160 < H < 315\text{ mm}$ .  
Operating speed normally above 600 RPM.

**Group 3:**

Pumps with multi vane impeller and with separate driver with rated power above 15kW.

**Group 4:**

Pumps with multi vane impeller and with integrated driver with rated power above 15kW.

The ISO 10816-3 standard allows for slightly higher limits when a foundation is considered more 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.



The next logical step is to use more advanced analyzers like VIBER X3™ or VIBER X5™ to learn the frequency behind the vibration and thus the exact mechanical fault.

The practice of this is beyond the scope of this manual.

## 7 Vibration analysis

### 7.1 Recommended vibration levels

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    0 – 0,12 in/s**

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

- **3 – 7 mm/s    0,12 – 0,28 in/s**

Noticeable vibration levels are often concentrated to some specific part as well as direction of the machine. Noticeable bearing wear. Seal problems occur in pumps etc. Increased noise level; try to investigate the reason. Plan an action during next regular stop. Keep the machine under observation and measure at shorter time intervals than before to detect a deterioration trend if any. Compare vibrations to other operating variables.





- **7 – 11 mm/s    0,28 – 0,43 in/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.

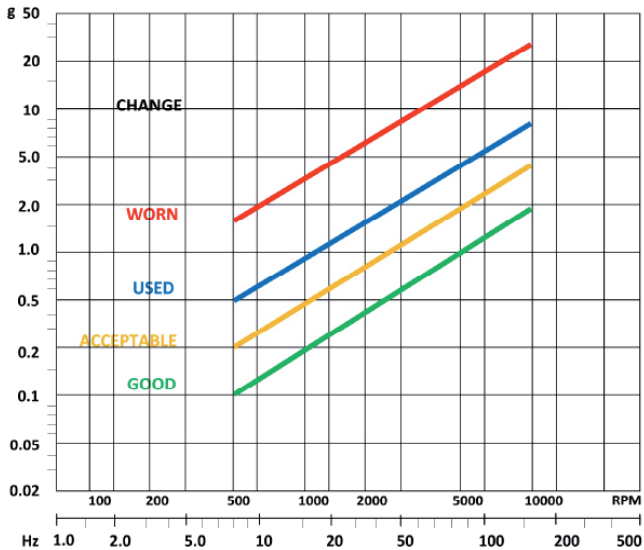
- **11 – mm/s    0,43 – in/s**

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 internal or external damage. Reduce any further running time to an absolute minimum.

## 7.2 Recommended bearing condition levels

The bearing condition value is the total RMS value of the acceleration of all high frequency vibrations within the range from 500 Hz up to 16000 Hz with the unit “g”. Find the machine speed. Follow this line up to the judgment lines and read the value on the left axis.

The diagram on the next page is a guide to interpret the bearing condition value. If vibrations of other causes (e.g. flow surge, gear mesh) are within in the selected frequency range, this can give a high bearing condition value without any bearing faults. A high bearing condition value can also be acquired if the bearing is poorly lubricated or is overloaded (e.g. by misalignment, or large belt forces).



## Technical data VIBER X2

Vibration transducer	Accelerometer	Standard nom 100 mV/g	(Selectable sensitivity in the instrument) 0,1 - 99999 mV/g
Input amplitude range	Vibration	Max 50g RMS	With other sensor up to 500 g
	Bearing condition	Max 30 gBC	
Dynamic range	80 dB (at 159 Hz with auto ranging)		
Frequency range	Vibration	2 - 400 Hz 10 - 1000 Hz 6 - 1600 Hz 11 - 3200 Hz	Note 1
	Bearing condition	0.5 to 16 kHz	
Vibration units	g-value, mm/s, mm/s <sup>2</sup> , in/s, $\mu$ m, mils		Note 2
Amplitude presentation	RMS, Peak, Peak-Peak		Note 2
Analysis	Five highest peaks can be displayed		
Frequency range of peak detection	Frequency range		Note 3
	2 - 400 Hz		
	6 - 1600 Hz		
	11 - 2000 Hz		
	10 - 1000 Hz		
Accuracy	Vibration	$\pm 3\%$	Note 4
	Bearing condition	$\pm 5\%$	Note 4a
	Frequency/RPM	$\pm 0.2\%$	
Battery	Rechargeable Lithium	2300 mA/h max 60°C	Note 5
Operating time	1 week normal use		
External charger	5,0 V regulated @ 2000 mA		
LCD display	B&W 64 x 120 pixels with background light		Note 6
Enclosure protection	IP65		
Operating temp. range	0 to 50°C		Note 7
Weight	340 gram		Note 8
Size (L x W x H)	145mm x 77mm x 47mm		



- Note 1. User selectable between Hz and RPM
- Note 2. User selectable
- Note 3. Only 11 to 2000 Hz differs.
- Note 4. Full scale is 50g for acceleration other units are frequency dependent. All values are related to the *normal acceleration* 9,80665 m/s<sup>2</sup> at sea level and 45° latitude.
- Note 4a. Over 0.5 gBC
- Note 5. Capacity of the batteries can vary depending on hardware revision. Max 2300 mAh.  
(storage temp. -20 to max 60 °C).
- Note 6. Operating temp. min 0°C to max 50°C,  
storage temp. max 72°C.
- Note 7. The restriction concerns display.
- Note 8. Instrument, including battery and transducer.
- OBS. If you change to another accelerometer, then you have to change the sensitivity(mV/g). This is done in the menu under “Transducer”

VMI declares that the VIBER X2™ 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



1 November 2012

Vibration Measurement Instrument International AB  
(VMI)

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. When returning the product, be sure to indicate that the purpose is to make repairs and indicate the original invoice number and date of shipment to you, always fill in the repair, claim and calibration document.



## **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 the distributor you purchased the unit from.*



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