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.

- Indicates the battery status
- Total Value
- Unit
- Frequency of the highest peak
- Stability bar
- Frequency range
- Bearing condition
- Measurements status
- Alarm levels
Vibration measurement status can be one of the 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 choosen, the following menu is displayed

Enable or disable
Enable or disable
20, 30, 40 sek / 1, 2 or 3 minutes
Choose language by pressing Arrow key

* 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 choosen, the following menu is displayed.

Change of unit (see below)
Choose Hz or RPM
Change of frequency range (see below)
Enable* or disable alarms
Alarm* settings
Alarm* settings

*Note: Can only be used for velocity unit RMS
Change the settings of the selected item with the LEFT and RIGHT arrow keys.
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 too 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.

![Battery status bar image]

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.

**Total vibration (RMS) = \sqrt{4^2+2^2+5^2} = 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 machi-
nes that have high RPM’s and

<table>
<thead>
<tr>
<th>Unit</th>
<th>Group 1 and 3</th>
<th>Group 2 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm/s</td>
<td>Rigid Flexible</td>
<td>Rigid Flexible</td>
</tr>
<tr>
<td>0-1.4</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>1.4-2.3</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>2.3-2.8</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>2.8-3.5</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>3.5-4.5</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>4.5-7.1</td>
<td>Orange</td>
<td>Orange</td>
</tr>
<tr>
<td>7.1-11</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>11-</td>
<td>Red</td>
<td>Red</td>
</tr>
</tbody>
</table>

Extraction's from ISO 10816-3

Industrial machines with power above 15kW and
nominal speeds between 120 - 15000 r/min
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 > 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 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

• 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).
Vibration Measurement Instruments

Important information

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### Technical data VIBER X2

<table>
<thead>
<tr>
<th>Vibration transducer</th>
<th>Accelerometer</th>
<th>Standard nom 100 mV/g</th>
<th>(Selectable sensitivity in the instrument) 0.1 - 99999 mV/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input amplitude range</td>
<td>Vibration</td>
<td>Max 50g RMS</td>
<td>With other sensor up to 500 g</td>
</tr>
<tr>
<td></td>
<td>Bearing condition</td>
<td>Max 30 gBC</td>
<td></td>
</tr>
<tr>
<td>Dynamic range</td>
<td>80 dB (at 159 Hz with auto ranging)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency range</td>
<td>Vibration</td>
<td>2 - 400 Hz</td>
<td>Note 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 - 1000 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 - 1600 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 - 3200 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bearing condition</td>
<td>0.5 to 16 kHz</td>
<td></td>
</tr>
<tr>
<td>Vibration units</td>
<td>g-value, mm/s, mm/s², in/s, µm, mils</td>
<td></td>
<td>Note 2</td>
</tr>
<tr>
<td>Amplitude presentation</td>
<td>RMS, Peak, Peak-Peak</td>
<td></td>
<td>Note 2</td>
</tr>
<tr>
<td>Analysis</td>
<td>Five highest peaks can be displayed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency range of peak detection</td>
<td>Frequency range</td>
<td></td>
<td>Note 3</td>
</tr>
<tr>
<td></td>
<td>2 - 400 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 - 1600 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 - 2000 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 - 1000 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>Vibration</td>
<td>± 3 %</td>
<td>Note 4</td>
</tr>
<tr>
<td></td>
<td>Bearing condition</td>
<td>± 5 %</td>
<td>Note 4a</td>
</tr>
<tr>
<td></td>
<td>Frequency/RPM</td>
<td>± 0.2 %</td>
<td></td>
</tr>
<tr>
<td>Battery</td>
<td>Rechargeable Lithium</td>
<td>2300 mA/h max 60°C</td>
<td>Note 5</td>
</tr>
<tr>
<td>Operating time</td>
<td>1 week normal use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External charger</td>
<td>5,0 V regulated @ 2000 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD display</td>
<td>B&amp;W 64 x 120 pixels with background light</td>
<td></td>
<td>Note 6</td>
</tr>
<tr>
<td>Enclosure protection</td>
<td>IP65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temp. range</td>
<td>0 to 50°C</td>
<td></td>
<td>Note 7</td>
</tr>
<tr>
<td>Weight</td>
<td>340 gram</td>
<td></td>
<td>Note 8</td>
</tr>
<tr>
<td>Size (L x W x H)</td>
<td>145mm x 77mm x 47mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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* $9,80665 \text{ m/s}^2$ 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:

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.